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METHODOLOGICAL APPROACHES TO LABOR NORMING IN R&D

Introduction. *Research and development (R&D) activities are sophisticated and multifaceted type of human labor that has a creative component, so the problem of its norming is a very complex and, at the same time, extremely important issue in the light of modern paradigm of the widest possible introduction of innovations in socio-economic processes.*

Problem Statement. *The authors proceed from the fact that labor in R&D is internally heterogeneous with a particularly important creative research component. Therefore, based on qualitatively and quantitatively related phenomena of coordination of scholarly research organizational issues in terms of planning, organization, and conduct of R&D activities, while considering methodological and empiric aspects of structural and systemic factors, based on in-house experience and applied approaches that have been implemented in sectoral legislation, they have offered a concept of prospects for further research in the sphere of norming of scholarly research labor.*

Purpose. *The purpose is to contribute to elaborating methodological approaches to labor norming in scholarly research and development.*

Materials and Methods. *Analytical processing of applicable regulations and scholarly research publications in order to develop approaches to norming scholarly research labor.*

Results. *The authors consider that despite, in general, each R&D work is unique, there are elements that are common for all researches in different qualitative and quantitative combinations, in all types of scholarly research activities. In other words, all common elements, i.e. the basic activities, can be normalized based on unified coordinated system that takes into account a broad range of peculiarities, structures, and contents of scholarly research labor with consideration of differential need in creating new knowledge resulting from R&D activities. Theoretical and applied generalization presented by the authors facilitates the formation of a systemic and structural model for scholarly research labor norming.*

Conclusions. *The obtained results can be the starting point for further improvement of the regulation of R&D sphere in the context of reforming the activities of Ukrainian higher educational establishments and R&D institutions.*

Keywords: norming of scholarly research labor, researcher's creativity, scholarly research and organizational work, forms and methods of scientific cognition.

In the present-day conditions, integration яof fundamental and applied research is getting more and more enhanced. To find their optimal ratio is one of the most important tasks in the field of research planning.

BORYS PATON

The R&D in its dialectic unity is an integral instrumentarium for the transition from science to practice. Concerning the institutional aspect of this problem, pursuant to the main international document — the Frascati Manual [1] — the main sectors involved in R&D activities have been identified as business enterprise, government, higher education (university), and private nonprofit, as well as international organizations.

In the discourse on the forms of organization of science, it should be regarded that in the present-day conditions, team is the main form of researcher labor, with R&D institution being an aggregate of teams. However, this general trend manifests itself in different ways from one field of science to other. The closer the field of knowledge to theoretical science, the more individual work prevails there, while the collective form is more typical for the experimental research [2].

In 2016, in Ukraine, 972 organizations were involved in R&D activities: 46.6% of them belonged to the government sector, 37.7% was private corporations (business enterprises), and 15.7% was universities. The largest share of 181 institutions is subordinated to the National Academy of Sciences of Ukraine; the Ministry of Education and Science of Ukraine has a lesser share of 119; 86 institutions belong to the National Academy of Agrarian Sciences of Ukraine; 51 ones are held by the Ministry of Agrarian Policy and Food of Ukraine; the rest is distributed among the Ministry of Healthcare of Ukraine and the National the Academy of Medical Sciences of Ukraine (35), the Ministry of Economic Development and Trade of Ukraine (34), and the National Academy of Pedagogical Sciences of Ukraine (12) [3].

In 2016, the total staff employed at R&D institutions amounted to 97.9 thousand (including part-time employees and those who were working under civil contracts). Out of them, 65.1% was researchers, 10.2% was engineers, and 24.7% was supporting personnel. The share of the above-mentioned staff in the total number of employed population accounted for 0.60%. The share of DSc and PhD (CSc) in the R&D staff amounted to 27.9%, that in the total number of researchers reached 42.6%. More than half of the total number of DSc and PhD (CSc) involved in R&D was enrolled on the public sector organizations, 39.1% worked in the university sector, and 4.8% was employed in the private (business sector) [3].

In the period under review, the total R&D expenditure amounted to UAH 11530.7 million, including UAH 5751.0 million salary, UAH 5203.7 million other current expenses, and UAH 576.0 million capital expenses, including UAH 487.6 million cost of equipment. According to preliminary estimates, the share of total expenditure in GDP was 0.48%, including 0.16% funded at the expense of the state budget; 19.3% of the total expenditure was spent on the fundamental research, 91.7% of which was financed from the budget; the share of expenditure on the applied research made up 22.2%, whereas 58.5% of total expenditure was allocated for experimental (R&D) projects [3].

Every single science sector in Ukraine requires a circumspect financial support from the government in order to continuously improve the theoretical and methodological framework for identifying strategic goals and sustainable development priorities in this area and for updating the needs to use limited financial resources more effectively. The targets for the growth of funding in the medium term are foreseen by the Law of Ukraine on Scientific and R&D Activities [4]. In the future, this will also require a more profound analysis, rethink, and search for the most appropriate approaches to setting norms of R&D labor in order to ensure a public consensus on the parity of development of the relevant sectors involved in R&D. At the same time, it is quite clear that in the above structure of expenditure, the most part is the labor costs, which is natural for R&D activity, but will require a more careful jus-

tification in order to further improve the R&D management in the national economy.

Recently, researchers have been increasingly taking interest in philosophy of science [5, 6], institutional changes that take place in natural sciences [7—10], the possibility of evaluating the results of scholarly research activity [11—13], and approaches to its financing [14—16]. However, the issues related to norming the scholarly research labor remain outside attention of these studies, although domestic researches have already been engaged in these problems before [17—19]. The structure of labor input of researchers and academic staff, as a complex system of interconnected elements of teaching, organizational work, research and expert activities, is also of interest to foreign researchers [20—22].

Analyzing the current normative and legal framework for the standardization of scholarly research labor, in particular, from the departmental standpoint, one can see that the only applicable regulatory document is the inter-branch regulations for norms of library staff labor input to research works as approved by the order of the Ministry of Labor and Social Policy of Ukraine dated December 13, 2004 No. 332 [23]. This document does not completely address the problem of scholarly research labor standardization, since it is intended solely for practical use in the process of norming, planning, monitoring, and streamlining of library staff scholarly research labor [23].

At the same time, the problem is very important and requires systematic accumulation and transformation of relevant experience for further differentiation of methodological and integrated social implementation. In addition, the development of unified approaches to the standardization of scholarly research labor will contribute to the creation of a balanced methodology for evaluating the effectiveness of research, scientific, engineering, and innovation activities of R&D institutions, as stated in the Resolution of the Ministry of Education and Science of Ukraine on the Establishment of a Working Group for Developing a Methodology for Evaluating the Effectiveness of R&D, engineering, and innovation activity of R&D Institutions dated September 11, 2017 No. 1268 [24].

In R&D institutes and higher educational establishments (HEE), always there is a problem of the most efficient use of available labor resources, in particular, taking into account the differentiation resulting from the specifics of the main and creative activity. The reason for this is the lack of substantiated norms that take into account the actual labor costs and are used as basis for planning the scholarly research labor. Establishing the basic principles of norming the labor-intensive works create real prerequisites for scientifically grounded planning and control of the efficiency of high-skilled labor, standardization and unification of the methodological principles of research and development in various sectors.

The application of balanced and scientifically grounded labor standardization can be an intensive resource for further improvement of the organization of scholarly research labor. Any labor, including scholarly research, can be properly organized if it is known how long and how many specialists are needed for its realization.

There are different points of view on the problem of labor standardization in R&D institutions and HEE. On the one hand, the specificity of R&D activity does not enable a full normalization of labor inputs associated with R&D works, since not all activities constituting the R&D implementation process are typical and repeated. Proponents of this view do not take into consideration the fact that the denial of norming leads to a paradoxical assumption that it is impossible to organize the scholarly research labor in an efficient way. Some experts admit the development of consolidated norms based on reporting data on similar R&D works for the previous period. In this case, the projects and scope of scholarly research do not determine the number of high-skilled staff to be recruited. On the contrary, the complexity of works is determined based on the actual staff composition established without

proper technical and economic justification, which is not fully in line with budget planning methodology. The most common approach to determining the required amount of financing for scholarly research is to take into account the provisions of the Resolution of the Cabinet of Ministers of Ukraine dated 20.07.1996 no. 830 concerning the application of the Model Provisions for the Planning, Accounting and Estimating the Cost of R&D and Design Works, which need to be revised because of some outdated regulations underlying the document. In any case, the estimates of R&D expenditure for researcher salaries that in academic institutions are determined in accordance with the Resolution of the Cabinet of Ministers of Ukraine of 31.01.2001 No. 74 [25], current and capital expenditures and utility payments are expected to be included. Practical experience of recent years has indicated that due to scarcity of resources for financing the R&D sphere, the share of salaries and related payments in the structure of the R&D estimates can reach 90%, which further increases the importance of a correct and balanced approach to norming such a unique resource as human capital in science.

In this publication, the following approach is used: although every individual research is unique, R&D constituents are present in all types of R&D works in various quantitative and qualitative combinations. In other words, all repetitive elements, i.e. the simplest operations, can be normed on the basis of a single agreed system that takes into account a wide range of features, structure, and content of R&D works, considering the differentiated need for creating new knowledge as a result of the R&D implementation.

SPECIFICITY AND CONTENT OF R&D WORKS

The scholarly research and academic staff labor differs from other types of labor by, first of all, mental activity based on the results of world science and technology development. The research and development (*R&D*) is scholarly research, engineering and design works aiming at obtaining applied results in the field of scholarly research, engineering and design [4]. *The academic activity* is a pedagogical activity at universities, R&D institutes and postgraduate education institutions, which is related to scholarly research and (or) engineering and design activities [4]. That is, R&D is a special kind of high-skilled intellectual work that has a creative character. The creative work of scholarly research and academic staff involves special abilities and long-term training to develop and to improve the skills.

It should be noted that the types of operations in science are neither similar nor even comparable. It is necessary to emphasize the special role of the most creative aspects of this activity — the scientific creativity that forms the framework for creating new knowledge and prospects for their introduction into practice. It is that for which researchers need special abilities, even talent. And, naturally, it is the least suitable for formalization, and therefore, accordingly, for norming. However, from this standpoint, the important factors are not only the personal qualities of the researcher and his/her place in science, but also, first and foremost, those aspects that qualitatively and substantially distinguish the scholarly research process of solving objective research problems from the usual processing of information.

One of the integral components of true full-fledged R&D activity is scholarly research and organizational work that is focused conscious high-skilled intellectual organizational work in the field of science in accordance with the formal laws of logic (without heuristic breakthrough and associated unexpected effects). The scholarly research and organizational work of researcher is much easier to formalize and to norm in order to optimize the structure and orientation towards more relevant and socially significant results.

Of course, the structure of the process of scholarly research activity (or labor) cannot be reduced to only two these types, it is much more complicated (and often depends on the field of science and the peculiarities of problems). Inside each of them, there is a differentiation of certain

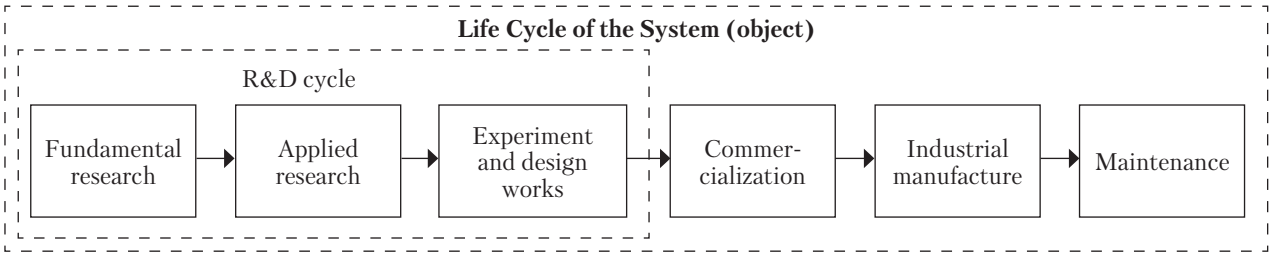

Fig. 1. Model of complete manufacturing process of the system (object)
Source: designed by the authors based on [27].

kinds and their divisions. However, the mutual affinity of the two mentioned types is of fundamental importance, and it should always be considered in the context of methodological analysis of specific issues of scholarly research work organization while conducting R&D works. At the same time, both these forms of the organization of cognition as a social function are closely intertwined, organically linked in a single process of science development. The objective dialectic of scientific reality obliges the researcher to consider the complexity and internal contradiction of these relationships while planning, organizing, and conducting R&D works. That is why the problem of standardization of scholarly research labor is considered through the systematizing and structuring the content and factors of scholarly research and organizational activity as a component of conducting R&D works for further study of this pressing problem in the dialectical unity of the form and the content of organizing the cognition processes in society as a whole, proceeding from the organic integrity of the labor process in science despite a great diversity of its forms.

This diversity is rather clearly visible by the example of scholarly research works by R&D and academic staff, listed in the Resolution of the Ministry of Education and Science of Ukraine of August 07, 2002, No. 450 [26]. It is clear that depending on the departmental affiliation and sectoral orientation, this list may have separate peculiarities and differences.

The scholarly research works are distinguished by their intended purpose: *fundamental research, applied research, experimental and design works* [1, 4]. Naturally, this refers to the dialectical transition from pure knowledge (scientific theory) to material production and social practice, which transforms the world (Fig. 1). However, it is impossible to exclude singular situations, when in the course of obtaining a scholarly research result at one of the stages, there may arise a problem as a result of which the tasks formulated at the previous stages of the cycle can be revised.

METHODS AND TECHNIQUES FOR ESTABLISHING THE SCHOLARLY RESEARCH LABOR NORMS

The practical application of scientific knowledge is a regular process, since basically all modern material production is the embodiment of scientific knowledge in the tangible elements of the manufacturing facilities, devices, processes, technologies, and organizational forms.

When standardizing labor, it is necessary to determine the complexity of certain types of operations made by researchers and their scope. These processes are closely interconnected, and at the same time, each of them has an independent meaning. The complexity of certain types of R&D works is determined in order to properly distribute the labor inputs of specialists in accordance with their qualifications and abilities, to analyze the rationality of the processes and level of their productivity, to estimate the cost of works and, as a result, to pay for the labor in accordance with its quantity and quality. In turn, the quantitative composition of the research team is determined primarily to establish correct proportions between researchers, engineers, and backstopping staff, as well as to plan the necessary staff

and labor costs for the next stage. In addition, the labor norming is a criterion for estimating the economic efficiency of R&D activity and evaluating its results.

Fig. 2 shows a general scheme of work on norming labor inputs within the framework of the R&D project implementation as designed by the authors. The labor intensity of R&D works is usually normed by the three methods: expert, statistical, and analytical ones [28].

The expert evaluation of labor intensity of R&D works made by researchers' team is given by a group consisting of highly qualified experts who have a sufficient experience not only in evaluation, but also in related fields.

The statistical method is based on comparing the planned labor inputs for project with similar, previously implemented R&D projects. To do this, the reporting and statistics collected from the researches' individual plans. Having analyzed and generalized these materials (for example, for 2—3 years), summary datasheets showing the average complexity of different types of R&D works are compiled. Based on such statistical information on individual research groups it is possible to establish normative labor inputs for certain types of R&D works.

In *the analytical method*, the labor inputs are considered a result of observations of the labor process. The analytical methods for processing the output data are divided into logical, statistical, and mathematical. The main task of *logical analysis* is to identify causal relationships between the measurement of labor inputs for the implementation of R&D works and various factors related to it. Doing so, the content of functions of R&D activity, as well as the content and nature of researcher labor associated with the implementation of R&D works are studied. The logical analysis is based mainly on *statistical evaluation* of the processes studied. However, the quantitative values of norms can be obtained only by *mathematical processing* of the output data by the correlation method and the method of linear programming. The former is used mainly for developing the consolidated norms while the latter applies to the differentiated norms.

The labor norms for researchers should take into account the complexity of works (experimental, applied, and fundamental ones). The development of norms for R&D works consists of several stages: the classification of labor input, the selection of factors that affect the complexity of the R&D work implementation, and the development of norms by the statistical method with their subsequent approbation and adjustment.

While norming, it is necessary to analyze all possible factors that affect the complexity of R&D works. Detailed description of the factors is given in [17, 19]. They can be divided into the two groups: the quantitative and the qualitative factors.

The quantitative factors include, in particular, indicators that directly or indirectly characterize the amount of works to be done. The list of all factors can be modified and extended depending on the specifics and conditions of the research team for which the norms are developed.

The qualitative factors include the complexity and comprehension of the ongoing R&D, the qualifications of researchers, and their material support.

Different factors influence each type of labor, but it is inappropriate to take into account all of them, since this will considerably complicate the calculations and will not significantly affect the accuracy of norms. As a basis for determining the size of creative team, it is advisable to consider the labor inputs per individual operations and the overall labor inputs of R&D and organizational support of R&D works. Therefore, the priority issue is to choose the main factors that have a significant impact on the overall labor inputs, including those which have a considerable share in the total amount of R&D works.

On the other hand, when determining the composition of the factors affecting the number of individual units of the research team, they should not be minimized because of the difficulties related to their identification. As a result of over-

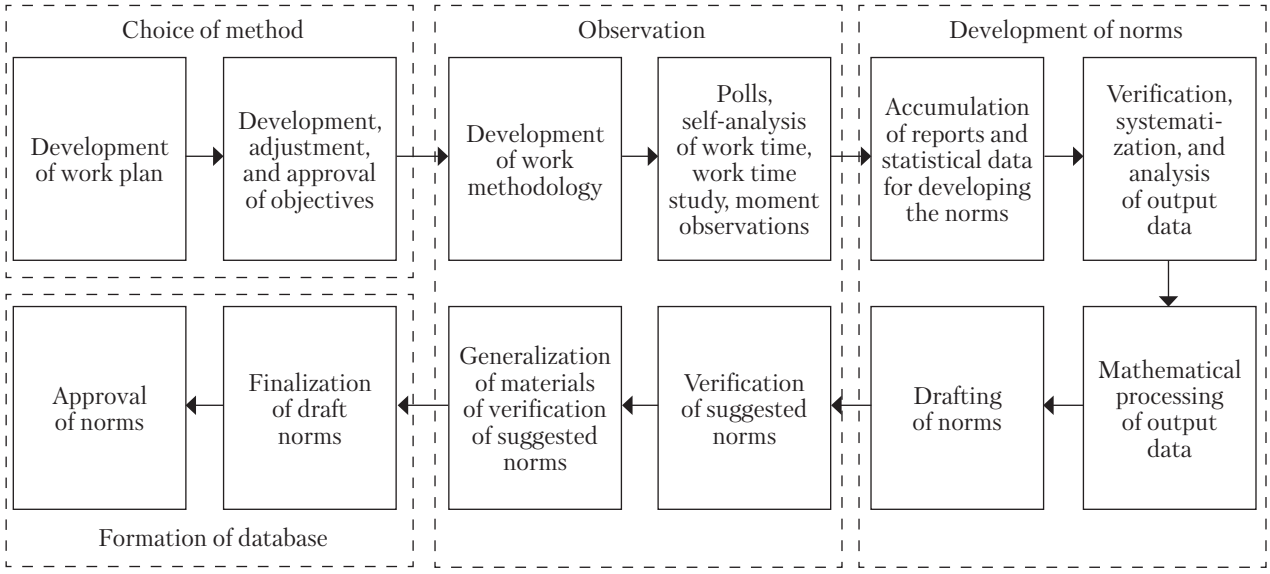

Fig. 2. Flowchart of R&D labor norming

simplification of the actual situation, the validity of norms drops sharply and all advantages of scientific approach are cancelled out. Since the determination of influence of each factor on the number of researchers in some structural unit of research team is a difficult task both from theoretical and practical standpoint, the collected statistical data on labor inputs for performing certain types of R&D works should not contain random variables. Consequently, it is necessary to analyze the actual data, to create the proper conditions for effective labor in the studied areas and, based on them, to establish standard norms (Fig. 2).

Effective organization of R&D works is impossible without establishing its measurement. This, in turn, allows for an analysis of the methods and conditions for implementing R&D works and determining on this basis the required labor inputs in the form of standards for work time, performance, manageability, proportions, and headcount.

Regarding the interpretation of norms and standards, it is expedient to briefly describe these concepts [28]: *labor norm* is the amount of labor (time input or number of employees) required for performing a certain R&D work under specific organizational and technical conditions; *labor standard* is time input (number of employees) needed to perform a certain amount of R&D work in typical organizational and technical conditions and as established based on special studies and used to develop labor norms.

It is necessary to apply such forms, methods, and means of R&D implementation, which ensure achieving the best result with minimum labor costs.

One of the tasks for improving the labor norming is the development of reasonable well-justified norms. The justification must contain both technical, economic, and psychophysiological aspects. *The technical justification* implies the most rational organization of R&D work and effective ways to implement a R&D project. *The economic justification* is to set the minimum time input into a certain type of work, which ensures a rise in labor productivity and an increase in the labor efficiency. *The psychophysiological justification* of labor norms is to assure a normal labor intensity and content of R&D work, in particular, to prevent excessive fatigue and labor monotony, resulting in a high labor capacity of employees during working hours, as well as normal ergonomic conditions.

APPROACHES TO NORMING THE RESEARCHER LABORB

Proposed approaches to the development of time standards should make it possible to form theoretical and methodological support for estimating the labor inputs in R&D work performed in R&D institutions and HEE and for justifying the number of employees who perform the specified work. They are based on a thorough analysis:

- legislative, regulative, and methodical documents (including sectoral ones) to regulate scholarly research and R&D activities [1, 4, 25];
- qualification requirements for scholarly research and academic staff [29];
- sectoral norms of time inputs for R&D works [23];
- Publicly available planning and reporting documentation of R&D institutions and HEE.

In order to determine time inputs required for one or another stage of R&D project, it is necessary to clearly identify specific structural elements of the research activity, the generalized form of which is shown in Fig. 3

There are regulatory requirements for the elements of scholarly research:

1) to study the very objects of knowledge, to apply specific means of cognition, and to use previously established results;

2) to control the use of means and methods of cognition, to minimize the uncertainties that arise;

3) to divide all cognitive actions into such basic operations that enable to reproduce the results and to verify them using different methods;

4) to distinguish the established and the hypothetical knowledge, the established and the predicted facts, etc. [30].

Scholarly research is a specific system of structural elements, through which targeted cognitive operations are realized. We consider it expedient to identify the following stages in this structure:

1) determination, clarification, and approval of the lines of research;

2) development of research program and plan;

3) research;

4) processing, synthesis, and analysis of the results.

In science, it is impossible to realize the purpose of research with the help of whatever single element only. To do this, it is necessary to complete all operations — from the initial cognitive operations to obtainment of the final result, which is the main feature of the systemic nature of scholarly research. Each element of scholarly research is not only involved in achieving the purpose in different ways, but also differently uses of the source data. Accordingly, it should be noted that the accuracy and logic of the initial data in any

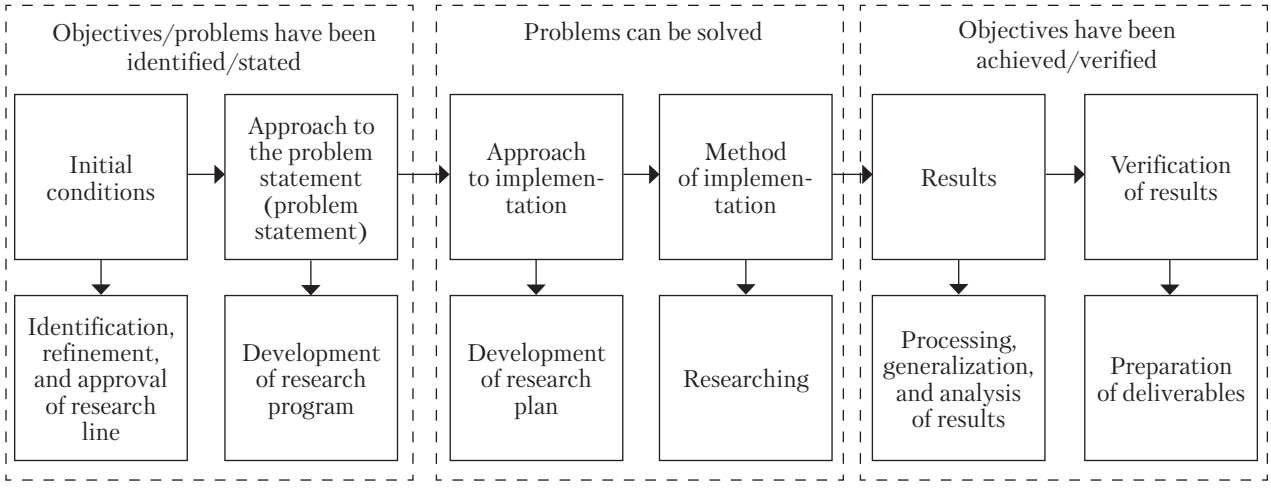

Fig. 3. Structural flowchart of R&D implementation

scholarly research corresponds to the perfection of means of cognition.

It is also necessary to clearly understand that in practice there are fundamental differences in the R&D implementation in the academic and university sectors. If for the HEE, the main activity is teaching students who are receiving higher education, with the employee engaged in research when he\she is free from the educational process, then in academic institutes R&D is the main activity.

These differences at the initial stage determine the different influence of organizational factors on the structure of the working time for the implementation of scholarly research in various sectors of science. It should be noted that in practice, members of creative teams combine the last stage of current research with the initial preparatory and organizational stages of new research to be implemented. Therefore, we believe that it is impossible at this stage to propose unified time inputs per a researcher or a research team expressed in man-hours per time basis for the academic and the university sectors. It would be more logical to determine the relative distribution of working time as percentage of working time required for one research instead of expressing it in man-hours per time basis.

Based on the current sectoral labor input standards for performing R&D works [23], the average proportion of scholarly research elements (%) has been determined (Fig. 4) and the specific creative elements of research, in particular, the need to identify and to specify the scientific problem, to choose the object and to identify the subject of research, to make and to formulate hypothesis, etc. (which are absent in the applicable standards because of limiting the scientific knowledge to the sectoral framework) have been clearly identified.

The main factors influencing the time norms are the complexity and novelty of R&D work to be done. It is also necessary to keep in mind the works classification by complexity. Under the conditions of labor division, scholarly research is

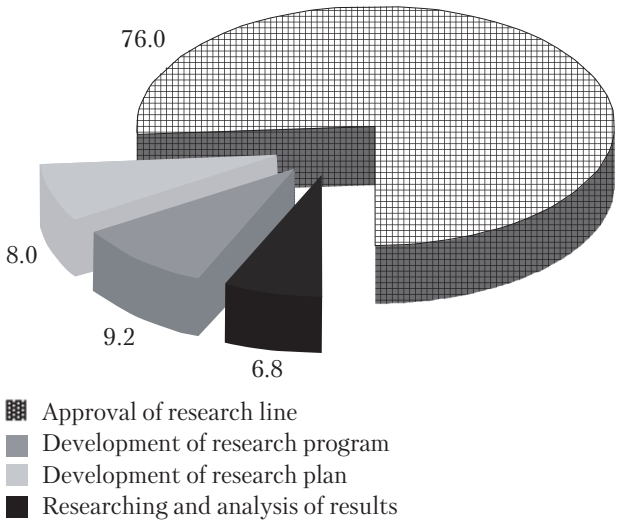

Fig. 4. Structure of scholarly research, average, %
Source: estimated by the authors based on [17–23].

divided into initial tasks of cognition (experimental, applied, and fundamental) to be solved by different groups of researchers simultaneously or by the same group, but in different time. In this case, it is advisable to talk about the three groups of R&D organizational complexity, in accordance with the Law of Ukraine on Scholarly Research and R&D Activity [4]:

- R&D activities based on scientific knowledge obtained as a result of scholarly research or practical experience and carried out in order to bring such knowledge to the stage of practical use (Group I);
- theoretical and experimental research aiming at obtaining and using new knowledge for practical purposes (Group II); and
- theoretical and experimental research aiming at obtaining new knowledge about laws of organization and development of nature, society, human being, and their interrelations (Group III).

DETERMINATION OF TYPES OF WORK FOR NORMING R&D LABOR

To systematize the further work on determining the time input required for the stage of scholarly research, let us briefly characterize them.

THE INITIAL STAGE OF SCHOLARLY RESEARCH

The initial stage of scholarly research involves defining, refining, and approving the line of research, based on detailed analysis and synthesis of available sources of information, definition and refinement of the scientific problem, selection of the object and the identification of the subject of research, and hypothesizing. The time input norms for the initial stage of scholarly research are presented in Table 1.

The R&D project manager estimates the resources needed to solve a particular scientific problem and makes an organizational plan.

Scholarly research, regardless of the group of organizational complexity to which it belongs, can be effectively performed if it is preceded by an *analysis and synthesis* of available sources of information. An overview of the sources should answer the questions, "What new publications have been published in our country and abroad for a certain period of time? What publications deal with the problems to be addressed in the planned R&D work? What publications in adjacent (or other) branches of science can help in solving the problem to be analyzed in the planned R&D work?"

The definition and specification of scientific problem is a prerequisite for any research that begins with an understanding of the problem to be solved. In the logical and methodological sense, *scientific problem* is a contradiction between the existing knowledge of phenomena and ignorance of them resulting from the lack of understanding of the nature of studied phenomena and the corresponding laws of science. If the problem has been formulated, the researchers should analyze, refine, and modify it. When formulating, substantiating and critically analyzing scientific problems it is necessary to theoretically consider the objects studied, to identify the means of cognition, and to specify the practical ways of solving the problem. Typically, every research begins with *general statement of problem*, which is subsequently refined. So, *the problem is specified*. It is also necessary to remember: if the object studied is a system, it should be studied using a systemic approach.

The problem formulation entails the choice of a specific research object. *The object of research* can be anything that explicitly or implicitly contains contradictions and creates a problem situation. This is that towards which the process of knowledge is directed (that is, it has an ontological status). In addition to the object, there is also *subject of research* or those properties, aspects, and features of the object, which are most significant from a practical or theoretical point of view and studied directly. The rest of the object characteristics are beyond the researcher's attention. In other words, the subject of research always has a logical, epistemological, and methodological status. Usually, the subject of research includes the central question of the research, associated with assuming the possibility of discovering a law or, at least, a logical center of laws of the controversy analyzed. The statement and analysis of this question is the source of working hypotheses.

The hypothesis is the main methodological tool that organizes the entire study process. The hypothesis is assumptions, suggestions, or predictions that are based either on prior knowledge or on new facts about the structure of the object studied, the nature of links between it and other objects, as well as possible approaches to solving individual problems, but most often, on both simultaneously. If the assumption clearly contradicts well-established facts, it cannot be considered a hypothesis. *Facts* are established, proved statements about certain things and their properties. In addition, it should always be kept in mind that when establishing a social fact, there is much more discrepancies than while establishing a natural fact. The more so it concerns the assessment of facts.

The scientific hypothesis is based on the observation of real facts and their explanations, and therefore, its content is much broader than the data on which it relies. It is impossible to speak of confirming the hypothesis, unless the facts which

confirm it are established and specified. In the process of scholarly research, the hypothesis is used for dual purpose: to explain the existing facts and to predict new, unknown facts.

The hypothesis does not logically follow from given experience. If the existing knowledge does not enable to explain the data obtained during observation, there appear new working (intermediate, auxiliary) hypotheses. Irrespective of facts on which the hypothesis is based, this form of scientific knowledge gives only probable, not reliable knowledge of the object studied. However, the degree of such probability can vary in a fairly wide range, from false to practically reliable. The working hypothesis gives the first, preliminary answer to the problem and therefore, the degree of its probability usually never approaches the practical certainty.

It should be kept in mind that the hypothesis is a form of scientific knowledge, which creates only the initial part of the four-element system, "hypothesis — concept — theory — law" [5].

The development of science is characterized by the established links between empirical data accumulated, their unification within the framework of a unified theoretical system rather than by the amount of data, since, as a rule, scholarly research deals with system of problems rather than with isolated, individual ones. The *conception* is an orderly system of views on a certain phenomenon, a way of understanding, interpreting and, at the same time, a researcher's general idea of how to get new knowledge of and to transform the reality. All scientific theories pass through the stage of conception, until their postulates reach proper depth and perfection, because theory is the highest, the most advanced form of scientific knowledge.

The theory usually offers some new and original way to summarize the experience and points out what conclusions can be derived from it. Having identified issues that can be generalized from the experience and formulated this generalization into relevant conclusions, the theory on a specific question is formulated. Being a reflection of a certain fragment of the objective world, the theory gives a single, coherent idea of it. As Full Member of the Academy of Sciences P. Kopnin put it, until our knowledge is not systemized in such a way as to enable interpreting the known phenomena and, if possible, to predict still unknown ones, it has no theoretical and practical significance. The purpose of scientific theory is to comprehend already known results and to determine the ways of getting new knowledge and to predict new phenomena" [31].

The theory is associated with discovering and formulating laws of science and paving the way to them. *The laws* characterize the general, repeated, essential links between things and their properties. Scientific laws can be characterized by a certain degree of completeness. After all, they, like the phenomena described by them, arise, develop, and ultimately become void [32].

Table 1

Time Input Norms for the Initial Stage of Research, % of Total Working Time per Research

Type of work	Conditional groups of organizational complexity			Method for adjustment of works complexity
	I	II	III	
Preparation works. development of organizational plan	0.3	0.3	0.4	Statistical
Overview of information sources	2.0	2.2	2.3	
Definition and specification of the scientific problem	1.6	1.9	1.9	Expert
Selection of the object and identification of the subject of research	0.9	0.9	0.8	
Hypothesizing	1.5	1.6	1.7	

Source: developed by the authors, based on [17—23].

Accordingly, it is advisable to distinguish between the categorical content of the prediction and the forecast. The *prediction* is based on the knowledge of laws — having known the laws, one can predict individual specific phenomena governed by these laws. Unlike the prediction, the *forecast* is not based on the knowledge of laws. It proceeds from other well-known facts, therefore, it does not pretend to be true-to-fact, but gives a probability of phenomenon discussed. In addition, the forecast is always associated with the prediction of future events.

Also, it should be noted that the complex phenomena that are usually caused by many factors and the theories explaining them are also interrelated, in many cases. The path of science development shows that science evolves from simple, one-causal theories that explain complex phenomena by one economic, psychological or some other reason, towards complex structures, in the very nature of which there is the possibility of various development options.

DEVELOPMENT OF RESEARCH PROGRAM

The program of research determines its purpose and objectives, subject and conditions, resources, and expected results. The research program is the main content of future activities. Its development involves: clarification of purpose and formulation of research objectives; justification of the relevance based on available data; determination of stages and benchmarks; formulation of basic requirements for the object studied; development of methods for obtaining the research results; establishment of the list of deliverables provided after the completion of research stages and the procedure for review and acceptance of the results (Table 2).

The purpose, in the broadest sense, is imaginary prediction of the desired results of the research. The cognitive method by which this knowledge is achieved is very essential. *The method of cognition* is usually a way in which the researcher finds a solution of the tasks formulated. *The research objectives*, they are to disclose the internal relations in the system studied, proceeding from the facts obtained.

The purpose of research focuses the researcher's efforts on the final *result* (theoretical or practical), the objectives formulate the questions to be answered while achieving the research purpose. It also defines how comprehensive the data obtained should be analyzed. The sequence of researcher's operations in the analysis of empirical data is shown in Fig. 5. It should be noted that not all elements of the given scheme should be implemented in each research. It illustrates the principle of procedure for analyzing phenomena and processes.

As a rule, researchers set objectives they are capable of solving since, usually, any objective arises when the material conditions for its solution are available or will appear in the near future. Deducing various conclusions from the hypothesis it is possible to evaluate its theoretical and empirical significance. If, for example, consequences from the hypothesis contradict each other, this means the hypothesis is weak. Getting empirically verifiable consequences from hypothesis is the most important proof of its relevance. In this case, the hypothesis plays a different role, namely, as an initial premise of some plausible, or hypothetical, consideration.

The stages of implementation of R&D works are usually:

- Theoretical and empirical studies, in particular, the collection of socio-economic and statistical information;
- Analysis of the obtained data and discovery of empirical dependencies;
- Predictions based on initial data and empirical dependencies of the behavior of object studied (previously unknown knowledge must be predicted);
- Development of basic ideas that reflect a certain insight of the object being studied, and discovery of the basic relations on which the explanation of the phenomena is based;
- *Explanation* of the phenomena studied, which consists of identifying the causes, essence, patterns of the phenomena studied;

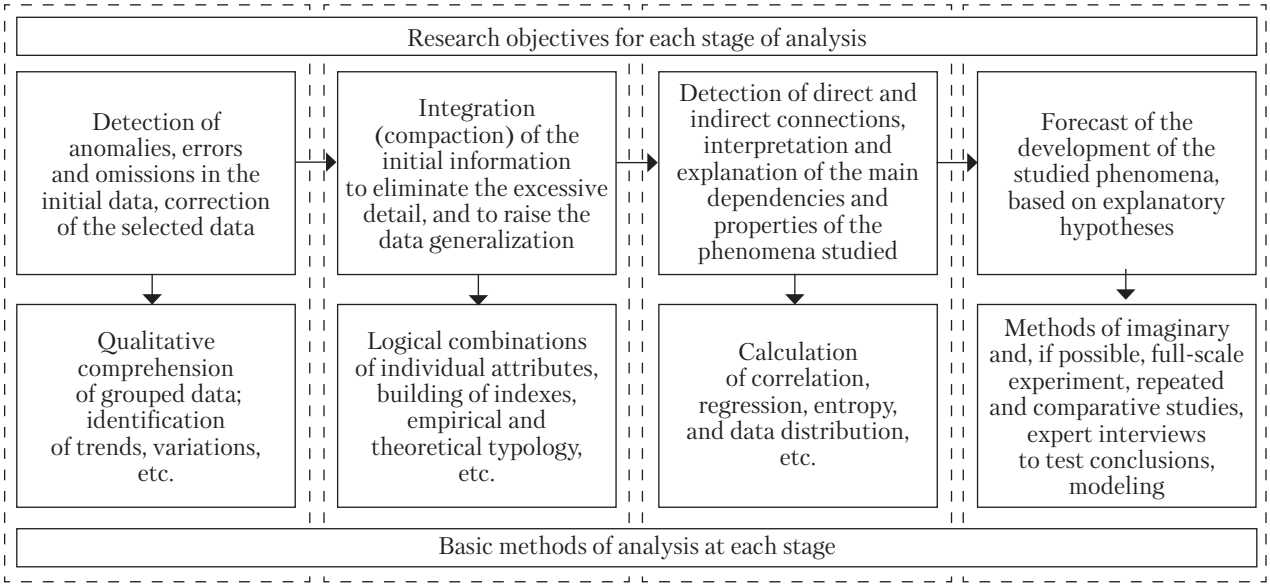

Fig. 5. Sequence of states of data analysis while doing the scholarly research

Table 2

Time Inputs for Development of Research Program, % of total time input per research

Type of work	Conditional groups of organizational complexity			Method for adjustment of works complexity
	I	II	III	
Clarification of purpose and formulation of research objectives	0.9	1.1	1.3	Expert
Justification of the relevance based on available data	3.9	3.9	4.3	Statistical
Determination of stages and benchmarks	0.5	0.7	1.0	
Formulation of basic requirements for the object studied	0.4	0.4	0.5	Expert
Development of methods for obtaining the research results	1.3	1.5	1.7	
Establishment of the list of deliverables provided after the completion of research stages and the procedure for review and acceptance of the results	1.3	1.3	1.5	Statistical

Source: developed by the authors, based on [17—23].

- Discovery of empirical dependencies of the corresponding theoretical statements and the establishment of empirical dependencies based on these theoretical statements;
- Formulation of conclusions, practical recommendations and proposals based on the research results.

It has already been mentioned that the study of social (and often other) objects should be systemic, that is, the studied object in the process of analysis is usually divided into subsystems that must satisfy the following requirements:

1) each individual subsystem is a functionally independent part of larger object and is associated with its other subsystems by means of links of a different nature;

2) each subsystem may have properties that do not coincide with the properties of the whole system;

3) each subsystem, if necessary, can be represented as a system of subsystems of lower level.

The study can be conducted at *the macro* level, if the analyzed system is enlarged and presented as a system consisting of a set of basic subsystems and links between them, and at *the micro* level, if it is necessary to work out in detail the internal structure of the system at lower level.

Since the realization of scholarly research results means not only the actual application of the results obtained in theory and in practice, but also their documenting — at the stage of developing the research program it is necessary to take into account the implementation of its results and the respective paperwork.

The specified stage of scholarly research is completed by establishing the list of deliverables and the procedure for review and acceptance of the research results.

DEVELOPMENT OF RESEARCH PLAN

The research plan contains actions that need to be taken to fully implement the research program and to solve the problem. The development of research plan consists of the following stages: collection, study, and analysis of information sources; development of a manual and selection of an adequate mathematical apparatus for processing of research data; formulation and approval of the research plan; formation of a team of researchers and collaborators, frameworks for conducting scholarly research, etc. (Table 3).

The research based on previously selected information materials is carried out in the following sequence: analysis and generalization of progress in solving the identified problem, evaluation of development of the given research line abroad and inside the country; comparison of foreign and in-house experience in solving the problem studied; conclusions about trends in the development of research on the subject of interest, and recommendations for choosing a research line; the list of sources analyzed.

The processing of initial data obtained during the research involves data verification, ensuring of their comparability, analytical processing of data and development of methodological framework of analysis. The information collected for analysis should be checked for quality: how complete the data is, whether they are properly documented; the essence of data obtained is examined. While verifying, it is necessary to determine whether and how far a particular indicator is true. The analysis will be much less labor-intensive if indicators are comparable. Analytical processing of data is direct analysis. The organization of data processing requires appropriate methodological framework, a certain level of skills of staff involved in the analysis, equipment of staff with technical means of analysis.

Scientific problems vary significantly in terms of content, but at the same time they have a lot in

Table 3

Time Input Norms for Development of Research Plan, % of Total Time Input per Research

Type of work	Conditional groups of organizational complexity			Method for adjustment of works complexity
	I	II	III	
Collection, study, and analysis of information sources	2.0	2.3	2.5	Statistical and analytical
Development of a manual for processing of research data	0.5	0.7	0.7	
Selection of an adequate mathematical apparatus for processing of research data	1.0	1.1	2.0	Expert
Formulation and approval of the research plan	0.7	0.8	0.8	
Formation of a team of researchers and collaborators, frameworks for conducting scholarly research, polls, trainings, correspondence	3.0	3.2	2.9	Statistical and expert

Source: developed by the authors, based on [17—23].

common. As a rule, research results have some quantitative characteristics. Often information obtained in the course of research is incomplete, contradictive, and ambiguous. Any quantitative description of data obtained requires mathematical processing. The contradictory nature of the information obtained manifests itself immediately if numerical characteristics are known [33, 34]. The mathematical apparatus is chosen in accordance with the following criteria: the solution must be not only correct, but also economically justified in terms of efforts spent; must be processable by modern computing facilities and convenient for further use and update.

The general research plan is worked out in detail in *the work plan* that is developed to elaborate the research plan more specifically. The work plan is a list of actions, schedule of research, composition and competence of staff, cost estimate and expected results for each stage of the research. It defines stages of which the total amount of work consists; terms of the commencement and completion of works for each research stage, schedule of works; distribution of spheres and specific objects of the research by subgroups and individual members; establishment of specific tasks and competence of subgroup leaders and members; description of intermediate results, as well as forms and time framework of submission of reporting; cost estimate for each research stage.

Until recently, one and the same researcher could simultaneously and equally well perform various forms of research (observation, experiment, survey, expert evaluation, etc.) and process (systematize, classify, explain, and forecast) new knowledge gained. Nowadays, to combine these activities is getting more and more complicated. Therefore, every team leader of particular scholarly research must create a team, all members of which can work according to their research specialization, but having as deep insight as it is necessary for both stratifying the problem studied and applying interdisciplinary research approaches.

RESEARCH-DOING, PROCESSING, GENERALIZATION, AND ANALYSIS OF THE RESULTS OBTAINED

The next stage of R&D implementation usually involves observations, expert evaluation, etc.; further processing of results, assessment of the research objectives completeness; detailed analysis of the data obtained in accordance with the research program; identification of principal ways of solving the problem of research and their possible application in theory and in practice. The approximate time distribution for these steps is shown in Table. 4.

While doing observations, expert evaluation, etc., it should be borne in mind that social objects are empirically observable objects. Their study is complicated and limited, and sometimes impossible under the conditions that apply to science or technology. Therefore, in this case, *scientific observation* that is an appropriately organized se-

Table 4

Time Input Norms for Practical and Generalizing Component of the Research, % of Total Time Input per Research

Type of work	Conditional groups of organizational complexity			Method for adjustment of works complexity
	I	II	III	
Observations, expert evaluation, etc.	11.9	10.5	9.7	Statistical, analytical
Further processing of results, assessment of the research objectives completeness	14.4	14.5	13.5	
Detailed analysis of the data obtained in accordance with the research program; identification of principal ways of solving the problem of research and their possible application in theory and in practice	1.0	1.1	2.0	Expert

Source: developed by the authors, based on [17—23].

lective process based on respective theory is acceptable. Observations in scholarly research are intended to carry out the three main functions: providing empirical information that is necessary for testing the problem and hypotheses based on it; testing such hypotheses, concepts, and theories, which cannot be done experimentally; verifying the adequacy and truth of the results obtained during the research.

Expert evaluation is the use of certain means by researcher to acquire new knowledge about the object. It should be noted that *expert* is a qualified specialist on a particular problem involved in evaluating the task, and *competence of expert* is his/her ability to formulate reliable judgments about the object of evaluation based on professional knowledge, intuition, and experience. At the same time, the results of expert evaluation should not be absolutized, since they are obtained in conditions of incomplete subjective information, etc.; it is only a secondary material for making decisions.

Obtaining objective knowledge in social sciences, in particular, in economics, is complicated by the fact that the results of studying certain processes not always can be verified directly, because the features of this practice are not always fully understood, and proven techniques of the practical activity may not apply to the research subject without significant refinements and limitations.

The observational results always cover a relatively small number of phenomena and events, while the scientific statements usually have a versatile application. With the help of hypothesis, it is possible to expand knowledge by extrapolating a pattern discovered while studying a limited number of cases to the whole set of probable cases. This is how *conceptions* appear. Having appropriately processed data collected during the study, the scholars seek to understand and to explain them theoretically. To do this, hypotheses are needed as a preliminary explanation, and the conclusions from hypothesis should not contradict the facts obtained from the study.

The results and facts obtained must be reproduced and duplicated, indicating the existence of the law as a necessary, substantial, sustainable, and repetitive relationship between the phenomena in the nature and in the society. Reproducibility and repetition of the fact in strictly prescribed conditions is a prerequisite for the existence of science. The compliance of the obtained results with the existing theory shows the completeness of solution of the research task.

The empirical test of hypothesis is reduced to examining the consequences that are derived directly from the results obtained. If the predictions derived from hypothesis are consistent with the data obtained, then the hypothesis is said to be confirmed by these data. With the help of experience, only a relatively small number of cases can be tested. Therefore, in principle, always there is the possibility of refuting the hypothesis using new data obtained. That is why, general hypotheses can never be completely verified based on experience. On the other hand, one case that does not confirm the hypothesis is enough to refute it as a whole. At the same time, if while testing the hypothesis, its consequences contradict the experience, this does not mean that the original hypothesis is wrong. It is possible that the negative result of the experiment is explained by a wrong assumption used to support the original hypothesis. All this suggests that the process of testing and refuting hypotheses that are part of any scientific theory is more complicated than it may seem to be, at the first glance. Each scientific hypothesis is usually associated with several secondary assumptions or hypotheses. Therefore, negative results derived from the data obtained may indicate that the secondary assumption rather than the original hypothesis is false. If the false assumption can be corrected or modified, then the research can confirm the underlying hypothesis.

The examination and interpretation of the data obtained by the researcher is the only way to ensure reliability, theoretical and practical significance of the research results. The framework

Table 5

Time Input Norms for Preparing Deliverables Based on the Research Results, man hours per 1 author's sheet

Type of work	Conditional groups of organizational complexity			Method for adjustment of works complexity
	I	II	III	
Preparation of text, discussion inside the team, finalization of the text based on the discussion results	40.0	55.0	70.0	Statistical, expert
Preparation of deliverables based on the research results (monographs, articles, etc.)	50.0	60.0	70.0	
Finalization of deliverables based on remarks and proposals	10.0	20.0	40.0	

Source: developed by the authors, based on [17—23, 35].

for interpretation and explanation is established in the research program. While realizing the program goals, the researcher verifies initial hypotheses based on the data obtained, complements and refines the theory that is an outcome of the study, and prepares deliverables based on the results (reports, publications, etc.).

PREPARATION OF DELIVERABLES BASED ON THE RESULTS OF R&D WORK

At the stage of preparation of materials according to the results of R&D work, other conditional groups of organizational complexity of works are used, namely:

- scientific reports at each stage of the research, reports, statements of research results (Group I);
- scientific reports, practical articles in applied and professional periodicals, expert analytical materials (Group II);
- monographs, theoretical articles in collections of scientific works, scholarly research and analytical materials (Group III).

The time limits set for the abovementioned types of work are given in Table 5.

The abovementioned has enabled to determine the structural composition of the labor-intensive components of scholarly research work, which in the future can lay foundation for developing uniform and balanced norms for various sectors of the national R&D sphere. In general, the labor norming allows researchers to realize reasonably justified planning of the size of research teams, to reduce the manifestations of subjectivity in the organization and coordination of scholarly research, to effectively adjust the public need in new results with publishing scholarly research results in order to enhance their implementation into the public practice.

The norming of scholarly research labor should be based on quantitative and qualitative study of research processes and the possibility of their implementation with minimum labor and time inputs. Thus, norming of labor should aim at creating standards for time input, labor input, manageability, composition, and number of employees. The study provides reasonable grounds for defining the field of application of different types of norms, in particular, in the context of improving the structural relations that have been created, as well as for consistently expanding the sphere of labor standardization up to the full coverage of all employees (researchers, engineers, and auxiliary staff) and practical application [36]. This will form a basis for systematizing the norming of overheads for research and the planning of funding of science as a whole, updating the relevant legislative framework and institutionalizing it in the global space research. Fulfillment of this scope of works, application of the whole range of methods for evaluation and processing of statistical data in various sectors of science should be realized in cooperation between researchers, experts, and government authorities.

REFERENCES

1. Frascati Manual — 2015 Edition Guidelines for Collecting and Reporting Data on Research and Experimental Development. URL: https://www.oecd.org/sti/inno/Frascati-Manual-2015-Flyer-EN.pdf (Last accessed: 12.03.2018).

2. Semenyuk, E. P., Kotlyarevskyy, Ya. V., Melnikov, A. V. (2016). Informational and Communicational Aspects of Forming and Functioning Scientific Schools of Publishing and Printing Branch. *Science and innovation*, 12(2), 71—89 [in Ukrainian].

3. Research and innovation activities in Ukraine. (2017). *State Statistic service for Ukraine*. Kyiv. P. 13 [in Ukrainian].

4. Law of Ukraine «About scientific and scientific-technical activities» 26.11.2015 № 848-VIII (latest amendments 28.09.2017 p.). URL: http://zakon5.rada.gov.ua/laws/show/848-19 (Last accessed: 14.10.2017) [in Ukrainian].

5. Semenyuk, E. P., Melnyk, V. P. (2012). *The philosophy of modern science and technics*. Lviv [in Ukrainian].

6. Melnyk, V. P. (2010). *Philosophy. Science. Technics: a methodology and ideology analyses*. Lviv [in Ukrainian].

7. Gabovych, O., Kuznetsov, V., Semenova, N. (2016). *Ukrainian fundamental science and European values*. Kyiv [in Ukrainian].

8. Yegorov, I., Popovych, O., Solovyov, V. (2003). «Strategy of borrowing» and development of science. *Visnyk of the National Academy of Sciences of Ukraine*, 5, 3—14 [in Ukrainian].

9. Solovyov, V. P. (2004). *Innovation activity as systematic process in competitive economy (Synergetic effects of innovations)*. Kyiv [in Russian].

10. Solovyov, V. P. (2009). National strategy for innovative development in globalized world: elements of concept. *Science and innovation*, 5(3), 16—22 [in Ukrainian].

11. Yegorov, I. Yu. (2014). Assessment of scientific activity outcomes: traditional approaches and new challenges. *Science and Science of Science*, 10(3), 42—47 [in Ukrainian].

12. Yegorov, I. Yu. (2013). Improvement of R&D statistics: modern tendencies in developed countries in the world. *Statistics of Ukraine*, 3, 46—49 [in Ukrainian].

13. Malitsky, B. A. (2017). Who and How should Assess Research Results of a Scientist. *Science and Science of Science*, 3, 34—53 [in Russian].

14. Iefimenko, T. I. (2016). Conceptual approaches to science funding mechanisms' development. *Finance of Ukraine*, 8, 9—23 [in Ukrainian].

15. Yegorov, I. Yu. (2015). Transformation of research systems in Central and Eastern Europe countries: possible lessons for Ukraine. *Science and innovation*, 11(1), 26—33 [in Ukrainian].

16. Paduchak, B. M. (2014). New tendencies in innovations in Western world. *Science and Science of Science*, 10(4), 43—49 [in Ukrainian].

17. Dobrov, G. M., Klymenyuk, V. N., Smyrnov, L. P., Saveliev, A. A. (1969). *Capacity of Science*. Kyiv. [in Russian].

18. Dobrov, G. M., Klymenyuk, V. N., Odrin, V. M., Saveliev, A. A. (1970). *Organization of science*. Kyiv [in Russian].

19. Dobrov, G. M., Tonkal, V. E., Saveliev, A. A., Malitsky, B. A. (1987). *Scientific and technical capacity: structure, dynamics, efficiency*. Kyiv [in Russian].

20. Soliman, I., Soliman, H. (1997). Academic Workload and Quality. *Assessment & Evaluation in Higher Education*, 22(2), 135—157.

21. Milem, J. F., Berger, J. B., Dey, E. L. (2000). Faculty Time Allocation: A Study of Change over Twenty Years. *Journal of Higher Education*, 71(4), 454—475.

22. Bozeman, B., Gaughan, M. (2011). Job Satisfaction among University Faculty: Individual, Work, and Institutional Determinants. *The Journal of Higher Education*, 82(2), 154—186.

23. Yeremenko, V. O., Shypylin, M. A., Volodko, I. A., Vyazemskyy, V. G., Tolstyakova, T. M., Kosuhina, T. V., Maksymenko, G. M., Sova, V. K., Tovstenko, O. P. (2004). *Intersectoral time norms for research activities for librarians*. Kramatorsk [in Ukrainian].

24. Order of Ministry of education and Science of Ukraine «About establishment of working group to develop a methodology for assessment of research, scientific-technical and innovation activities efficiency of scientific institutions» dated 11.09.2017. № 1268. URL: http://old.mon.gov.ua/ua/about-ministry/normative/8064- (Last accessed: 12.03.2018) [in Ukrainian].

25. Decree of Cabinet of Ministers of Ukraine «About conditions for employment patrol for staff in public scientific institutions and establishments and other scientific entities of national academy of Sciences» dated 31.01.2001. № 74. URL: http://zakon0.rada.gov.ua/laws/show/74-2001-%D0%BF/print1509540380195563 (Last accessed: 12.05.2018) [in Ukrainian].

26. Order of Ministry of Education and Science of Ukraine «About approve of time norms for planning and accounting educational activities and lists of main types of methodological, research and organizational operations of pedagogical and scientific-pedagogical staff in higher educational establishments» dated 07.08.2002. № 450. *Official Herald of Ukraine*, 2002, 35, 52 [in Ukrainian].

27. Melnikov, A. V., Semenyuk, E. P., Kotlyarevskyy, Ya. V. (2010). Application of informational approach towards poligraphy development analyses. *Herald of Academy of Engineering Sciences of Ukraine*, 1(40), 40—48 [in Russian].

28. Kvasko, A. V., Kotlyarevskyy, Ya. V., Melnikov, A. V., Siryk, M. V. (2010). *Norm-setting, organization and labor payroll in poligraphy*. Kyiv [in Ukrainian].

29. Order of Ministry of Education and Science of Ukraine «About approve of qualification characteristics of professions (positions) of pedagogical and scientific-pedagogical staff in educational institutions» dated 01.06.2013. № 665. URL: http://old.mon.gov.ua/ru/about-ministry/normative/1672- (Last accessed: 29.06.2018) [in Ukrainian].

30. Gerasimov, I. G. (1985). *Structure of scientific research*. Moscow [in Russian].

31. Kopnin, P. V. (1968). *Logical foundations of science*. Kyiv [in Russian].

32. Melnikov, A. V., Senkivskyj, V. M., Shtangret, A. M., Semenyuk, E. P. (2013). About ordinances of development and functioning of printing and publishing branch. *Technology and Technique of Typography*, 4(42), 117—125 [in Ukrainian].

33. Semenyuk, E. P., Stasyshyn, V. M. (1980). Matematization of scientific knowledge and informatics. Issues of theory. *NTI. Series 2*, 1, 1—7 [in Russian].

34. Semenyuk, E. P., Stasyshyn, V. M. (1980). Matematization of scientific knowledge and informatics. Applied aspects. *NTI. Series 2*, 4, 1—8 [in Russian].

35. Cholod, Z. M., Chernysh, N. I., Malyarchuk, I. I., Shtangret, A. M., Shlyahetko, V. V. (2006). *Sectoral time and production norms for editorial and publishing processes*. Lviv [in Ukrainian].

36. State Standard of Ukraine 3973-2000. System of elaboration and installation for production. Rules of carrying out scientific and research activities. General provisions. Kyiv, 2001 [in Ukrainian].

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МЕТОДОЛОГІЧНІ ПІДХОДИ ДО НОРМУВАННЯ ПРАЦІ У СФЕРІ НАУКОВИХ ДОСЛІДЖЕНЬ ТА РОЗРОБОК

Вступ. Наукова діяльність є складним та багатогранним різновидом людської праці, який має творчу складову, тому проблема її нормування є досить непростою, але водночас винятково важливою парадигмою якнайширшого впровадження інновацій у сучасні соціально-економічні процеси.

Проблематика. Робота вченого внутрішньо неоднорідна, різнопланова, з обов'язковою креативною складовою безпосереднього творчого пошуку. Проте, виходячи із якісно й кількісно споріднених феноменів координації наукової та науково-організаційної діяльності в межах планування, організації та проведення наукових досліджень і розробок, зокрема спираючись на методологічні та емпіричні аспекти структурних та системоутворюючих чинників, ґрунтуючись на вітчизняному досвіді й прикладних підходах, що вже апробовувалися у галузевих нормативних документах, наведено авторське концептуальне бачення перспектив подальших досліджень проблеми нормування наукової праці.

Мета. Сприяти напрацюванню методичних підходів до нормування праці у галузі наукових досліджень та розробок.

Матеріали й методи. Аналітична обробка діючих нормативних документів і наукових праць з метою розроблення підходів до нормування наукової праці.

Результати. Автори вважають, що хоча самі по собі окремі наукові дослідження й розробки в цілому унікальні, елементи, що складають наукову діяльність, в різних кількісних і якісних поєднаннях присутні у всіх видах наукових

робіт. Отже, всі повторювані елементи, тобто найпростіші роботи, можуть бути унормовані за єдиною узгодженою системою, яка б враховувала широкий діапазон особливостей, структури та змісту наукової праці з урахуванням диференційованої потреби створення нових знань в результаті виконання наукових досліджень і розробок. Наведені теоретичні узагальнення та практичні узагальнення сприяють формуванню системно-структурної моделі нормування наукової праці.

Висновки. Отримані результати можуть слугувати базою для подальшого удосконалення регулювання сфери наукових досліджень і розробок у контексті реформування діяльності вітчизняних закладів вищої освіти та наукових установ.

Ключові слова: наукова праця, нормування наукової праці, творчість ученого, форми і методи наукового пізнання.

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МЕТОДОЛОГИЧЕСКИЕ ПОДХОДЫ К НОРМИРОВАНИЮ ТРУДА В СФЕРЕ НАУЧНЫХ ИССЛЕДОВАНИЙ И РАЗРАБОТОК

Введение. Научная деятельность является сложным и многогранным видом человеческого труда, который имеет творческую составляющую, поэтому проблема ее нормирования является достаточно сложной, но в то же время исключительно важной парадигмой широкого внедрения инноваций в современные социально-экономические процессы.

Проблематика. Работа ученого внутренне неоднородна, разноплановая, с обязательной креативной составляющей непосредственного творческого поиска ученого. Однако, исходя из качественно и количественно родственных феноменов координации научной и научно-организационной деятельности в пределах планирования, организации и проведения научных исследований и разработок, в том числе опираясь на методологические и эмпирические аспекты структурных и системообразующих факторов, основываясь на отечественном опыте и прикладных подходах уже апробированых в отраслевых нормативных документах, представлено авторское концептуальное видение перспектив дальнейших исследований проблемы нормирования научной работы.

Цель. Способствовать наработке методических подходов к нормированию труда в сфере научных исследований и разработок.

Материалы и методы. Аналитическая обработка действующих нормативных документов и научных работ с целью разработки подходов к нормированию научной работы.

Результаты. Авторы считают, что хотя сами по себе отдельные научные исследования и разработки в целом уникальны, элементы, составляющие научную деятельность, в различных количественных и качественных сочетаниях присутствуют во всех видах научных работ. Таким образом, все повторяющиеся элементы, то есть простейшие работы, могут быть нормированы на основе единой согласованной системы, которая учитывала бы широкий диапазон особенностей, структуры и содержания научной работы с учетом дифференцированной потребности создания новых знаний в результате выполнения научных исследований и разработок. Изложенные теоретические обобщения и практические сведения способствуют формированию системно-структурной модели нормирования научной работы.

Выводы. Полученные результаты могут служить базисом для дальнейшего совершенствования регулирования сферы научных исследований и разработок в контексте реформирования деятельности отечественных высших учебных заведений и научных учреждений.

Ключевые слова: научный труд, нормирование научной работы, творчество ученого, формы и методы научного познания.