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FUNDAMENTAL RESEARCH AS A STARTING POINT APPLIED AND OTHER RESEARCH

Abstract: Fundamental research are basic. By their very nature, they provide a basis for knowledge about certain phenomena and define basic rules, which can later be built on and further developed through further research of the same type, or through applied researches. The results of these researches primarily concern theory, so most often and as a rule the goal of these researches is scientific explanation. Applied research continues from fundamental research in a logical sequence of inevitable practice. Based on the theory and evidence of fundamental research, the goals of applied scientific research set the task of explaining and discovering the possibility of practical application of the results of fundamental research. Therefore, models, prototypes and projections are often applied, as well as general rules that have been tested in practice.

Fundamental and applied research represent two separate but pervasive categories that have their own distinct differences. Despite all the overlaps and intertwining, these researches carry different expectations and have different social effects, such as differences in the judgment criteria related to the assessment of research success or failure, then differences in the effects on social movements and differences in the organization of research implementation, especially in the degree of autonomy in relation to political and economic interests and goals.

Key words: fundamental, (basic, primary) applied research, practical results.

1. INTRODUCTION

All scientific research and all practical and applied results of human mind, which are put to the function of human needs, are directly or indirectly based on the results of fundamental (basic, primary) research. In the modern world of accelerated and multiplied events, as a rule, priority is given to applied research, where the focus of attention is the speed of the researcher's response to the practical problems of society or special research commissions, but also

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economy in time and invested resources. According to the above, it is clear that fundamental research has a vital role in the corpus of the scientific research system and that another type of research cannot replace it. On the other hand, it itself, in some areas of human life, can play the role of applied research with its results. At the same time, based on the theory and evidence of fundamental research, the goals of applied scientific research set the task of explaining and discovering the possibility of practical application of the results of fundamental research. Therefore, models, prototypes and projections are often applied, as well as general rules that have been tested in practice.

Conditionally, it can be said that fundamental research is conducted without a narrowly defined idea of practical results and goals. Rather, it could be stated that it is about the intention to understand reality, the natural and social environment and processes and phenomena, that is, about the desire to reach general knowledge, principles, truths and rules. Although general knowledge from fundamental research cannot provide concrete answers to numerous problems of a practical nature, which are dominant in people's daily lives, general knowledge provides the basis for applied research. Since research includes numerous activities, it is inevitably important to ensure the observation and description of a phenomenon in the early stages of its appearance, and then to observe, describe and understand its regularities.

Although one can always talk about the peculiarities, that is, the specifics of fundamental research compared to others, it can also be said that all scientific research is more or less equal in its basic principles, goals, motives and structure. For this reason, it seems more justified to shed some light at this point regarding the treatment of fundamental research in the contemporary context of science and the understanding of the place and role of this research in overall human knowledge, as well as the relationship between fundamental and applied (applied) research. Some considerations from foreign literature and from countries where there is a lively debate about the place and role of fundamental research, that is, about the relationship between governments and financiers of such research, were used for this (Remedios, 2013).

Despite his apparent disinterest in practical purposes, every great scientist has a deep belief that knowledge is the essential value of life. He believes that a greater understanding of general phenomena will lead to greater well-being of mankind. The time devoted to research and the belief in the justification of the goals justify the effort, because the history of science confirms the fact that basic research, although it does not aim at practical goals, is by no means impractical research. Nevertheless, fundamental research in a way is moving towards the unknown through numerous hidden and uncertain paths. These researches usually involve large teams of researchers. Large scientific projects must be supported completely and to the end, which are very often not small expenses, where concrete and usable results are not immediately visible. It is possible very often that only a small or the smallest part of the research results has practical use.

2. RELATIONSHIP OF FUNDAMENTAL AND OTHER RESEARCH

When we have in mind the idea of fundamental research, the thought inevitably arises about the complexity of this type of research, which primarily rests on complex thought processes arising from an idea, from a recognized problem that created that idea, that is, from the overall experience and knowledge of the researcher. Inevitably, the question arises whether researchers in basic, fundamental research, in the process of scientific work, also use some applied research, but which in a general sense do not give the entire research the epithet of fundamental?

The answer to this question is not simple, but it can certainly be assumed that in the modern age there is a permeation of these researches and that numerous fundamental researches have in their process sub-researches or experiments that are of an applied nature. Because the very term research, no matter what prefix it is marked with, implies research and development, i.e., every fundamental research has some application and purpose, and from it, if successful, applied research will inevitably result, which is narrower in terms of problem coverage. Hence, within the framework of current historical, philosophical, sociological, economic, and other research in science and technology, there is a strong tendency to reduce the differences between fundamental and applied research, or between science and technology. Recognizing the differences between fundamental and applied research improves the chances for rational management and funding of research so that the sciences serve society as a whole, and not just the special interests of certain groups, such as private companies, political movements, religion, the scientific community, or others (Roll-Hansen, 2009).

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The measure of the success of the results of fundamental research is indicated by the number of new phenomena discovered and explained, whereby new ideas of general interest are opened and developed. General scientific interest is determined primarily within a discipline that is current in some way. On the other hand, the primary criterion of success in applied research is a concrete contribution to solving practical problems (Danilović, Tančić, Bogavac, 2019). Practical technical-technological success is the main criterion for evaluating the success of applied research, both in terms of initial projects and in terms of demonstrating the final results.

Fundamental research, as has already been said, reveals phenomena, processes, cause-and-effect relationships and rules in nature, society and human thought in order to improve and create basic human knowledge, which further serve as a basis for applied and developmental research. They do not have immediate economic and commercial goals. Precisely for this reason, in order to determine the possibility of using the results of some fundamental research, bearing in mind its practical application or in order to find a new method or a new way of achieving a special predetermined goal, applied research is carried out, which always starts from existing knowledge in order to solve special problems.

There are enough concrete examples in the social sciences, and especially in the natural sciences. Today, we are witnessing numerous applied researches in the natural sciences, for example in medicine, when solving specific problems related to the treatment of humans or animals. However, before that, it took decades and even centuries and numerous fundamental researches that were carried out on the collection, classification, description of man and his psychophysical structure and characteristics and numerous individuals of the plant and animal world. When the Atlas of Human Anatomy appeared in the middle of the 16th century, it represented a turning point in the development of scientific thought in medicine because it was the result of specific anatomy research conducted on actual experiments and dissection of the human organism (Vesalius). This is how important biological scientific theories such as the theory of evolution or genetics were created, which provided the basis for all other applied research that did not have a general scientific goal, but a practical and concrete task of solving the problems that arose. That is why fundamental research has the task of providing general and complete answers by producing theories that contain proven regularities and true descriptions. It is possible that researchers in fundamental research have no initial idea about the practical application of their results, but it is evident that without their basic research there would be a general social regression, stoppage of industrial development, stagnation in education, health, economy and other applied areas. In this way, social and scientific satisfaction of the researcher is achieved in an indirect way by using the basics from basic research in enriching people's quality of life (Hsieh, 2005).

Developmental research is based on the results of applied research, which are also called expert or development-research. This research further develops and refines practical solutions and achievements of applied research. Very often, various technical-technological innovations that arose as a result of practice requirements, as an attempt to solve a problem more efficiently or as an upgrade of existing ideas that arose as a result of active thinking about the possibilities of improving existing solutions are classified as developmental research. There are also opinions that developmental research is, in fact, prognostic in nature, i.e., that it is a combination of fundamental and applied research that relates mainly to the future, i.e. on the future state of the subject being studying

(Sakan, 2006). In any case, in an indirect way, developmental research also rests on the theoretical premises of fundamental research or their process is checked in relation to achievements in the theory of one science or scientific discipline.

Development research is carried out by institutions whose activity is research and development. Research units can be scientific-research and research-development institutes or centers with research-development units that are part of it and whose basic or predominant activity is scientific research or research-development. In addition to researchers, expert associates participate in the process of development research and participate directly with researchers in the execution of research and development tasks, while technical staff perform the technical part of the research and development task, under the supervision of researchers. In addition to these, there is also support staff that performs administrative, financial and personnel tasks whose work is directly related to development research (Krippendorff, 2009).

Developmental or professional research represents systematic work, based on knowledge acquired through basic or applied research, that is, on practical experience. That experience is aimed at introducing new or significantly improving existing procedures, products and services. Developmental research, which is also called technological improvement, are all activities that occur between invention and production, such as experimentation on drawings or development of prototypes, experiments, pilot projects, models, etc. These researches have a very practical goal and their basic feature is a clear purpose, that is, a direct and quickly achieved benefit in a narrow area.

3. ACTION RESEARCH

Action research, according to the general meaning of this definition, is an organized process of examining some phenomenon that is carried out for the needs and with the intentions of the researcher who undertook the research. Researchers who engage in action research are looking for what will improve their own experience. For this reason, action research has positive effects on researchers and on their current and future experiences. It is obvious that the most important thing is that these researches are always the most important for the one who conducts them, and who actually models them. The benefit is guaranteed because the essence of each research project is determined by the researcher who is also the primary user of those results, thus perfecting his research procedures. Action research is aimed at improving some practice and it contributes to the development of practical theories. That is why various methods are used in social science research.

Discourse or discussion is the basic method in action research. Discourse means joint consultation about what needs to be done at some stage of the research. In addition, surveys, case studies, analysis of lifestyles, analysis (content) of documents and others are also used. In addition to methods, instruments

such as questionnaires, judgment scales, observation protocols and others are also used. Action research can thus be carried out by individuals or groups that share the interests of solving a common problem, or by an entire institution. Whatever the idea of action research, it generally includes the following stages of the process: determining the focus of research, clarifying the theoretical basis, defining research questions, collecting documents (data), analyzing documents, communicating results and taking further steps based on the information obtained (Sagor, 2009).

All scientific research is carried out within a planned research process that has its own stages and phases. It is important to emphasize here that it is not a rare phenomenon that in the process of scientific research certain phases are neglected or completely omitted, and therefore the research results are often full of shortcomings and inconsistencies. On the other hand, due to certain specificities, the processes are different in research in the natural and social sciences, so it is possible that certain phases do not exist or their order is different. But in any case, the research process represents a unique, meaningful and logical whole that has its own internal organization and parts that stand in cause-and-effect connections and relationships and that consists of theoretical and empirical parts (Milosavljević, 1975).

As Vujević states that, due to the specificity of social research, it should be kept in mind that all activities within the process are not necessary, but only possible in specific research, and that the development and application of these activities must not be templated but the result of constructive creative thought activity. Because the research process is a unique activity in which the theoretical part, composed of phases, determines what will be measured empirically, while at the same time, the results of empirical measurement determine the validity of the theoretical reflection. In the process of fundamental scientific research, each work should begin by recording and activating existing knowledge (Vujević, 2006). This inevitability is logical and realistically the only acceptable because in human knowledge and experience there can hardly be anything from the known reality that is not included in some way in some part of the previous research at any level or in any scope.

4. SPECIFICS OF PROCESS OF SCIENTIFIC RESEARCH

If the activities of the research process were to be grouped in the most general sense, then it is necessary to talk about three basic entities. In the first place is the creation of an initial hypothetical framework based on existing theories that include the existing scientific fund and existing knowledge about the subject and problem of research and about the phenomenon itself that is being explored. The second part belongs to practical and empirical activities related to collecting the necessary information about a certain reality, but also about looking at the existing experiential records about the same type of problem.

The third unit includes the effort and initiative to complement the research results into the existing scientific fund, to have a certain degree of relevance and validity and to define a final theoretical or practical purpose for them.

Conceptualization is important for the process of fundamental scientific research as a general idea of research that contains all the phases of the process tentatively divided into stages, from identifying the problem to communicating the research results. Part of the stages of this process takes place before the research project is created, and the rest within the project. A detailed and very clear description of the conceptualization, which can be applied to fundamental research, can be found in Termiz's statement. He states that it is most appropriate to observe the beginning of conceptualization through the stages of the first stage that exists before the start of the research project, which includes the perception and recording of problems, identification and description of problems, determination of the research task and formulation of the conceptual project (Termiz, 2009). It is quite clear that this is a preparatory stage that includes the mentioned stages and that it is quite justified to conclude that in this stage the existing scientific and empirical, theoretical and practical knowledge is exploited. On the basis of this knowledge and experience, and through the observation of important relationships and factors, the initial scientific parameters are identified (Fajgelj, 2010). Here, in the first place, we think about the initial ideas about the research problem and about the phenomenon from which the problem arises, while a concrete and precise assessment of the justification of the research, the actuality of the problem, the possibility of researching the subject, goals and the like, will be realized in the later stages of the next stages. Before the conceptual project, a conceptual sketch is created that contains the most important ideas described in abbreviated scope, which refer to the preliminary determination of the subject, assumed research goals, basic hypothetical views on the phenomenon, problem and subject of the research, the significance of the research is stated, as well as which methods and techniques to be applied and required time, personnel and resources (Milosavljević, 1982).

The basic idea is operationalized and determined more closely through the research project, which is the most important scientific document that is tested and later, as indicated and observed, corrected and refined. The research project that represents the essence of the scientific research process is an intellectual work of the first category. It is a complex mental construct that requires academic and professional virtues and abilities, rich scientific erudition and the ability to think and act creatively and inventively. The initial research project, as stated in the already cited part by Milosavljević and Radosavljević, contains, among other things, a preliminary determination of the research subject in which the topic on which the research is conducted is defined and briefly described, the desired goals of the research are formulated, that is, those to be reached possible to come. In addition to the above, in the conceptual project there are also hypothetical positions on the research problem and on the subject that will be the focus of the researcher's scientific concentration, which practically

gives hypothetical positions on the observed phenomenon. The significance and justification of the research precedes the definition of research methods and techniques, and the project also contains technical details related to the required time in which the research will be carried out, as well as the necessary funds and the list of researchers who will carry out the process.

5. TRANSMISSION OF EXISTING KNOWLEDGE

Since, as stated earlier, existing knowledge must be taken into account, regardless of how that knowledge was obtained, when looking at the possibility of researching a phenomenon, the idea of future knowledge is also in mind. The connecting, transmission function of the research project in the conditional thought model performs the transfer of existing knowledge into enriched new knowledge that is reached in the research results through hypothesis testing and in accordance with the set research goals. In this way, different parts and phases of the process are connected, i.e., theory, methodology and actually unknown and unexplored phenomena contained in the problem and subject of research. Directing the research as a function of the project is realized from the beginning of the collection, arrangement and interpretation of data to the description and explanation of the phenomenon and the problem and the subject of the research. Guidance also refers to the procedure for choosing research methods and techniques, but also to conclusions based on the knowledge gained during data processing. Finally, the guiding function of the research project is visible in the theoretical and operational definition of the subject.

However, each individual part of the research project, just like the project as a whole, has its own guiding and coordinating function. Researchers know that the verifiability and reproducibility of a research is ensured by consistently following the sequence of activities during the scientific research process. For example, in the phase of data collection, arrangement and processing, the guiding factor is precisely the framework imposed by this phase and this stage as part of the research project, and a systematic and verifiable procedure will ensure that the population, sample and processing units are clearly seen. The coordinating and synchronizing function of the project comes to the fore from the very beginning of its creation. First, coordination and synchronization take place in the researcher's imagination. This does not only refer to operational and technical details, but also to conceptual and thought synchronization of logical and semantic entities that are part of the problem and subject of research, goals or hypotheses, that is, to the conceptual justification and expediency of research.

Although thinking about a phenomenon precedes research itself, formulating a problem begins the scientific process. In the researcher's opinion, the problem may arise as a result of active reflection based on theoretical and empirical experience, and it may also be "imposed" from the side, as a certain concrete task resulting from some phenomenon, that is, the need for new knowledge about

that phenomenon. However, when choosing a research problem, it is necessary to enter the process of scientific research with, conditionally speaking, a structured problem that should satisfy certain principles that make it credible and worth the effort that will follow. The problem should be current and new, and original in a specific way. Researchers strive to make an original contribution to science, not only because of the needs of science itself and solving some unknown, but also because the personal credibility of the scientist is strengthened by reaching new knowledge and making a contribution to science. In addition, it is necessary to show that the problem has its practical applicability through the formulation of the problem, whether it is research in fundamental or other research that has concrete usability in everyday life.

6. REPORTING ON RESEARCH AND RESULTS

The last stage represents the communication of the research results and the presentation of the scientific knowledge that was reached during the research process. The report on the research results is narrower in scope and treats primarily scientific problems at different levels of knowledge. The role of the achieved new knowledge in the overall fund of science is described, but new questions and scientific dilemmas that were opened during the previous process are also communicated. The preparation of this report begins at the beginning of the hypothesis test and its essence is to confirm the hypothesis and prove the truth of its positions, or, otherwise, to prove that the indicators refute the truth of the statements in the position of the hypothesis, which is certainly checked through the provision of collected data.

In addition to the report on research results, it is common in science to write a research report that is broader in scope and contains descriptions of practical procedures, but also a description of the essence of the research process with stated and described stages and phases, main problems, methodological issues, conclusions, etc. The report is an integral part of the research process and by default has a strictly defined structure and content. The report inevitably states the conclusions about the research that preceded the specific research on which the report is being compiled, then the results that were reached during the research with a description of all the factors of the structure of the conclusion that make up that conclusion. Therefore, all the main and auxiliary subjects that give the conclusion an outline and essence are listed, such as reviews, tables, graphs, measurement results, conclusions from hypothesis testing, etc. In addition, there are findings that are inductively arrived at during the writing of the report itself. Then it is more generally concluded on the basis of concentrated experience that has its proven empirical value and its full theoretical confirmation since the research process has just been completed (Kracauer, 1952).

It is usual to have a preliminary report on the results of the research and its role is to indicate the direction and essence of the conclusions reached

during the research. In contrast to this type of report, there is a final or final report that was requested and funded by whoever initiated the research or its implementation. With that, the report is submitted to the scientific public and the report itself gets an open and general social and scientific form and role. There are also phase or stage reports that partially describe some parts of the research process and the results that result from those parts. In the basic contents of these partial reports, Milosavljević and Radosavljević also include spatially defined reports, problem or thematic reports, reports related to the type of research subject and partial reports by data properties.

7. CONCLUSION

In fundamental research, there are numerous specificities that are related to the ways of reaching scientific knowledge and scientifically relevant conclusions. Many important theoretical fundamental discoveries have resulted from experiments conducted with different initial goals and intentions. Because in fundamental research it is not easy to predict the results of the research, but if during the scientific process a solution to the problem appears as a side product, the researcher in basic research will recognize it and use it. This enriches the scientific fund and completes the total social knowledge, which ultimately gives the possibility of practical application of that knowledge.

Perhaps the greatest profitability of fundamental research is reflected in its application in the content of higher education institutions where, in addition to direct research and work on scientific projects, the education of scientists is carried out precisely on the content of basic, basic research. The essence of education based on examples from fundamental research is to train the scientific staff to observe phenomena, to conduct experiments on them and to analyze them objectively. Thus, objectivity stands out as the main and leading principle in fundamental research, and in the institutions where these researches are mainly carried out, there are also objective opinions of other researchers, which ensures the verifiability of theories, and therefore the validity of conclusions about research results.

When it comes to the responsibility and challenges posed to the researcher in fundamental research, it can be said that his commitment and scientific curiosity as initiators of research are also the main risks that appear in the research process. A researcher in basic research who does not respect the rules of science and/or is not consistent in the application of scientific principles can mislead researchers in applied research by setting up new theories that are not properly created. However, unlike researchers in applied research who cannot present their results until their functionality has been fully verified, researchers in fundamental research can also show the failure of their initial ideas in their results by disproving the viability of hypotheses or declaring failure to achieve the goal.

Both cases involve moral, professional and financial losses, and it is difficult to compare where the consequences are greater. In fundamental research, the scientist has somewhat more freedom. His knowledge, inventiveness and creative abilities are his only obstacles to success, while applied research has many more limitations. A researcher in applied research has a specific task, conditions and deadlines and very often limited resources. In such conditions, it is necessary to find sustainable and functional solutions, and one of the conditions is knowledge of the results of fundamental research, because he can compare his attempts through the stages of research with existing knowledge and possible models given in theory.

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Миливоје Г. ПАЈОВИЋ

ФУНДАМЕНТАЛНА ИСТРАЖИВАЊА КАО ПОЧЕТНА ТАЧКА ПРИМЕЊЕНИХ И ДРУГИХ ИСТРАЖИВАЊА

Резиме

Фундаментална истраживања су основна. Она по својој природи дају основу за сазнања о одређеним појавама и дефинишу основна правила, која се касније могу надограђивати и развијати кроз даља истраживања истог типа, или кроз примењена истраживања. Резултати ових истраживања првенствено се тичу теорије, па је најчешће и по правилу циљ ових истраживања научно објашњење. Примењена истраживања се настављају на фундаментална истраживања у логичном низу неизбежне праксе. На основу теорије и доказа фундаменталних истраживања, циљеви примењених научних истраживања постављају задатак да се објасне и открију могућност практичне примене резултата фундаменталних истраживања. Због тога се често примењују модели, прототипови и пројекције, као и општа правила која су проверена у пракси.

Фундаментална и примењена истраживања представљају две одвојене, али продорне категорије које имају своје посебне разлике. И поред свих преклапања и преплитања, ова истраживања носе различита очекивања и имају различите друштвене ефекте, као што су разлике у критеријумима просуђивања у вези са проценом успеха или неуспеха истраживања, затим разлике у ефектима на друштвена кретања и разлике у организацији истраживања и спровођењу, посебно у степену аутономије у односу на политичке и економске интересе и циљеве.

Кључне речи: фундаментална, (основна, примарна) примењена истраживања, практични резултати.