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INCENTIVE SYSTEM AND MOTIVATION OF EMPLOYEES TO SCIENTIFIC ACTIVITY: ECONOMIC ASPECTS AT THE UNIVERSITY AND STATE LEVEL

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The algorithm of stimulation to scientific activity at local and state levels is formed in the paper. The review of research on incentives for employees in the world scientific practice is carried out, the connection between incentives and innovations resulting from scientific activity is demonstrated. The issues of academic motivation, a component of which is motivation for scientific activity, as well as barriers to motivation for the exchange of scientific data, which is especially relevant in the scientific environment, which is on the path of transition to open science, are discussed. The distinction between the concepts of stimulation and motivation in the context of encouragement to perform scientific tasks is presented. The problem of lack of practice of using tools of motivation for scientific activity at the state level is outlined. The categories of sources of stimulation of scientific activity in Ukraine are given and the actual problems of involvement of categories of stimulation are investigated. The ways of solving the problem of funding at the university level, available within the lowest categories of sources of stimulation of research projects, are analyzed. The connection of economic indicators of scientific activity evaluation with the requirements of actual competitions for obtaining scientific research funding is demonstrated. Problems of management and implementation of scientific projects related to the Pareto principle and the Ringelman effect are discussed. The prerequisites for improving the quality of group work in a research project is proposed. To determine the points of influence for the implementation of the proposed prerequisites are diagrams of the state of work on research projects and publication activities within research groups. The successful experience of Sumy State University in stimulating the effectiveness of scientific activity and the method of determining the rating of structural units, which determines the indicators of influence on the level of evaluation of scientific results, are demonstrated.

Keywords: scientific research, stimulation, motivation, mechanisms, economic indicators.

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Introduction and problem statement

The level of organization of scientific activity at the university is a decisive factor in achieving success indicators, which are determined by national and international rating agencies, customers of scientific and technical products, domestic and foreign potential and relevant partners in educational and scientific activities, international grant organizations, etc. Certainly, for external stakeholders, the mechanisms and algorithm for implementing the scientific vector of development are not the subject of interest at the stage of implementation of joint projects. However, when conducting various audit of activities when reporting on such projects, the study of mechanisms and algorithm is significant. Among other components of building a successful scientific space at the university, the motivation and motivation of employees to achieve high results is significant. It is the human potential that determines the vector of development of the scientific direction, if all the necessary conditions are created for this development. All participants in the process of conducting research and transfering their results to the commercial sector

or production must have a clear idea of the rules of the game, incentives to action, including economic.

Motivation and incentives are terms that are most identified in the modern scientific literature and other sources on the issues of team management, career growth, etc. [1,2]. Substitution of the concept "incentive" for "motivation" leads to the fact that material incentives as a result of certain tasks are perceived as motivation along with the real means of motivation: moral encouragement in the form of gifts, providing a comfortable workplace (for example, by providing appropriate equipment), etc. Scientists talk about stimulation as one of the methods of motivation, divide motivation tools into material and moral encouragement, and so on.

Literature review

Motivation is the driving force to achieve the goal, incentive is the "subject", which is obtained after the task; the incentive is announced before the start of the task in order to intensify activities. Foreign authors (given that the term "stimulation" is not widespread) present motivation as an internal process (internal motivation), stimulus as an external process (external motivation) [3,4]. This approach may be more understandable in the domestic scientific space, but the allocation of motives and incentives should be clear and divided in content. The existence of this approach is confirmed by the results of bibliometric analysis of the query "motivation" (data is from database Scopus, www.scopus.com, tool is from VOSviewer, www.vosviewer.com, analyzed the first 2 thousand articles by the number of citations in Business, Management and Accounting and Economics, Econometrics and Finance, published in the period 2017–2020), which is shown in Figure 1.

Some clusters focus on internal motivation ("satisfaction", "well-being", "involvement", "opportunity", "quality of life", etc.), the results of internal and external motivation, as shown in Fig. 2 and 3. It is also important to have a cluster of transformation of motivation into knowledge and technology transfer (keywords "business", "innovation", knowledge transfer ","" entrepreneur", "consumer ","economic effects", etc.). Understanding stimulation as the main driving force of the process of achieving results in the domestic scientific space, attention will be paid to external motivation in international terminology.

The analysis for "stimulation" was performed for 197 articles in Business, Management and Accounting and Economics, Econometrics and Finance (excluding articles in other fields of knowledge), published in the period 2017–2020. The analysis showed that in the selected time period there is only one cluster, which is presented in Figure 4.

All other keywords related to the search request are unrelated. The relatively small number of publications and the inconsistency in the relationship between keywords confirm that the problem of researching employee incentives in the world

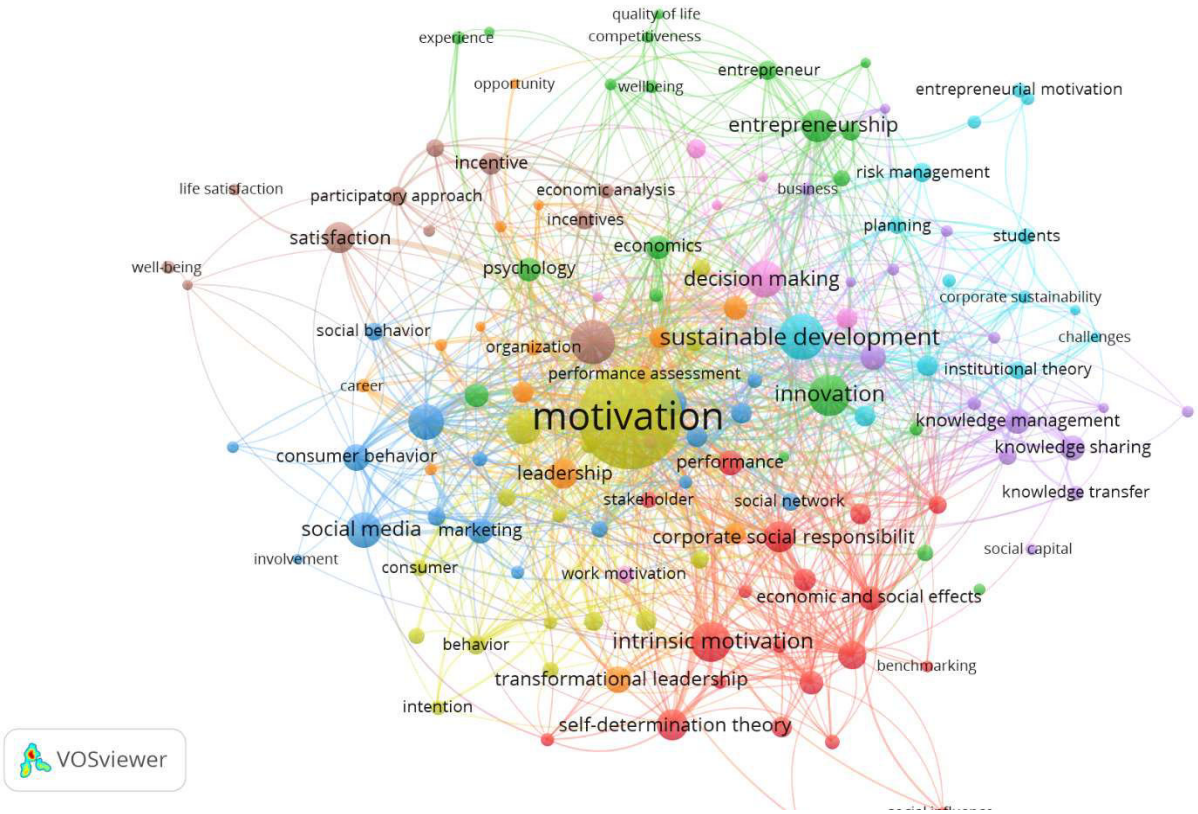

Fig. 1. Results of bibliometric analysis for the request "motivation"

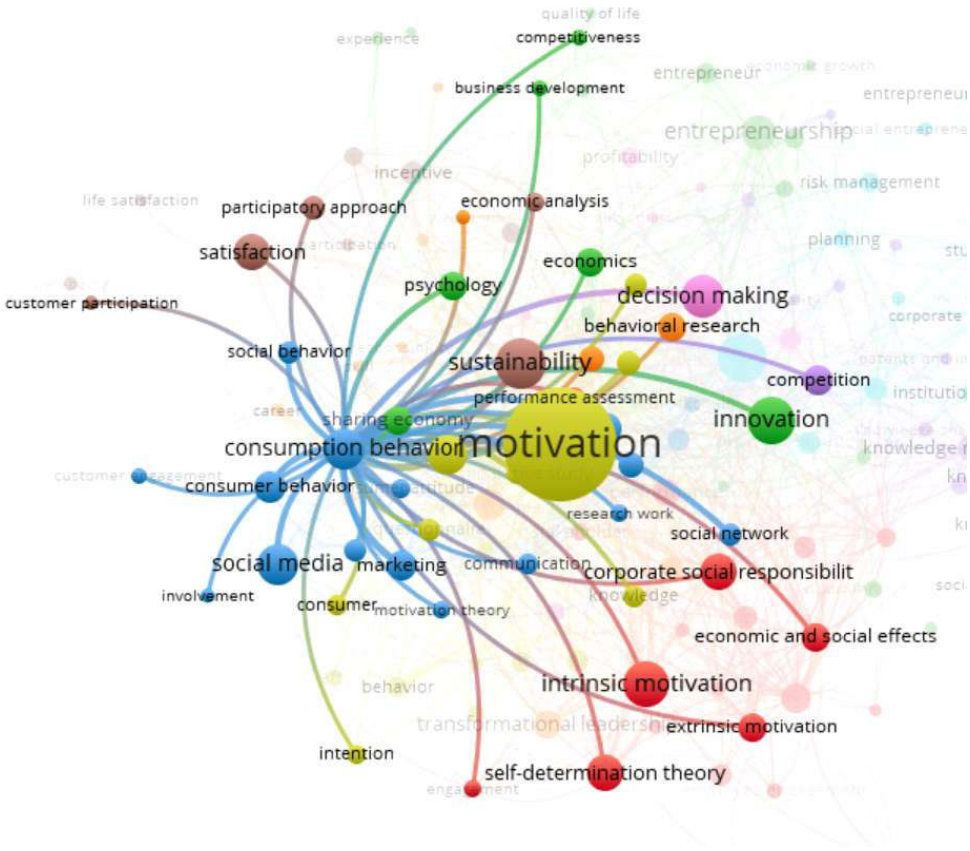

Fig. 2. Cluster “results of internal and external motivation”: option 1

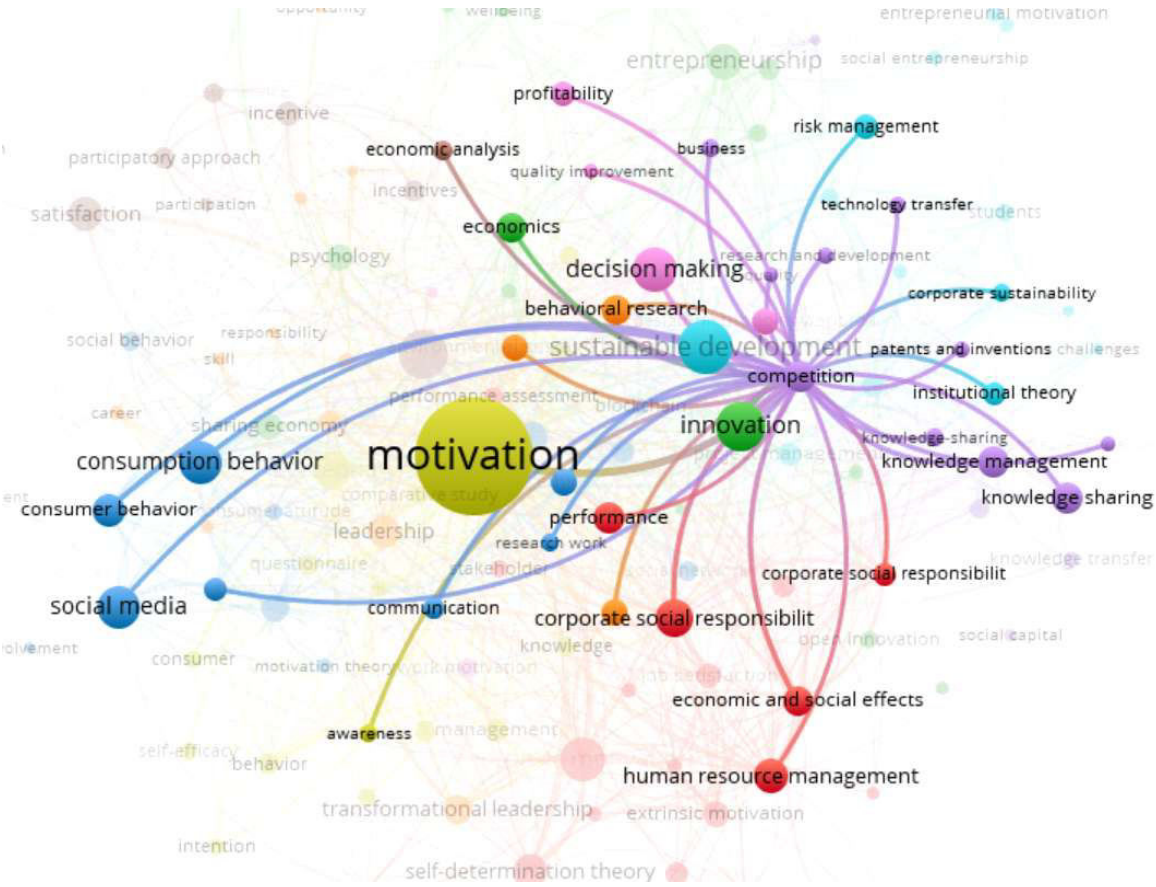

Fig. 3. Cluster “results of internal and external motivation”: option 1

Fig. 4. Cluster "stimulation" within the search request

scientific opinion is not singled out, but is only part of the study of external motivational mechanisms. However, the presented cluster also demonstrates the connection between stimulation and innovation, which are the result of scientific activity.

It should also be noted that a combined tool can be used in research at the university level: the motivation of an employee or department to occupy a certain place in the university ranking or competition will also have a material incentive.

Academic motivation, a component of which is the motivation of scientific activity, is a complex problem that is also studied in the context of a person-centered approach [5]. Since research projects and the scientific environment in general are dynamic systems, the motivation of their performers requires regular reconceptualization. In this context, the achievement goal theory and current prospects for its development are of interest [6], which can be aimed, in particular, at developing an effective approach to stimulate and motivate researchers in research projects.

Researchers are also attracted by the problem of motivation for the exchange of scientific data, which nowadays is relevant scientific environment, which is on the verge of transition to open science. The work [7] characterizes this problem from different points of view, namely: technological perspective, organizational processes, legal status and complexity of data due to local context and specificity. Overcoming these barriers leads to an increase in motivation to disseminate scientific knowledge not only through the publication of scientific articles, but also by sharing the source data, which is the basis for the development of scientific discussion.

The purpose of the paper

Formation of a local-state algorithm of stimulation to carry out scientific activity.

Materials and Methods

Instruments of motivation for scientific activity at the state level are not actually used. Among the isolated cases, it should be noted the introduction by the National Agency for Quality Assurance in Higher Education of a new accreditation procedure, which, among other things, provides for the examination of certain indicators of scientific activity at the third level of higher education. Like motivation in general, this tool does not currently bring financial benefits, but in the long run (with the adoption of regulations on institutional accreditation) can provide the university with research status with appropriate additional funding for research. As for scientific activity, the motivator is the Ministry of Education and Science of Ukraine, which conducts certification of universities in scientific areas. Participation in this competition is voluntary and is part of the procedure for obtaining university research status. Stimulation of scientific activity in Ukraine according to Ministry of Science and Education data occurs at the expense of the following sources:

1. State budget funds.
2. Own funds.
3. Funds from foreign sources.
4. Funds from other sources.
5. Funds of public sector organizations.
6. Funds of organizations in the higher education sector.
7. Funds of business sector organizations.
8. Funds of private non-profit organizations.

Universities have the opportunity to implement their own research activities mainly through the first, third and seventh categories. The second category for universities is actually derived from the above categories.

The peculiarity of stimulating scientific activity at the expense of the state budget (general and special funds) is, first, competition in their receipt, which is based on achievements in the relevant scientific field for a certain period. Competitiveness is further exacerbated by the reduction in funding for research and development, which is laid every year in the state budget (Figure 5).

Despite the formal increase in funding (in UAH) each year, as shown in the figure, inflation and the dollar exchange rate are the reasons for the decline in the real value of financial support. This is especially true for projects that have capital expenditures for the development of research infrastructure.

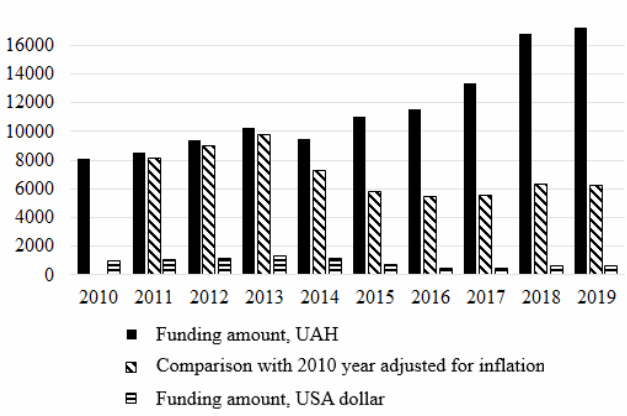

Fig. 5. Financing of scientific activity from the state budget (built according to Ministry of science and education data).

As stated in Ministry of science and education documents, "the Law of Ukraine "On Scientific and Scientific-Technical Activity" establishes an ambitious indicator that the state provides budget funding for scientific and scientific-technical activities in the amount of not less than 1.7% of Ukraine's GDP. However, in practice this is far from it, the cost of science in Ukraine decreased from 0.75% in 2010 to 0.47% in 2018".

The problem of funding at the university level can be partially solved by participating in competitions for grant funding from foreign donors. Achieving a successful result, as in the case of competitions for funding from the state budget, is possible through coordinated group work.

Research activities in universities have their own features that can be objective reasons for losing funding from the state budget and international donors: the Pareto principle [8] and the Ringelman effect [9] partially hinder the creation of project teams that have certain Ministry of Education and Science (competitions for financing of fundamental and applied developments) and National Research Foundation indicators of success in the previous period.

The objective presence of the laws of group work, defined by the Pareto principle and especially the Ringelman effect, imposes on the university the obligation to create mechanisms to stimulate employees to carry out scientific activities. In fact, indicators of evaluation of scientific activity (primarily economic) within the university should correlate with the requirements of current competitions for research funding.

The following prerequisites are required to implement successful group work and reduce the impact of the Ringelman effect:

1. Providing general management of the research group by one leader.
2. Clear task statement.
3. Comprehensibility of goals.
4. Motivation.

To determine the points of influence to meet the conditions set out above, consider a typical scheme of work on a research project. Fig. 6 illustrates a diagram of the state of work of the research team on the project from start to finish. After the start, the first state of the team will be "Project Planning", at the entrance of which the working environment is formed, the initial stimulation of performers takes place (external motivation by the manager) and a further work plan is built. This stage is especially important in the context of preconditions for minimizing the Ringelman effect, because this is where the authority of the leader is formed (consider the situation of a conditionally zero scientific team that has not worked together before) and it is necessary to clearly set goals to achieve real goals.

The result of the team's work at the exit from the "Planning" state will be the work plan and the transition to the "Work on the project" state. At the entrance to this state, a sequence of actions is formed to implement the plan and direct scientific work begins. It is during the scientific work that the internal motivation of the project executors as a manifestation of scientific interest is possible, in contrast to the previous state, which is characterized by the presence of tools to stimulate the performers. Depending on

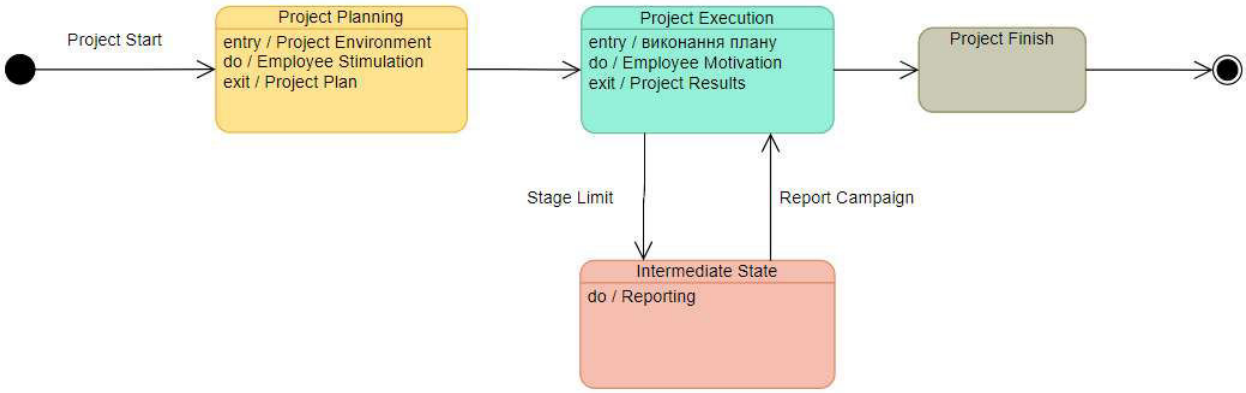

Fig. 6. Diagram of states of work on a research project

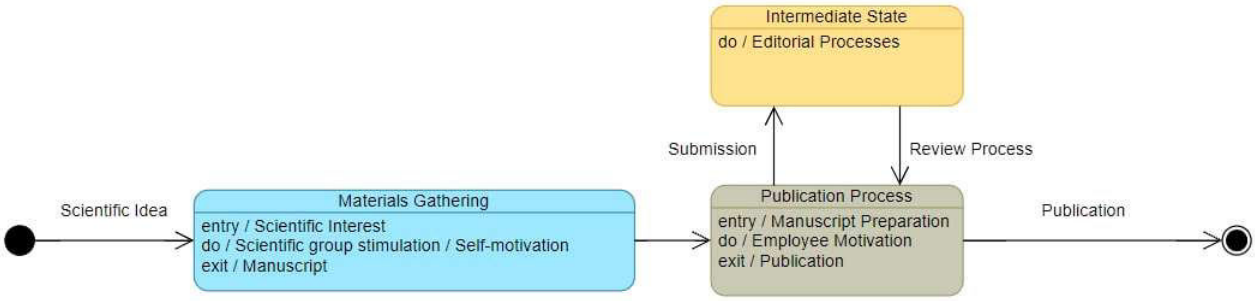

Fig. 7. Diagram of the states of publishing activity within the research project.

the number of stages of the project, from the state "Work on the project" it is possible to move to the intermediate state of reporting at least once in the case of the project without division into stages. The logical conclusion of the work is the successful reporting and closing of the project with the corresponding results.

Consider the role of stimulation and motivation in publishing activities. Figure 7 shows a diagram of the state of the scientific group (scientist) while working on the publication of research results. The first state is the development of material for which the input stream is a scientific idea, dictated by their own scientific interest. Due to the presence of scientific interest at the entrance to the system, the stimulation of the scientific group (scientist) in this case can be replaced by the existing self-motivation. At the exit from the state "Material development" the manuscript of the publication is formed and there is a transition to the state of the publication process. According to the structure of activity of the "Publication Process" and "Intermediate State" here are similar to "Work on the project" and "Intermediate State" Figure 6.

The method of determining the rating of structural units of Sumy State University (https://normative.sumdu.edu.ua/) determines the indicators of influence on the level of evaluation of scientific results:

1. Scientific and pedagogical potential.
2. Quality of scientific work with students.
3. Quality of international activities.
4. The level of publication of scientific results.
5. The quality of training of scientific and pedagogical staff.
6. Financial evaluation of the results of innovation.

It should also be noted the successful experience of Sumy State University in stimulating the effectiveness of scientific activities through a package of provisions, the names of which are shown in Figure 8.

As can be seen from Fig. 8, the regulatory framework of the university is constantly being improved in response to external challenges. This is evidenced by the version number of individual documents. Similar documents have been developed for other areas of the university's activities mentioned above.

Conclusion

Analysis of research results shows that at present in Ukraine there are virtually no motivational mechanisms for research. Virtually all existing tools use incentives in their basis, although often the

6. Наукова та науково-навчальна діяльність

6.1. Наукова діяльність (загальні питання)

6.2. Заохочення за результатами наукової діяльності

#	Назва документу	Рівень прийняття, №, дата затвердження	Версія
1	Про преміювання за активну участь у підготовці проєктів на державні наукові гранти (зі змінами, внесеними згідно з наказами №0695-І від 06.07.2021 р. та №0779-І від 26.08.2021 р.)	Наказ ректора №0635-І від 24.07.20 р.	-
2	Положення про конкурс "Кращі молоді вчені СумДУ"	Наказ ректора №1033-І від 29.12.20 р.	01
3	Положення про додаткове преміювання вчених за особливі досягнення у науковій роботі та підготовці науково-педагогічних кадрів	Наказ ректора №0464-І від 06.05.21 р.	13
4	Положення про преміювання за досягнення високого рівня оприлюднення результатів наукових досліджень	Наказ ректора №0806-І від 03.09.21 р.	17

Fig. 8. Stimulation documents of the general university normative base concerning scientific activity (https://normative.sumdu.edu.ua/)

concept of "incentives" is replaced by the concept of "motivation". Economic incentives for scientists to competitively select the best projects for further funding from the state budget of Ukraine, sources of foreign donors or other sources requires the creation of a systematic regulatory framework at the university level. The implementation of Key Performance Indicators, defined by this regulatory framework (sometimes overestimated in comparison with competitive indicators for the implementation of the strategy of advanced development) allows to be competitive in the market of scientific service providers. The emergence of motivation for scientific work occurs at the stage of direct scientific activity as a manifestation of scientific interest, which should also be taken into account when creating a model of functioning of the scientific sector of the university.

The work was carried out within the framework of state funding of projects "Convergence of economic and educational transformations in the digital society: modeling the impact on regional and national security" (№0121U109553) and "Reforming lifelong learning in Ukraine to prevent labor migration: cooperative model of institutional partnership" (№0120U102001).

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СИСТЕМА СТИМУЛЮВАННЯ ТА МОТИВАЦІЯ СПІВРОБІТНИКІВ ДО НАУКОВОЇ ДІЯЛЬНОСТІ: ЕКОНОМІЧНІ АСПЕКТИ НА УНІВЕРСИТЕТСЬКОМУ ТА ДЕРЖАВНОМУ РІВНІ

Артюхов А.Є., Васильєва Т.А., Волк Ю.Ю., Леонов С.В.

У роботі сформовано алгоритм стимулювання до здійснення наукової діяльності на локальному і державному рівнях. Здійснено огляд досліджень стимулювання співробітників у світовій науковій практиці, продемонстровано зв'язок між стимулюванням та інноваціями, які є результатом наукової діяльності. Обговорено питання академічної мотивації, складовою якої є мотивація до наукової діяльності, а також бар'єри у мотивації обміну науковими даними, що є особливо актуальною в науковому середовищі, що відбувається шляхом переходу до відкритої науки. Наведено розмежування понять стимуляції та мотивації у контексті заохочення до виконання наукових завдань. Окреслено проблему відсутності практики використання інструментів мотивації до наукової діяльності на державному рівні. Наведено категорії джерел стимулювання наукової діяльності в Україні та окреслено фактичні проблеми нерівномірності залучення категорій стимулювання. Проаналізовано шляхи вирішення проблем фінансування на університетському рівні, доступні в рамках найактуальніших категорій джерел стимулювання наукових проектів. Продемонстровано зв'язок економічних індикаторів оцінювання наукової діяльності із вимогами актуальних конкурсів із отримання фінансування наукових досліджень. Обговорено проблеми управління та виконання наукових проектів, пов'язаних з принципом Парето та ефектом Рінгельмана. Запропоновано набір передумов, що дозволяють підвищити якість групової роботи в рамках наукового проекту. Для визначення точок впливу для виконання запропонованих передумов наведено діаграми станів роботи над науковими проектами та публікаційної активності в рамках наукових груп. Продемонстровано успішний досвід Сумського державного університету у стимулюванні результативності наукової діяльності та методику визначення рейтингу структурних підрозділів, що визначає показники впливу на рівень оцінювання результатів наукової діяльності.

Ключові слова: наукове дослідження, стимулювання, мотивація, механізми, економічні показники.

СИСТЕМА СТИМУЛИРОВАНИЯ И МОТИВАЦИЯ СОТРУДНИКОВ К НАУЧНОЙ ДЕЯТЕЛЬНОСТИ: ЭКОНОМИЧЕСКИЕ АСПЕКТЫ НА УНИВЕРСИТЕТСКОМ И ГОСУДАРСТВЕННОМ УРОВНЕ

Артюхов А.Е., Васильева Т.А., Волк Ю.Ю., Леонов С.В.

В работе сформирован алгоритм стимулирования к осуществлению научной деятельности на локальном и государственном уровнях. Проведен обзор исследований стимулирования сотрудников в мировой научной практике, продемонстрирована связь между стимулированием и инновациями, являющимися результатом научной деятельности. Обсужден вопрос академической мотивации, составляющей которой является мотивация к научной деятельности, а также барьеры в мотивации обмена научными данными, что особенно актуально в научной среде, которая идёт по пути перехода к открытой науке. Приведено разграничение понятий стимуляции и мотивации в контексте поощрения выполнения научных задач. Обозначена проблема отсутствия практики использования инструментов мотивации к научной деятельности на государственном уровне. Приведены категории источников стимулирования научной деятельности в Украине и определены фактические проблемы неравномерности привлечения категорий стимулирования. Проанализированы пути решения проблем финансирования на университетском уровне, доступные в рамках наиболее актуальных категорий источников стимулирования научных проектов. Продемонстрирована связь экономических индикаторов оценки научной деятельности с требованиями актуальных конкурсов по получению финансирования научных исследований. Обсуждены проблемы управления и выполнения научных проектов, связанных с принципом Парето и эффектом Рингельмана. Предложен набор предпосылок, позволяющих повысить качество групповой работы в рамках научного проекта. Для определения точек воздействия для выполнения предложенных предпосылок представлены диаграммы состояний работы над научными проектами и публикационной активности в рамках научных групп. Продемонстрирован успешный опыт Сумского государственного университета в стимулировании результативности научной деятельности и методике определения рейтинга структурных подразделений, которая определяет показатели влияния на уровень оценки результатов научной деятельности.

Ключевые слова: научное исследование, стимулирование, мотивация, механизмы, экономические показатели.

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The algorithm of stimulation to scientific activity at local and state levels is formed in the paper. The review of research on incentives for employees in the world scientific practice is carried out, the connection between incentives and innovations resulting from scientific activity is demonstrated. The issues of academic motivation, a component of which is motivation for scientific activity, as well as barriers to motivation for the exchange of scientific data, which is especially relevant in the scientific environment, which is on the path of transition to open science, are discussed. The distinction between the concepts of stimulation and motivation in the context of encouragement to perform scientific tasks is presented. The problem of lack of practice of using tools of motivation for scientific activity at the state level is outlined. The categories of sources of stimulation of scientific activity in Ukraine are given and the actual problems of involvement of categories of stimulation are investigated. The ways of solving the problem of funding at the university level, available within the lowest categories of sources of stimulation of research projects, are analyzed. The connection of economic indicators of scientific activity evaluation with the requirements of actual competitions for obtaining scientific research funding is demonstrated. Problems of management and implementation of scientific projects related to the Pareto principle and the Ringelman effect are discussed. The prerequisites for improving the quality of group work in a research project is proposed. To determine the points of influence for the implementation of the proposed prerequisites are diagrams of the state of work on research projects and publication activities within research groups. The successful experience of Sumy State University in stimulating the effectiveness of scientific activity and the method of determining the rating of structural units, which determines the indicators of influence on the level of evaluation of scientific results, are demonstrated.

Keywords: scientific research, stimulation, motivation, mechanisms, economic indicators.

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