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Managing Efficiency in Higher Education: A Case of Ukrainian Universities

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Abstract: The rating positions of most Ukrainian higher educational establishments in the global international environment have not received any positive changes over a long period of time. Progressive regulatory changes are necessary to stimulate internal university reforms within the context of European integration. The purpose of the present work is to develop organizational-methodological measures in order to increase the efficiency of scientific-pedagogical activity in higher educational establishments of Ukraine. The following methods were used for the research: Monographic, historical, comparative, generalization, formal-logical, analysis and synthesis, categorical approach, observation, interviewing, graphic, benchmarking and forecasting. The concept and methodology of managing efficiency in the post-Soviet transformation of higher education has been grounded. The mechanism of utilizing re-engineering and motivational management in the process of implementing European integration objectives for university education in Ukraine has been suggested. The system of normative indices has been formed to stimulate the effectiveness of the scientific-pedagogical activities of universities, with the complex focus on the marketing of educational services, innovations and quality. The authors' mechanism of the accumulating system to stimulate scientific-creative activity of workers has been developed and put into practice. Procedures for scoring theproductivity level of scientific staff in universities have been described based on grading.

Keywords: higher education; efficiency; re-engineering; competitiveness; motivational management; grading

1. Introduction

Progressive democratic reforms in post-Soviet countries have been focused on encouraging new ideas and decreasing the level of constant control. The decisive condition for achieving success in any activity is efficient management (Illés et al. 2015; Vasylieva and Velychko 2017). Good examples of this method include the USA (Brooks and Kakabadse 2014), France (Hradilova 2015) and Singapore (Low and Tan 2017), which mainly due to a high level of organization and management in different fields, have transformed themselves into high-developed and wealthy countries. Nowadays management plays an important role in all fields of life in the society, including the area of educational services. Therefore organization of management in the area of higher education in Ukraine which would be built not on declarative, but on real deep democratic fundations, could provide far better improvement of the quality of work in many modern universities during the preparation of high-qualified specialists, carrying out scientific research, the provision of consulting services and so on.

In the last 20 years there have been great changes in the environment where the higher educational establishments of Ukraine operate: Structural changes at the labor market have taken place; requirements to prepare specialists have became more dynamic and changeable; the level of competitiveness at the market of educational services has increased significantly. In addition, the official state document indicating the completion of higher education has begun to play a less significant role in the labor market. In past decades, the special level of knowledge and skills of graduates have increasingly been taken into account. It also became possible to use alternative sources of financing for the preparation of specialists; the philosophy of higher education has become completely different. Recently the process to provide universities with more autonomy, which is the generally accepted practice for most successful countries, has become more evident in Ukraine. This process would increase the level of responsibility of universities and stimulate them to develop unconventional educational, educational-professional and educational-scientific programs. The purpose of the latter is to provide progressive development and to increase the efficiency at the market of educational, scientific and consulting services. However in practice, many universities are not motivated to achieve constant improvement in all areas of activity.

Management of efficiency in higher education is directly linked with the strategy of the government policy and implementation of progressive reforms. In this context Tvaronavičienė et al. (2017) underline that the efficient policy in the area of higher education provides the solution for many essential economic and social problems. On the other hand, Goncharuk (2015) and Oganisjana et al. (2017) stress the importance of universities in generating social and economic innovations. Many studies in the process of developing and implementing the models of management in higher education within the global context testify to the requirement to consider historic prerequisites, structural limitations, cultural traditions, impact on the environment and other special circumstances.

In particular, this confirms the study of educational reforms and features of stimulating systems for efficient work of universities in such countries as the USA (Bowen 2017), Great Britain (Moodie 2014), Germany and Italy (Dobbins and Knill 2017), Austria, Finland, The Netherlands, Portugal (Krüger et al. 2018), Switzerland (Hoidn and Olbert-Bock 2016), Denmark (Hansen 2011), Poland (Kwiek 2017), Hungary (Berács 2014), Serbia (Avramovic 2016), Australia, New Zealand (Christensen 2011), the Russian Federation (Popova et al. 2017), China (Yang 2015), Singapore (Low and Tan 2017) and others. Furthermore there is a certain complexity in the creation of a unified universal system for evaluating the efficiency of higher education (Goncharuk 2016).

Agasisti and Pérez-Esparrells (2010) pay attention to the expediency of the analysis and comparison of efficiency between universities of different countries. Researchers such as Johnes and Johnes (2009), as well as Koshal and Koshal (1999) consider the costs on the services of universities to be an essential criterion for efficiency in higher education. However the foundation for most successful practices of national models in university education has become the management of efficiency through mechanisms of competitiveness and motivation. Thus Berács (2014) and Berghman et al. (2013) stress the efficiency of enterprises in the area of higher education and the requirement to stimulate universities for creating their own entrepreneurial models. Particularly Slaughter and Rhoades (2004) at the beginning of the XXI century considered those issues through the prism of academic capitalism. The conclusions of scientists are focused on the progressive role in the implementation of market instruments into the system of management in universities. In the research carried out by Krüger et al. (2018), and Kwiek (2017) and Moodie (2014), the advantages of the entrepreneurial approach to efficient university management have been systematized. Particular attention has been paid to the formation of a successful marketing strategy at the market of educational, scientific and consulting services. Typical threats to the process of bureaucratization in higher education from the point of view of M. Veber were generalized by Sedláček (2017), and Taib and Abdullah (2016). At that the scientists paid much attention to the need to develop the concept of government policy to support the efficiency of higher education. Gormally et al. (2014) focuses on risks of resistance to the existing higher education system on the implementation of certain changes.

The issues of integration of Ukrainian universities into the European educational area are the object of attention for many scientists. Nalyvaiko (2015) paid particular attention to the need for deep reformation of higher education in Ukraine, considering both certain national features and European traditions. Gedikova (2016) suggested key directions to increase the competitiveness of universities at the market of educational services and defined certain instruments for providing a high level of quality for higher education in Ukraine.

At that time Burbyka and Telizhenko (2015) pay attention to the fact that current strategies of state regulation are not sufficiently effective in many spheres of activity. In turn Hudym and Khalatur (2016), as well as Sardak and Sukhoteplyi (2013) underline the contemporary problems of maximizing staff potential at the national labor market. Grynko et al. (2017) in turn stress the low motivation of many workers in the service sector. All these factors negatively affect the development of educational and scientific services in Ukraine.

At the same time many modern universities in Ukraine (mainly state-owned) remain establishments with a bureaucratic type of business activity which they inherited from the Soviet era and have not yet reformed. Under the conditions of international globalization, this slows the progressive development of the domestic science field and weakens competitiveness of most Ukrainian universities at the European market. Moreover even in comparison with many universities of post-Soviet countries, the leading Ukrainian universities now lag behind in the ratings (Table 1).

Table 1. Top-rating of universities in post-Soviet countries as of 1 July 2018.

University	Place among Post-Soviet Countries	Place in the World
Lomonosov Moscow State University	1	213
University of Tartu	2	418
Saint Petersburg State University	3	424
Belarusian State University	4	487
Tallinn University of Technology	5	560
National Research University Higher School of Economics	6	587
Vilnius University	7	755
Peter the Great Saint Petersburg Polytechnic University	8	759
Tomsk State University	9	773
Moscow Institute of Physics and Technology	10	778
Kazan (Volga Region) Federal University	11	834
University of Latvia	12	998
Novosibirsk State University	13	1077
Ural Federal University	14	1117
Tallinn University	15	1158
Taras Shevchenko Kyiv National University (Ukraine)	16	1267

Source: systematized by the authors according to (Ranking Web of Universities 2018).

The corresponding world rating of universities is made by "Cybermetrics Lab" of the Spanish National Research Council at the Ministry of Science and Innovation in Spain. The rating of post-Soviet universities was extracted from the data provided by Ranking Web of Universities by Webometrics. This situation requires progressive regulatory changes which will stimulate reforms inside universities. This defines the importance of the topic for scientific research. But the existing research is not focused on regulatory changes made to stimulate the internal university reforms under the conditions of integration into the educational area of the EU. Specific mechanisms to

improve educational-pedagogical efficiency which consider evolutionary, mental, social, legal and opportunistic features of this process in the contemporary context of the post-Soviet transformation of higher education in Ukraine, have been studied insufficiently. This mainly concerns the mechanism of motivation of such activities aimed at improving the quality of science and education.

The purpose of the research is to develop certain organizational-methodological measures to increase the efficiency of scientific-pedagogical activity focused on globalization of the educational environment in Ukrainian universities. The main tasks of the scientific research were then set: Identification and analysis of key reasons for low efficiency and competitiveness in most Ukrainian universities in the international area; creation of mechanisms for stimulating internal university reforms under conditions of post-Soviet transformations of the higher education in Ukraine; formation of methodology of managing work efficiency in Ukrainian universities as well as development of the accumulating system of stimulating scientific-creative activity for university staff under the conditions of the transitional period.

2. Methodology

The themethodological foundation for the research is the dialectical method of cognition, as well as the general scientific and special methods of the research. They are: The historical method, comparison and generalization, formal-logical method, analysis and synthesis, categorical approach, method of monograph observation, interviewing, calculating-constructive method, graphical method, method of benchmarking, forecasting method and so on (Cohen et al. 2017; Schulz 2017). The research has been made in two stages.

2.1. Systems of Providing Efficiency for Higher Educational Establishments (System of External Provision of Efficiency)

At the first stage the authors' mechanism of re-engineering and motivational management for the system of implementing transformational challenges for higher education in Ukraine has been developed. One of the key output moments of this mechanism are the classical principles of managing efficiency of F. Taylor on clear dependence of awards on the results of work (Taylor 1911). Moreover, the author's developments are based on certain principles of re-engineering (cardinal change) in some managerial processes (Mircea et al. 2016). Application of the concept of constant quality improvement based on rationalistic logistics (Velychko and Velychko 2017a, 2017b) and providing logistics (Velychko 2015) has been essential. Afterwards, the attention was paid to the fact that achievement of task implementation in the area of making Ukrainian achieve European standards is rather complicated without complex application in the system of public administration and management of higher educational establishments in those output moments.

Taking this into account, it has been suggested to include a set of efficient motivational mechanisms on constant improvement of university work into the program of implementing the strategy of reforming higher education in Ukraine. A competitive mechanism toward sustaining study in universities at the state budget's expense has been available since 2016. But such a competitive system does not stimulate universities towards complex development. For that to occur, it is necessary to also have working influence on the system of private financing of higher education and the process of supporting a multi-vector competitive environment within it. Such an environment implies the presence of a high level of competition between universities not only in the area of providing educational services, but also in the system of scientific, innovative and consulting activities.

Currently, Ukrainian legislation uses the term "Licensed amount of specialists". It refers to a maximal number of students allowed by the government for a certain direction in the current year. It concerns all students, whose study is financed by the government and private persons or corporations. The purpose of such a limitation is to carry out control over the availability of resources at universities for preparing specialists. This limitation is not widespread in international practice and it represents the remains of the post-Soviet transformation in the system of higher education in

Ukraine. However in the near future, it can be used for modernization in the process of managing efficiency in university education.

One of such mechanisms can be the connection of licensed number of students with the results of annual professional, complex and objective estimation of activity in universities. Therefore a system of new normative notions should be formed (Table 2).

Table 2. System of normative indexes for stimulating effectiveness in scientific-pedagogical activity of universities in Ukraine.

No.	Name of the Index	Method of Definition	Value (Role)
1	Basic licensed number of specialties	Calculated by the procedure of licensing the major according to the current legislation	Forms initial condition for activity
2	Current licensed number of specialties	Calculated as arithmetical mean for enrollment of students for last 3–5 years	Stimulates marketing of educational services
3	Factual licensed number of specialties	I variant: Calculated as multiplication of index # 1 (for 3–5 years after obtaining the license) by the coefficient of the annual change in the ranking position of the university II variant: Calculated as multiplication of index # 2 (after 3–5 years of university's work by the license) by the coefficient of the annual change in the ranking position of the university	Stimulates innovations and quality

Source: Developed by the first author.

The process of calculating average indexes can be carried out either by the method of mean arithmetical, or by the method of moving average (Huber 2011; Velychko and Velychko 2017b). Hence the adjustment of the current annual licensed number by all accredited programs of universities should take place annually by the coefficient of changes in ranking of this educational establishment in a transparent, objective and authoritative general Ukrainian rating, which will be formed by the National Agency for Quality Assurance in Higher Education of Ukraine (NAQAHEU) according to the articles of The Law of Ukraine "On Higher Education" (The Law of Ukraine 2014), or by the Ministry of Education and Science of Ukraine (MESU).

Such a system will stimulate both state and private universities towards constant improvement of "soft spots" as well as the cumulative improvement of the general quality of educational, scientific and consulting services of universities. Under those conditions alternative actions will lead to a gradual loss of potential amounts of private and possibly, budget financing of higher educational establishments. In addition, the previously obtained position in ranking can be kept (coefficient of changes—1.0), only through further progressive development of the educational establishment.

Thus positive change of the annual rating position of universities will promote the increase in the actual licensed number of students in a current year. Besides, this change can partly compensate for the loss in the licensed number due to insufficiently effective marketing of educational services in previous years. The principle of efficiency would be implemented in a just way when universities with highest ratings and dynamics provide education for most specialists through accredited educational programs. The main task is to form a maximally objective rating system based on a set of public external indexes of activity in universities. It is essential that the calculations of most indexes should be carried out per one staff member of scientific-pedagogical workers (SPW) in a certain university.

2.2. Systems of Providing Efficiency for Higher Educational Establishments (System of Internal Provision of Efficiency)

At the second stage, the authors' mechanism of accumulating the system for stimulating scientific-creative activity of scientific-pedagogical workers with the focus on principles of the grading system has been developed (Nepal 2012). In Ukraine, integrated requirements are used for the

scientific-pedagogical worker. In the state university, that worker should mandatorily combine research and consulting activities. The authors have suggested a methodological approach, which is focused on certain estimation criteria for the research activities of scientific-pedagogical workers of a certain department. It is essential that this approach could be extended and adapted to different operating conditions. A list of works and the process of their quantitative estimation can be individualized in the system of management of a certain department or university. Therefore the authors' list of important and prospective types of scientific works at the department in the modern Ukrainian university has been suggested. Considering the different levels of complexity and labor-intensiveness, each of them had a conditional score mark (Table 3).

According to the methodological approach, it can be used at planning individual work of scientific-pedagogical workers under conditions of hourly wages with a fixed official salary. The volume loaded to each worker during the academic year can vary from 0.25 to 1.5 of a wage-rate of the official salary. While drawing a plan for the scientific-research work for the next calendar year, every SPW by his/her own selection should foresee any measureable implementation which in total will make it possible to get results not worse than before (multiplication of 3.0 scores per planned average annual rate of SPW). Underperformed scores in fact at the end of the year (multiplication of 3.0 scores by factual average annual rate of SPW minus fact) should be added by SPW to the plan of the next calendar year(multiplication of 3.0 scores per expected average annual rate of SPW).

Table 3. Conditional score mark of essential and prospective types of the scientific activities of a modern Ukrainian university.

Measure on R&D	Value, Conditional Score
Defending of dissertations	
Doctor of Science	5.0
Candidate of Science (PhD)	3.0
Monographs in publications with category A, B according to the classification SENSE	
By one person	5.0
By a group	5.0/number of authors
Monographs in publications with category C according to the classification SENSE	
By one person	3.0
By a group	3.0/number of authors
Contract to create and transfer scientific-technical produce	0.5 from 10 000 UAH/number of performers
Research grant	
Leader	2.0
Group member	1.0
Carrying out the research on the account of specialized financing from the state budget	
Supervisor	2.0
Executive	1.0
Supervision over student's scientific work to participate in the competition	
Participation in the II round	0.5
Prize place	1.5
Article by SPW in the publication which is included in:	
Scopus and/or Web of Science Core Collection (quartile Q1 or Q2)	2.5/number of authors
Scopus and/or Web of Science Core Collection (quartile Q3 or Q4)	2.0/number of authors
Emerging Sources Citation Index, Web of Science	1.5/number of authors
Index Copernicus	1.0/number of authors
Professional publication in Ukraine	0.5/number of authors
Article of a student	Norm per article for SPW
Supervision over preparation	is divided by a factor of 1.5
Registration of copyrights (author's invention, patent)	1.0
Increase in the Hirsch index of SPW (+ one item)	
Web of Science, Scopus	2.0
Google Scholar	0.5

Source: Developed by the 1st author according to the data (Journal Citation Reports 2018; Research School for Socio-Economic and Natural Sciences of the Environment 2018; SCImago Journal and Country Rank 2018).

Considering the possible cyclic process of scientific-creative activities due to the fact that more is received by the end of the year (multiplication by 3 points per factual average annual rate),

SPW has the right to include the performance of additional enrollment for the following calendar year. The completion of extra enrollment of measures on research and development work is the reason for the suggestion made by the head of the department to the dean's office and the rector's office, in order to target awarding bonuses to employees of the department.

If such awarding bonuses haven't taken place, SPWs are entitled to transfer the received additional points to the plan of the following calendar year in the amount of 100% of overworking; instead, if the bonuses took place, the amount should be 50%.

Further development and improvement of the accumulating system for stimulating scientific-creative activities have led to the development of the motivational mechanisms of uneven distribution of the minimal amount of scientific consulting services (contract work) between workers of the department.

The main components of this mechanism are dependencies which, to a certain extent, harmonize the contribution of each worker into the overall result of the department. In particular, a SPW, who in the previous period worked more in the scientific-research activities, has the possibility to plan and provide a smaller amount of scientific consulting services (contract work) next year. Instead, a SPW, who in the previous period worked less in the scientific-research activities, should plan and provide a larger amount of scientific consulting services (contract work) next year.

The mechanism can be seen as the calculation of costs for minimal amounts of rendered services (performed work) in the planned period by a certain scientific-pedagogical worker. The process of calculation is done using the procedures which are described in the form of the linear algorithm (Figure 1).

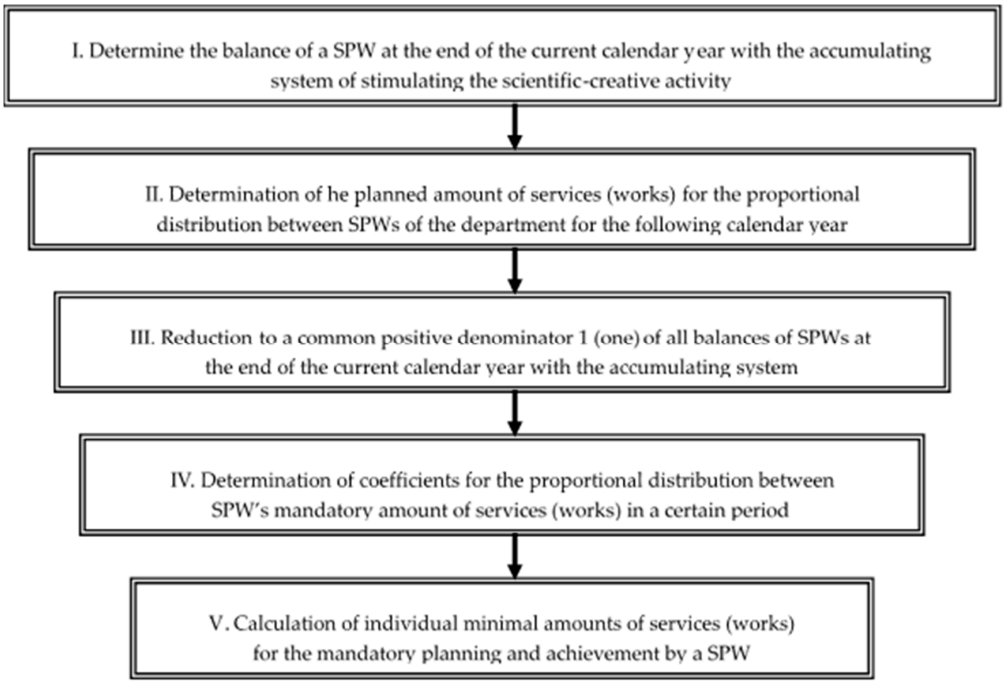

Figure 1. Algorithm for determining the minimal amount of the individual participation of every SPW in the performance of the plan of the department towards the provision of scientific consulting services (carrying out contracted work). Source: Developed by the first author.

Such an algorithm can be applied in practice only after the initial implementation and use of the accumulating stimulation of scientific-creative work of the department staff in the university. Thus the methodological approach objectively considers the possible cyclic type of individual achievements of a SPW both in scientific and consulting activities during a certain period of work. As such, the current growth in indexes of a certain SPW in scientific activities can be compensated by the possibility of

decreasing indexes in consulting activities and vice versa. It is especially efficient under the conditions of hourly wages.

3. Results and Discussion

3.1. Systems of Providing Efficiency for Higher Educational Establishments (System of External Provision of Efficiency)

At the first stage of the research, it has been determined that nowadays in Ukraine, scientific-pedagogical workers are often not fully interested in working efficiently, for their input into the communal result in most cases cannot be objectively measured and valued. The evaluation of work efficiency is often conducted subjectively: According to the personal attitude of a manager, his/her will and wish are based on his/her judgment but not with precise measurement. Therefore such an estimation can be precise. As such, the positions can be occupied by persons whose professional activity is not sufficiently efficient. The psychology of university workers with the dominating bureaucratic type of activity often contains a certain set of features. In such a way, only an imitation of activity by the staff takes place. Attempts to avoid individual activity for work results take place. For productive workers in the staff, uncomfortable psychological conditions can be artificially created. The ability to react quickly and proactively to changes is sometimes substituted by references to obsolete formal rules and instructions. This significantly opposes the idea of efficient work of the staff.

Under those conditions the main threat to the spread of the autonomy of universities in Ukraine is a low social responsibility for higher education as well as further bureaucratization of or focus on the low-commercial effect. The main preventer of these effects can be the implementation of a system of self-regulated complex efficiency and social responsibility of higher educational establishments under the conditions of academic, staff and financial freedom. But universities need a corresponding motivation for such a system.

As a result the operational plan for reforms in management of higher education was developed for the Ministry of Education and Science of Ukraine (Figure 2). It is focused on implementing the developed mechanism into the external stimulation of efficiency in educational and scientific activity of Ukrainian universities under the conditions of post-Soviet transformations and integration into the EU models.

The suggested mechanism of stimulating efficiency in scientific-pedagogical activity implies the formation of a multi-vector competitive environment, which in the best path ruins the existing destructive bureaucratic systems. In particular, changes in the environment of public administration could form the acting mechanism of competitiveness in the field of innovative development and real quality of education. By using this system, for example, Sumy, Lviv Ukrainian universities and Mariupol and Uzhgorod Ukrainian universities would become real competitors (which they are unlikely to be now in the competition for regional applicants). This exact process stimulates high-quality transformation of internal management for each university (the spread strategy of preserving jobs will be substituted by the strategy of progressive development). Under the conditions of academic autonomy, the limit of authorities to take additional students will become the consequence of the complex work of universities.

The mission of the National Agency on Provision of Qualitative Education is to form transparent rules for competition between universities. The rating estimation of universities by most indexes should be made per one university worker. After implementation of the suggested mechanism into the university environment, the system of self-regulation of quality will start to work. It can be conditionally compared with the principle of the "invisible hand" in the market economy. It will significantly decrease corruption risks in the higher education, as well as weaken the dependence of universities on administrative preferences at the government level. In such a competitive environment, not a famous but a dynamic university will gradually obtain new advantages in the licensed number of students over more famous universities with slow paces of development. Also a more severe progressive competition of universities for attracting professionals will begin. The main purpose

is to create conditions and stimuli for dynamic self-development for each university, since the long-term post-Soviet regression of higher education in Ukraine is a major threat to Ukrainian global competitiveness. The main purpose is to create conditions and stimuli for dynamic self-development for each university, since long-term post-Soviet regression of higher education in Ukraine is a major threat to Ukrainian competitiveness in the world.

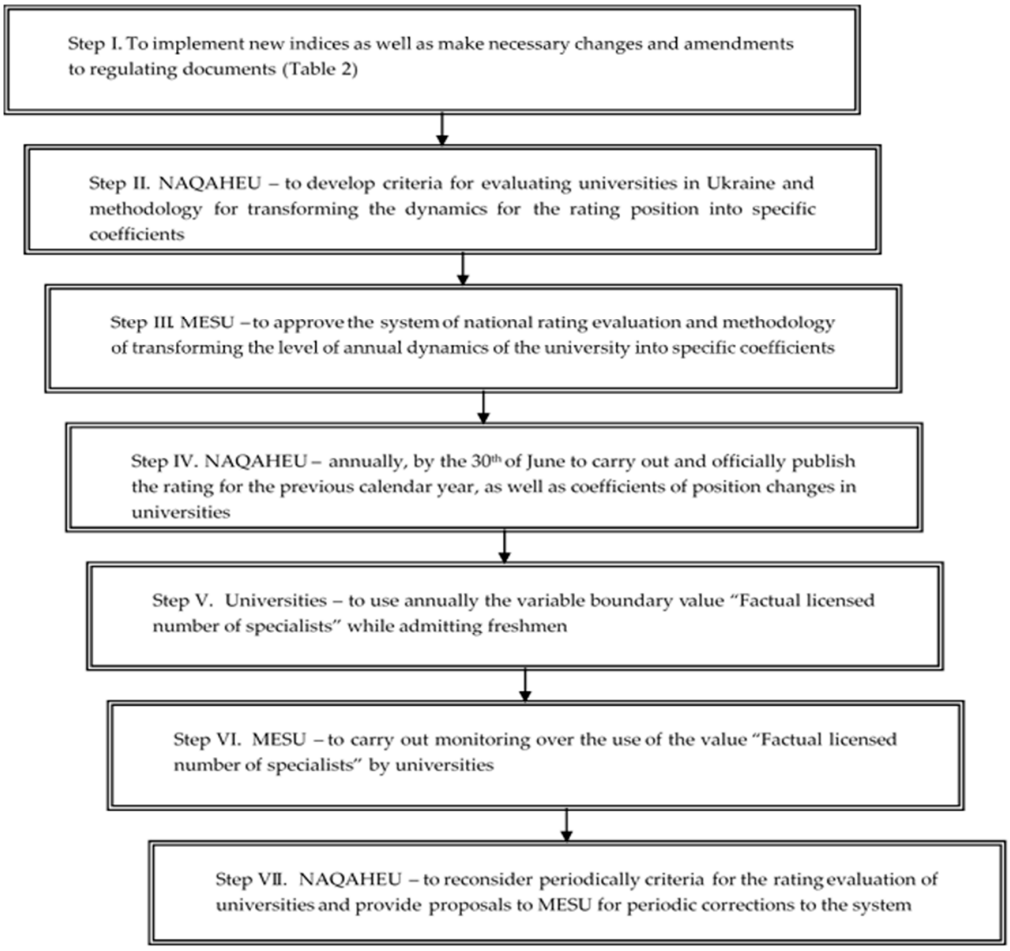

Figure 2. Operational plan of implementing the mechanism of external stimulation of efficiency into educational and scientific activities of Ukrainian universities at the stage of the post-Soviet transformation. Source: developed by the first author.

The best stimulus to innovative development and constant qualitative improvement in Ukrainian universities is not the external or internal control-bureaucratic system (Gedikova 2016; Nalyvaiko 2015), but the intensive environment. Under the suggested conditions, the component of the strategy in the professionally-directed work of most universities will be not only the marketing of educational services but also the system of real innovative management and quality control. As a consequence of thorough and thoughtful but target-focused implementation of such a Ukrainian approach (motivation both in quantity and complex quality), the competitive positions of most Ukrainian universities at the market of domestic and European educational services will obtain better prospects for dynamic growth.

3.2. Systems of Providing Efficiency for Higher Educational Establishments (System of Internal Provision of Efficiency)

At the second stage of the research, we analyzed the effectiveness of implementation of the developed accumulating system for stimulating scientific-pedagogical activity in Dnipro State Agrarian

and Economic University (Ukraine). Within the context of formation of academic autonomy in higher educational establishments and consideration of the existing features of the activity, on the Department of Management and Law, we implemented the internal regulation on the accumulative system of stimulating scientific-creative activity. The regulation has been developed in accordance with Article 33 of Law of Ukraine "On Higher Education" (The Law of Ukraine 2014) considering the implementation of own programs in educational, scientific, scientific-technical and innovative activity. According to the methodology described in Table 3, we carried out the estimation of factual individual productivity of SPW in conditional points (scores). The determined current level of activity of a worker was input into the developed accumulating system. As a consequence of summing the conditional points for the current year to the remaining points from the previous year, we determined the new balance for each SPW. The new balance shows a certain current condition by the end of the accounting period. The condition of the accumulating system by the end of the reporting year 2017 naturally testified to various individual results of implementing necessary planned indexes.

After setting new balances, there was a distribution in the minimal amount of scientific consulting services (contracted works) for the future planned period of 2018 between nine SPWs in the department. In particular, the output data for such distribution between SPWs is the value of the individual balance in conditional points. The procedure of distribution was carried out due to stages of determining the minimal amount of individual participation of each SPW in completion of the department's work plan on provision of scientific-consultation services (Figure 1). The results of calculations by the algorithm are represented in Table 4.

Table 4. Distribution of the minimal amount of the individual participation of a SPW in completion of the plan to provide consulting services at the Department of Management and Law in 2018.

Step of the Algorithm	Calculation of Data
I. Setting of balance for a SPW at the end of 2017 by the accumulating system of stimulating scientific-creative activity in conditional points	SPW_1 (+4.91); SPW_2 (+4.87); SPW_3 (−1.035); SPW_4 (−4.57); SPW_5 (+1.075); SPW_6 (+2.825); SPW_7 (−3.9); SPW_8 (−0.85); SPW_9 (−1.6).
II. Determination of the planned amount of services (works) for the proportional distribution between SPWs of the department for 2018	Difference between the general planned amount of services (works) of the department and amount of services (works), innovative SPW by the accumulating system (15,000 − 4500 = 10,500 UAH).
III. Reduction to a common positive denominator 1 (one) of all balances of SPWs at the end of 2017 by the accumulating system	A common positive denominator 1 (one) point with the minimal balance of SPW_4 (4.57) required addition of +5.57 points to all balances of SPWs. Hence there were the following intermittent results for each scientific-pedagogical worker: SPW_1 (10.48); SPW_2 (10.44); SPW_3 (4.535); SPW_4 (1.0); SPW_5 (6.645); SPW_6 (8.395); SPW_7 (1.67); SPW_8 (4.72); SPW_9 (3.97). At that the total sum was 51.855 conditional points.
IV. Determination of indexes for the proportional distribution between SPWs for the mandatory for the department amount of services (works) in 2018	SPW_1 (51.855/10.48 = 4.947); SPW_2 (51.855/10.44 = 4.966); SPW_3 (51.855/4.535=11.434); SPW_4 (51.855/1.00 = 51.855); SPW_5 (51.855/6.645 = 7.803); SPW_6 (51.855/8.395 = 6.176); SPW_7 (51.855/1.67 = 31.05); SPW_8 (51.855/4.72 = 10.986); SPW_9 (51.855/9.37 = 13.061). At that the total sum was 142.278 conditional points.
V. Calculation of individual minimal amounts of services (works) for mandatory planning and implementation by SPWs in 2018	SPW_1 [(4.947/142.278)*10,500 = 365 UAH]; SPW_2 [(4.966/142.278)*10,500 = 366 UAH]; SPW_3 [(11.434/142.278)*10,500 = 844 UAH]; SPW_4 [(5.855/142.278)*10,500 = 3827 UAH]; SPW_5 [(7.803/142.278)*10,500 = 576 UAH]; SPW_6 [(6.176/142.278)*10,500 = 456 UAH]; SPW_7 [(31.05/142.278)*10,500 = 2291 UAH]; SPW_8 [(10.986/142.278)*10,500 = 811 UAH]; SPW_9 [(13.061/142.278)*10,500 = 964 UAH]. At that the total sum was 10,500 UAH.

Source: developed by the authors.

Application of the developed algorithm (Figure 1), based on the individual balance of a SPW for the end of the previous accounting period of 2017, made it possible to receive a set of assuming results for planning the 2018 period (Table 4). Those results were shown in financial equivalents

(thous. UAH). 10,500—is the proportionally distributed minimal amount of services (works) at the department, allocated between the workers of the department for the future period. Moreover the general plan of the department for 2018 was 15,000 UAH. The remaining 4500 UAH was previously independently initiated for 2018 for SPW2 (2500 UAH) and SPW5 (2000 UAH) within the accumulating system of stimulating the scientific-creative activity.

Consequently, the results of calculations of the minimal amount of individual participation by SPWs in the completion of the department's plan on provision of scientific consulting services (performance of the contracted works), turned out quite versatile. However, unlike the results of the accumulating system of stimulating the scientific-creative activity, they were indirectly proportional (Figure 3).

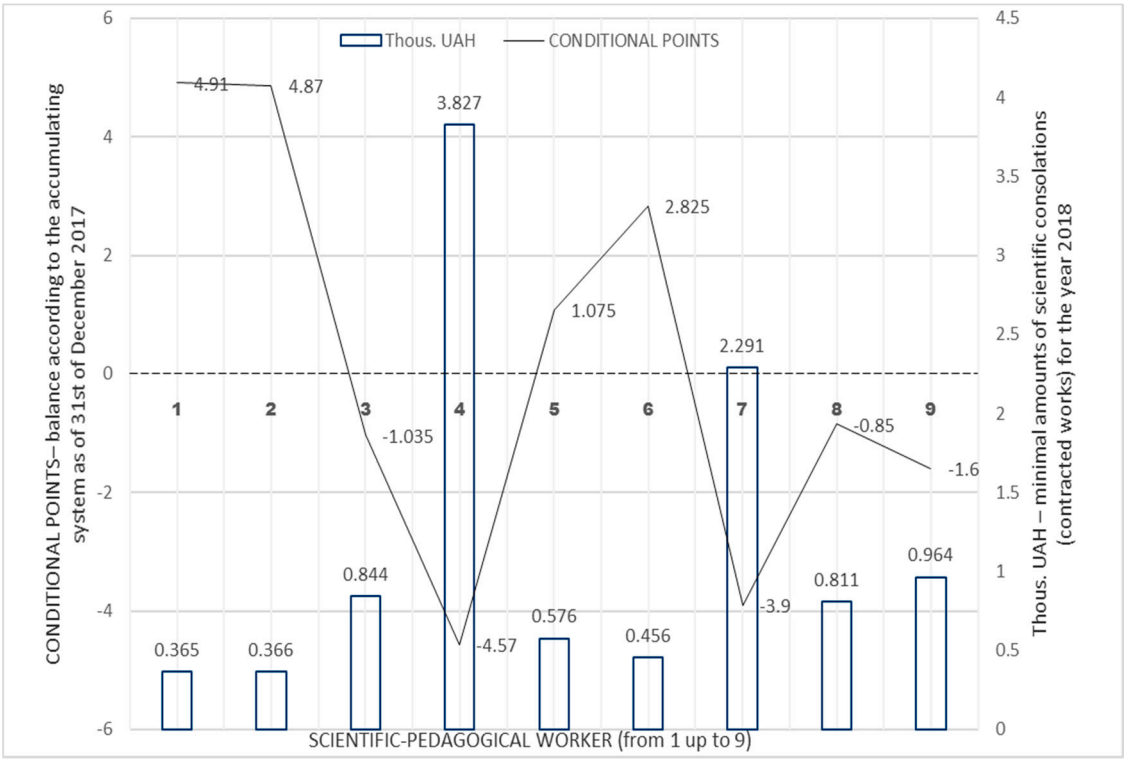

Figure 3. Harmonization in amounts of the individual participation of a SPW in scientific-research and consulting (contracted) work at the Department of Management and Law. Source: Developed by the first author.

Conclusively this makes possible to harmonize the individual part of each SPW both in the scientific-research and in the consulting (contracted) work of the department. Such an approach provides a possibility to support the staff potential more effectively and leads to improvements in efficiency.

The analysis also showed that the main advantages of the accumulating systems were: Clear formulation of minimal requirements with the simultaneous provision of a wide selection choice for each SPW; increase in value of personal results; creation of favorable conditions for implementing individual scientific-creative potential of professors; harmonization of personal inputs for each SPW into general scientific achievements of the department; consideration of the cyclic type of scientific-creative activity; formation of the efficient system for evaluation and stimulation of the scientific-research activity of professors, as well as fairness and transparency.

The suggested mechanism of the accumulating system to stimulate scientific-pedagogical activity to a certain extent is inferior to the globally widespread model of the individual material reward

of all scientific-pedagogical workers based on periodic rating evaluation (Ebert-May et al. 2015; Lee and Tan 2010; Nepal 2012; Phillips et al. 2014). However the experience of the practical implementation has proved the efficiency of this approach under the existing conditions for Ukrainian scientific-pedagogical workers.

4. Conclusions

Increase in the level of efficiency for the contemporary higher education in Ukraine can be achieved through the reformation of post-Soviet bureaucratic systems of management and intensification of multi-vector competitive environment between universities. The mechanism of implementation of such a strategy, developed by the authors, implies:

(1) a focus on principles of re-engineering and motivational management in the system of implementing transformational challenges of the higher education in Ukraine;
(2) implementation of the system of normative indexes for stimulating marketing, innovations and quality as main drivers for internal university reforms;
(3) connection between licensed numbers of enrolled students and results of national and international rating estimation of university activity;
(4) introduction of the accumulating system in order to stimulate scientific-creative activity of university staff;
(5) application of grading principles while planning and estimating the level of completion of essential and prospective types of scientific work carried out by university workers.

Theoretical value. The concept and methodology of the managing efficiency of the post-Soviet transformation of higher education based on re-engineering, rating and grading has been developed. Methodological approaches to motivational management in universities through development of the accumulating system of stimulating scientific-creative work of the research staff have been further developed.

Practical value. A system of normative indexes in the legislation area for stimulating efficiency of educational-scientific and innovation activity in modern Ukrainian universities has been suggested. The mechanism for score estimation of the productivity level in scientific-creative work of the university research staff based on grading has been developed. Efficiency of implementing this mechanism in Dnipro State Agrarian and Economic University (Ukraine) has been experimentally proven.

The results of the research can be used in the system of public administration of higher education as well as in practice for management in universities.

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