A NEW MODEL OF PUBLIC MANAGEMENT IN SCIENCE FINANCING IN RUSSIA

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Abstract: The article describes current world trends in attempts to solve the problem of linking of remuneration for scientific work to its effectiveness; in particular the attempt to transfer the principles of the concept of New Public Management in the sphere of science funding is investigated. The article presents the analysis of results of the new public management model implementation in financing of Russian research organizations using the tools of econometric benchmarking. The analysis leads to the conclusion about the existence of the conceptual limitations of benchmarking and performance management applicability to the research and development sector.

Key words: new public management, performance indicators, research organizations, research effectiveness, publication activity, benchmarking principles

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Introduction

Limitations presently imposed on state budgeting in general make the objective to enhance quality of public financing in the R&D sector evermore imperative. The main problem facing those in charge of making management decisions in this area is to tie remuneration for the scientific work to its performance, thus ensuring a fair and efficient allocation of budgetary funds. Solving this problem is of paramount importance - especially for those countries where the vast majority of scientific organizations pertain to public sector and R&D are financed predominantly out of state budget.

The global trend in the attempts to solve this problem is based on the fact that since the research organization pertains to the public sphere, then it is possible to transfer management practices well proven in the public sphere to the R&D sector. It is well known that major changes that occurred in public management in the late 20th century were conditioned on phasing out of the budget allocation that followed the line-item budgeting model (Pfiffner, 2004). The model is based on the presumption that the effectiveness of non-profit organizations cannot be tested via the market and therefore should remain under strict control of the authorities in charge of budget-allocation. The control was generally implemented through an annual planning of expenses and revenues generated by the nonprofit organization in question. All the expenses relevant to its' financial - economic activities were classified by type ("line-items") and for each of them specific rates were developed

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based on analysis of market prices or other mechanisms to determine the "fair" amounts of spending. The rates served the basis for the cost estimate against which the efficiency of budget spending was meticulously measured at the end of the year.

There's no debate that such a system is a poor instrument to tie the effectiveness of the financial costs to the actual goals of public spending. No matter how lawfully the finance allocated under the system would flow the quality of services or works it meant to provide may remain low or decrease even further. To correct this discrepancy first in 1980s in the UK (under Margaret Thatcher's cabinet) and since 1990 all over the world new approaches based on the concept of New Public Management (NPM) were introduced to the realm of public spending (Gruening, 2001).

The NPM concept is derived from the idea that organizational and motivational techniques used in advanced commercial companies can be successfully applied to the public sector. The approach views the users of services provided by public bodies as "buyers" and their employees – as "managers" or "sellers" of the services. Accordingly, the terms of public financing are formed in such a way as to maximize motivation for staff and management to improve the quality and scope of their services (Farazmand, 2006).

An integral part of the NPM concept constitutes the idea that the effectiveness of a public organization shouldn't be assessed by means of control over the way it spends its' inbound funding (input control) but rather through evaluation of the end-results relevant to its' primary activities (output control). By the same token to evaluate these results in the non-market environment the performance indicators are introduced, against which the quality of primary activities are measured laying the basis for further increase or decrease in public funding. In the late 1990s - early 2000s a performance financing model based on this approach found a wide field for application in the public sector of many countries. Conversely an introduction of performance financing principle to the realm of science and R&D sector immediately caused and still causing a lot of debate (Herbst, 2007).

Recent studies in the area show that application of performance financing to public science can produce rather mixed results. For example, K. Dougherty and R. Natow after carefully analyzing relevant experience in a number of universities in various states of US have come to the conclusion that at least for the moment it is impossible to establish scientifically based relationship between the introduction of performance financing and the rise universities' performance. A number of universities, which retained the traditional financing system proved to be no less cost-effective than those operating under performance financing principle. In addition it should be noted that introducing the performance financing model meets sizeable latent resistance on the part of both scientific community and the universities' administrations notwithstanding its' aggressive promotion by federal authorities - including the Obama's administration - as well as by a number of respectable public associations (Dougherty and Natow, 2015).

In European countries performance financing of the scientific sphere has also become a trend. For example, in Denmark universities have gained greater operational freedom in the spending of budget funds, but at the same time, funding is tied to the mandatory implementation of a number of performance indicators, which are found in public contracts concluded between the university and the authority provides funding (Larsen, 2010).

In Sweden another variation of the same approach has formed. The basic funding of universities has been significantly reduced while the additional research funding – considered "external" but derived mostly from government controlled sources – is carried out on a strictly competitive basis and allocated to specific research projects. The major external sources of public funding for R&D are organized in 3 tiers: first being System Science Council (the research council system), second – software and target agencies (the mission-oriented agencies) and the third – strategic research funds (the strategic research foundations). Each of these tiers has its own set of objectives in providing support for research projects while allocation of funds is conditioned upon certain performance indicators (Qquist and Benner, 2012). According to recent data the share of external sources in the Swedish universities can reach as high as 70% of the funding of their research activities (Qquist and Benner, 2015).

Another form of the NPM application to the public financing of R&D sector is endemic to Germany. There the state and regional (land) administrations have historically served the major source of financing for research activities carried out under the auspices of universities. Yet since late 1990s – early 2000s the share of basic public funding of the relevant expenditures in these budgets has continuously decreased giving way to the various alternative forms: subsidized projects, government contracts and a variety of options for formula-funding. In 2006 federal German Universities Excellence Initiative was launched – a program which paved way for acute competition between the leading German universities over federal funding. Richard Munch points out that at the same time the major factor in determining the size of public funds allocated to university has become the ability of the latter to attract third-party financing for its research activities. This has significantly changed the mode of management in the leading universities stirring them in the direction to the so-called "entrepreneurial university". Practically speaking it means that not unlike commercial enterprise governing body of the university is charged predominantly with ever active search for opportunities to attract private financing, participation in joint projects with other organizations and clusters and etc. (Munch, 2015).

The European experience in NPM-based financing of scientific organizations has thus been tested in a wide variety of forms and for over two decades by now. At the same time researchers have noted significantly different results various its models produces with regard to the effectiveness of scientific research (Qquist and Benner, 2015). For example, comparable populations and economic conditions notwithstanding relevant output of researchers measured through mainstream

scientometric indices is notably higher in Denmark and the Netherlands than in the Nordic countries (Karlsson and Persson, 2012). Moreover, the effectiveness of Swedish researchers is lower than of Swiss although the Swiss science is funded along rather conservative lines (Qquist and Benner, 2012). In general, the researchers came to the conclusion that the implementation of new approaches to financing does not mean a guaranteed increase of productivity of scientific organizations and that the process may depend on a number of factors, the identification of which is the subject of a study in its own right (Vetenskapsrådet, 2016).

In the Russian Federation, the funding of public research organizations was for a long time been carried out in the framework of budget financing. This model has been inherited from the Soviet epoch. Like any model based on the principles of line-item budgeting it has been criticized for the lack connection to the ultimate performance of the organization. The administration of the institution, as a rule, was limited to an annual line-item plan of financial and economic activity. If there was any deviation in the way money were supposed to be spend along the year it meant protracted tiresome interaction – if not haggling – with controlling authorities, distributing funding. Thus any maneuvering with available resources was rendered virtually impossible and managerial initiative and creativity curbed to all but stalemate. In addition, not using up the resources at the end of the financial year was also considered a deviation from the plan or else a planning error thus severely demotivating any qualitative revision of costs.

Fortunately, since 2010 as part of overall reform in public administration a new NPM-based model of public financing has been implemented in Russia with regard to scientific organizations. Instead of the former Soviet-style budget financing a so-called "state task" instrument was introduced to the realm of science. With regard to research institutes it took a form of subsidy burdened with far lesser limitations on spending and not unlike the so-called block grants prevalent oversees. At the same time productivity of a scientific institution enabling it to receive the subsidy is assessed through various performance indicators defined in relevant agreement – most commonly by a number of publications over certain period of time. Subsidiarity approach in public financing of R&D provided administrative bodies governing scientific institutions with far greater discretionary powers and therefore allowing them to use a wide array of organizational and motivational techniques in resource and personnel management. Among Russia's public officials charged with management of R&D it is considered to be virtually beyond any discussion that binding state subsidies to the performance indicators is the only way to enhance effectiveness and productivity of the state-run science.

Econometric Modeling

To test this premise – the indispensability of NPM principle to public financing of R&D – and to test the efficacy of NPM realization in the form of state task currently prevalent in Russia the instrument of benchmarking as a methodological

basis was chosen (Stapenhurst, 2009). The latter has already passed sufficient approbation in management decision-making at macroeconomic level and is now universally accepted by the mainstream of scholarly community as a mean to the end in question (Goncharuk et al., 2015). Benchmarking has furthermore provided the basis for the reforms in European power-generation (Pollitt, 2009).

To solve the problem of identifying the factors affecting the volume of the annual public funding of scientific organizations, and determine the nature and extent of their influence the methods of econometric analysis as a part of benchmarking approach were used (Kaufmann and Beardow, 2001). These methods allow assessing the relationship between costs and results of scientific activities. The studies were conducted on a sample of 130 scientific organizations which are subordinate to the Federal Agency of Scientific Organizations, with the total number of researchers - 19195 people. The sample can be considered sufficient for the task, as the number of researchers that are included in it, according to the data of 2013 is about 36% of the total number of researchers of scientific organizations under Federal Agency of scientific organizations. Correlation and regression analysis was performed for two groups of research organizations within the produced sample. The first group "A" (104 organizations) are scientific organizations, in which the main activity are "Natural and exact sciences" and "Engineering and technology". The second group "B" (26 organizations) are scientific organizations in which the main activity are "Humanities" and "Social sciences". The annual volume of state funding of scientific organizations was selected as explained variable (variable y).

In the process of formation of the regression model different combinations of explanatory variables among the indicators of the number of employees of scientific organizations, their assets and effectiveness of their activities were tested. In the process of modeling it was concluded that the optimal number of variables to create a qualitative regression model is from 2 to 3 variables. The use of indicators of fixed assets of scientific organizations (buildings, equipment and machinery) as explanatory variables did not lead to the creation of high-quality model, which could reveal the nature of the relationship between the value of fixed assets owned by the scientific organizations and the amount of public funding. The nature of the relationship between the amount of public funding and performance indicators such as the total number of scientific, design and technological works and the number of created intellectual property was not revealed either. The use of indicator "average number of employees" (variable x1) as explanatory variables and "the number of scientific organization publications indexed in Russian and international citation databases" (variable x2) allowed to create high-quality regression model.

Sample analysis within the groups of natural (group "A") and humanitarian science (group "B") showed the high level of differentiation for the indicator of annual public funding of scientific organizations (the maximum value of the group "A" is 56 times higher than the minimum value of this group, for the group "B" - 16 times higher) compared with the level of differentiation for the indicator of annual

volume of public funding per employee (maximum value for the group "A" is 5 times higher than the minimum value, for the group "B" - 2 times higher).
Correlation analysis of both groups of organizations identified the closest positive relationship between the explained variable of annual public funding of scientific organizations (y) and explanatory variable of average number of employees (x1) (rA1 = 0.964; rB1 = 0.981). The relationship between the explained variable of annual public funding of scientific organizations (y) and explanatory variable of scientific organization publications (x2) is less close in both groups, though it is positive and its value is high enough to include this indicator in the regression model (rA2 = 0.654; rB2 = 0.614). Besides, the analysis showed the absence of multicollinearity in the regression models which could complicate the process of regression analysis since the pair correlation of variables x1 and x2 less than the critical value of 0,8: rx1x2 = 0.65 for the group "A", rx1x2 = 0.57 for the group "B".
In the process of creation of the regression model the version of the model with a constant (a coefficient of the regression equation b0) which is not equal to zero and the version of the model with a constant which is equal to zero were tested. Analysis of the two variants of calculations of multiple linear regression equations showed that the model with a constant equal to zero is more appropriate and statistically more reliable for both groups of scientific organizations.
The linear regression equations for the group "A" (1) and the group "B" (2) describing the dependence of variable y on variables x1 and x2 are presented below:

$$y = 499.48*x1 + 18.87*x2 \quad (1)$$

(30.613) (1.667)

N = 104; R-squared = 0.963; F = 1336; px1 = 0.948; px2 = 0.639

$$y = 493.23*x1 + 22.80*x2 \quad (2)$$

(21.429) (2.475)

N = 26; R-squared = 0.984; F = 771.40; px1 = 0.954; px2 = 0.707

y – the annual public funding of scientific organizations, thousand rubles,
x1 – the average number of employees in scientific organization, people,
x2 – the number of scientific organization publications indexed in Russian and international citation databases,
N – the number of observations (sample of 104 research organizations for the group "A" and 26 companies for the group "B"),
R-squared – coefficient of determination,
F – the observed value of F-statistic,
px1, px2 – Spearman's rank correlation coefficient for variables x1 and x2.

The figure 30.613 for the equation (1) and the figure 21.429 for the equation (2) - the observed value of t-statistic for the coefficient b1 (significance level 95%); the figure 1.667 for the equation (1), and the figure 2.475 for the equation (2) - the observed value of t-statistic for the coefficient b2 (significance level of 90% - for the group "A" and 95% - for the group "B").

The equations presented above show that the growth of the average number of employees in a scientific organization causes more intensive growth of the annual public funding than the growth of the number of publications of a scientific organization, with other conditions remaining the same. Thus, with an increase in the average number of employees of a scientific organization per 1 person the annual public funding of scientific organizations grows by 499.48 thousand rubles for the group "A" and 493.23 thousand rubles for the group "B", with other conditions remaining the same. With the growth of the organization publications per 1 unit the annual public funding of scientific organizations grows by 18.87 thousand rubles for the group "A" and by 22.80 thousand rubles for the group "B", with other conditions remaining the same.
The high values of the coefficients of determination R-squared, the observed F-statistic and Spearman's rank correlation coefficients confirm the statistical significance of the model.

Comparative Analysis of the Actual and Predicted Values of Annual Public Funding of Scientific Organizations

Figures 1 and 2 presented below show the actual amount of annual public funding of scientific organizations included in the study groups "A" and "B", and the predicted amount of this variable depending on the average number of employees and publication activity of scientific organizations.

The graphs 1 and 2 show that there are discrepancies in the actual and predicted values of the annual public financing of scientific organizations. This obviously suggests the presence of additional factors that influence the annual public financing of scientific organizations besides the average number of employees and their publication activity included in the regression model. Among the unaccounted factors can be, for example, the scale of scientific organization, the size of its property complex (buildings, equipment and machinery), the success of the participation of scientific organizations in the funding programs of the Presidium of Russian Academy of Sciences and its branches, etc. The discrepancies in the group "B" are not as significant as in the group "A". The reason for the difference in discrepancies in the group "A" and in the group "B" can be the lack of large property complexes in the scientific organizations relating to the "Humanities" and "Social Sciences" and fewer opportunities for such organizations to receive public funding from the Presidium of Russian Academy of Sciences and its branches.

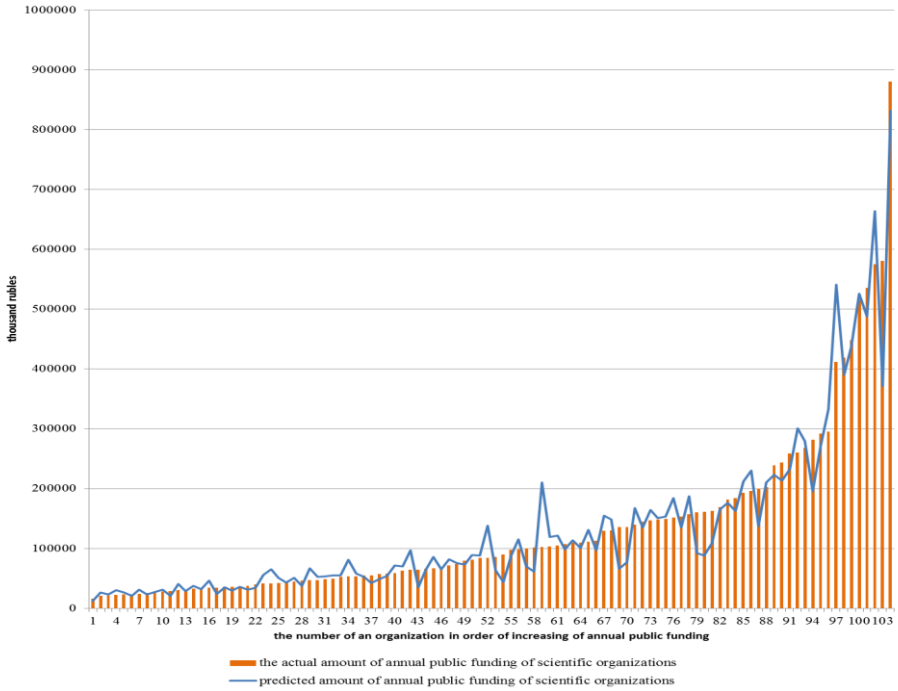

Figure 1. Actual and predicted volume of annual public funding of scientific organizations included in the group "A", thousand rubles

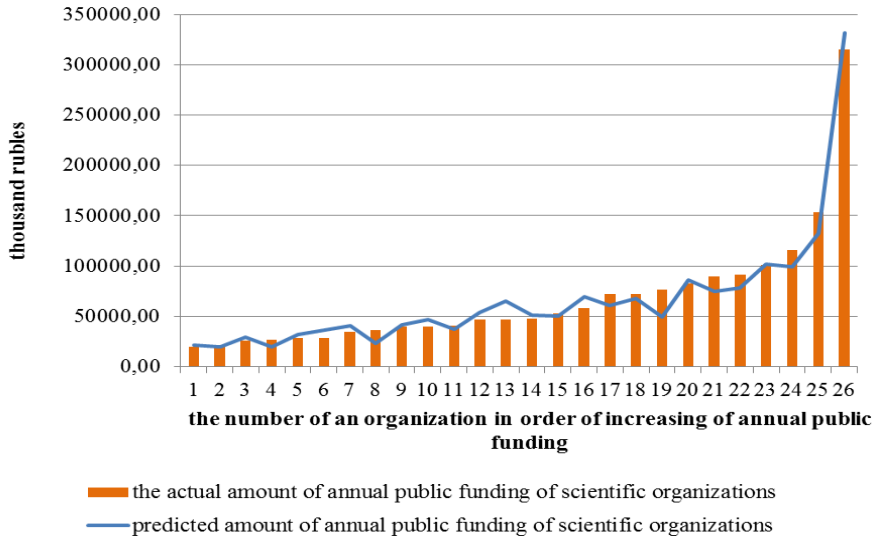

Figure 2. Actual and predicted volume of annual public funding of scientific organizations included in the group "B", thousand rubles

Conclusions

The analysis of results of implementation of the NPM concept in financing of research organizations using the tools of econometric benchmarking leads to the following conclusions:

1. The significant differences in the level of differentiation for the indicator of annual public funding of scientific organizations in general and per employee underline that the state system of financing of scientific organizations is based primarily on the quantity of employees.
2. The conclusion mentioned above is confirmed in the course of creation of the regression model for two groups of scientific organizations related to natural (group "A") and humanities and social sciences (Group "B"). The indicator of annual public funding of scientific organizations is more sensitive to a change in the number of employees in a scientific organization than to a change in its publication activity.
3. The use of quantitative indicators such as the indicator of fixed assets of scientific organizations (buildings, equipment and machinery) or the number of created intellectual property as explanatory variables does not lead to the creation of qualitative regression model and does not allow to evaluate the dependence of the volume of public funding on these indicators.
4. The study leads to the conclusion that the system of public funding of scientific organizations which are subordinate to the Federal Agency of Scientific Organizations is based to a greater extent on the principle of per capita financing than on the results-oriented principle (achieving targeted performance indicators). This makes it necessary to work out new public funding methods based on quantitative indicators of productivity of scientific research in order to improve the efficiency of fund spending. The new method may be based on the principles of benchmarking, when on the basis of historical data the "ideal" target quantitative indicators of research performance for each branch of science are modeled. Scientific organizations can obtain more public funds when they reach a certain level of targeted quantitative indicators of productivity of scientific research.
5. Finally the analysis revealed significant conceptual limitations of applicability of the benchmarking and performance management in general to the specifics of R&D sector. The main function of the latter is to generate new knowledge that is a value with extremely vague or at least highly volatile commercial characteristics. Performance management on the other hand was formed predominantly in the framework of commercial activity and therefrom derives most of its advantages and competitive edge – especially with regard to public administration. Methods of performance management are therefore inherently lack ability to take comprehend and ingest key features of scientific inquiry reducing productivity assessment in the relevant sphere to rather meaningless figures of publication activity. The particular vulnerability of performance management techniques with regard to defining indicators – even when applied to purely routine operations – is noted e. g. in the article of Šoltés and Gavurová (2015). In the worst case this approach

mechanically equates the results of studies of at a times drastically differing quality. However even in the best case scenario scientific publications, this "quantum" of formal scientometrics, are ranked and measured against "yesterday knowledge". Yet the true economic value of scientific discovery – its potential to redefine reality – is proportional to the degree it outpaces its time. Which practically speaking equals the time lapse before its' potential could be fully utilized in mass production. Of more particular deformations performance management demonstrates with regard to the specifics of R&D one should point out its: a) inability to distinguish between the results produced through updating and even reselling scientific reserve from the achievements genuinely innovative; b) very much fictitious attribution of the particular scientific results to various financial sources and instruments; c) outright ignoring of non-material motivation for scientific research – notwithstanding the fact that the latter equally pertains to both labor-economic and cultural- recreational areas of social interaction.

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NOWY MODEL ZARZĄDZANIA PUBLICZNEGO W FINANSOWANIU NAUKI W ROSJI

Streszczenie: W artykule przedstawiono aktualne trendy światowe w próbach rozwiązania problemu powiązania wynagrodzenia za pracę naukową z jej efektywnością; w szczególności badana jest próba przeniesienia zasad koncepcji nowego zarządzania publicznego w sferze finansowania nauki. Artykuł prezentuje analizę wyników wdrożenia nowego modelu zarządzania publicznego w finansowaniu rosyjskich organizacji badawczych z wykorzystaniem narzędzi ekonometrycznego benchmarkingu. Analiza prowadzi do konkluzji o istnieniu konceptualnych ograniczeń benchmarkingu i stosowaniu zarządzania wydajnością w sektorze badań i rozwoju.

Słowa kluczowe: zarządzanie publiczne, wskaźniki wydajności, organizacje badawcze, efektywność badania, aktywność publikacji, zasady benchmarkingu

公共管理科學與融資在俄羅斯新模式

摘要：本文介紹了在試圖解決報酬科學工作聯繫起來的問題，當前世界的趨勢是它的有效性;在試圖轉移新公共管理理念的原則在科學基金的特定領域進行了研究。本文介紹了在使用計量基準的工具俄羅斯研究機構的融資新公共管理模式的實施目錄的結果的分析。分析導致約的基準和績效管理適用性的研究和開發領域的概念局限的存在結論。

關鍵詞：新公共管理，性能指標，研究機構，有效性研究，出版活動，基準原則