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Features of Labor and Measurement of Efficiency of Mental Workers

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Abstract: In our view, the indicator of significance of results of scientific exploration should reflect something more essential of the scientific product content. Just the quality cannot assure the universality of its application, in other words, the possibility to compare all results without exception; this indicator should represent the opportunity to measure at once of scientific result proper rather the consequences of its application. Only the possibility of continues rather than the postponed application of assessments can prevent the dependence of results as the tool of efficient science management. The article deals with the measurement of efficiency of mental workers governed by specific features of their labor, creativity, motivation and working time cost. The real ways of measuring the efficiency with some single indicator have not yet been established. Meanwhile, the product of scientific workers can be to a certain extent characterized with a system of indicators.

Key words: Measurement · Efficiency of scientific workers · Labor and creativity · Working time cost

INTRODUCTION

The measurement of efficiency of scientific workers has become challenging only in recent years. Few scientific institutions employed those who fully dedicated themselves to research. Naturally, these conditions of measuring efficiency of a few researchers had no practical appeal.

The changing situation put forward a number of economic challenges; one of which was to develop the methods of measuring the efficiency of researchers. Within the framework of [1] the efficiency of academic scientists was studied. It is shown that the efficiency of academic scientists depends on the sphere of scientific interests, autonomous motivation [2, 3] and the intensive participation in research. For instance, the efficiency of research grows in response to the extent how much the researcher can influence the choice of own scientific subjects [4]. The obtained data clearly evidence about the need to take into account both the management at research and designing institutions, the features of managing the research staff when choosing the types of intervention into the creative process and the comprehension that freedom and independence are not the absolute dominant in reaching high research efficiency [5].

Of course, the measurement of efficiency of scientific researchers has a number of specific features.

Let us consider the factors of efficiency of the researcher:

- The efficiency of mental worker requires a clear-cut answer to the question “What is the production assignment?"
- The responsibility for efficiency bares fully the researcher personally. The mental researcher should manage themselves (it can be said that they are managers themselves). They need independence [6].
- The efficiency of mental researcher requires a clear-cut answer to the question “what is the production assignment?"
- The responsibility for efficiency is fully borne by the researcher. The mental researchers should manage themselves (it implies they are managers themselves). They need independence.

Like the mental work should be incorporated into the production assignment, the mental worker should be responsible for adaptation of knowledge and introductions [7].

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The real ways of measuring their efficiency is to use some single indicator, which has not yet been found, like the researcher's product cannot be measure with some single indicator.

Meanwhile, the product of researchers can be to a certain extent characterized with the system of indicators. Like any qualitative indicator in this sphere, they naturally possess definite limitations and disadvantages, which should be taken into account during analysis**.** The search for new spheres of research application is still an acute challenge.

Therefore, the aim of the present work is to study how to measure the efficiency of researchers.

Discussion of Results: The publications and practice usually limit to the comparison of the number Q_{ih} of works of the *i*-th type of scientific research [8] created by some researcher during the *h*-th year (or period). Meanwhile, the product is disregarded for the *h*-th year of this researcher of the accomplished assignment. That is why, in addition to the values *Qin*, Q_{oi} was taken into account too as the total number of scientific works of the *i*-th type created by the researcher in question during all years. But the correlation of these values, as a rule, the supremacy belongs to the researcher who is senior in age and has had more time for exploration [9].

In addition to absolute values Q_{oi} the specific values are necessary characterizing the efficiency of researchers' P_i as the created scientific product and their mean annual product [10].

Different scientific researchers are in different times during the day, week, month and year. They work with different tension and intensity. As the working time unit spent by a researcher, it is advisable to use the calendar year in which the researcher implements research. The peculiarity of researchers dictates the need to calculate each *i*-th type of scientific (research) product by the indicators of their mean annual product P_i during the period of creative research T_a. The latter indicator characterizes the period of life during which they should yield the research product. The period of creative research of explorers and developers of engineering is the following:

$$T_a = T_{á} - 26 \text{ years}, \quad (1)$$

where T_a is the duration of creative research by the explorer (developer) of engineering; T_{ag} is the age.

If the researcher (developer) of engineering during the life period is aged over 26 years, the creative research should be calculated in the following manner:

$$T_a = T_{ag} - (26 + T_n) \quad (2)$$

where T_n is the number of years the researcher deals with scientific research.

The mean annual product P_i, during the period of creating research T_a characterizes the efficiency of a researcher by the *i*-type of scientific product:

$$P_i = \frac{Q_{0i}}{T_a} \frac{scientificproduct\ unitofi-th\ type}{yearofcretiveresearch} \quad (3)$$

where P_i is the indicator of mean annual product by a researcher during ïðy period of creative research of the *i*-th type of scientific product; Q_{oi} is the total quantity of scientific products created by this researcher during all time of the *i*-th type; *i* is the type of the scientific product or its assessment (encouragement).

The total scientific product of the *i*-the type Q_{oi} created by this researcher during all the time should be calculated with the account of the fact how many researchers *nil* fulfilled each *l*-work of the *i*-th type:

$$Q_{0i} = \sum_l \frac{1}{n_{il}} \quad (4)$$

Assume there are *i* authorship certificates. Let us assume that this researcher has three of these authorship certificates: $l = 1, 2, 3$. The number of persons awarded each of these certificates is: $ï_{i1} = 2, n_{i2} = 1$ and $n_{i3} = 4$. Then, the researcher in question should be awarded not three authorship certificates, but only

$$Q_{0i} = \sum_l \frac{1}{n_{il}} = \frac{1}{2} + \frac{1}{1} + \frac{1}{4} = 1{,}75$$

The hardest to measure the efficiency of scientificñ researchers with this formula (3) is the characteristic with these quantitative indicators and the creative level of the fulfilled works of the *i*-th type that has the top priority significance in the sphere of activity in question.

As regards the scientific publications *I*, formula (3) implies monographs; university manuals published by central editorial publishers and having the ministry stamp; teach books published by higher education institutions, scientific brochures; scientific articles in central magazines; total number of scientific publications; their translations published elsewhere.

Formula (3) appears in the list of values *I* together with the positive assessment of the researcher (developer). Here *i* implies bonuses for the works published by home and foreign press with positive

references to the w orks in reference magazines. They would seem quantitative indicators because they all are expressed in figures. But in fact they characterize just the quality of works by the researcher (developer). It is natural that *I* in formula (3) should indicate separately special prizes for the works of this researcher (developer): the Lenin prize, state prizes and international prizes.

The largest appeal is the comparison of the above indicators for each researcher calculated with formula (3) with the average and maximum their values for researchers in this area (sphere) of science of own and similar institutions. Therefore, it is necessary to systematize and to study åy average and maximum values among laboratories, sectors and departments, institutes.

When analyzing the indicators P_i calculated with formula (3), it should be borne in mind that they can be substantially different among researchers of one and the same sphere of science even at the same institute. The researchers and developers have most of the created new products, materials and technological processes. Meanwhile, the theoretician's account for a relatively large number of published works and, in a number of cases, would not have any authorship certificates or patents at all.

CONCLUSIONS

Thus, the system approach to implementation of the indicators of creative level, creative activity of accomplished works, permits to solve the problem of measuring the efficiency of researchers.

It is understandable that the measurement of efficiency implies that the scientific knowledge production contains a larger or smaller uncertainty. It is expressed, in the first place, that it is impossible to foresee the research results. Therefore, each time when the research fails to yield expected result, the conclusions should be drawn with great caution taking into account all circumstances.

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