

QUANTIFICATION OF THE FACTORS OF STATISTICAL WORK LABOR INPUT USING THE METHODS OF SAMPLE SURVEYS

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ABSTRACT

This research work aims at developing a methodological framework for evaluation of labor input of statistical work. Such an evaluation is necessary to determine the cost of services provided by state statistics on, as well as to determine the level of budget financing. During the study the method of a sample photo of the working day had been used. The aim of the study was to calculate the ratio of the working time (the cost of work which is not directly associated with an assignment to the cost of the operative time) in a general population of workers of the Minsk regional statistics department. Such ratio is necessary for further evaluation of complexity of statistical work on the methodology described in this paper.

Key words: labor input of statistical works, costs of statistical works, expenses on the state statistical bodies.

1. Introduction

The main objectives and principles of state statistics are stated in the Law of Belarus "On State Statistics" [1]. The main tasks are:

- Development of science-based methodology and its improvement in accordance with national and international standards in statistics;
- Collection, processing, compilation, storage and protection of statistical data (information) on the basis of statistical methodology;
- Providing statistical data (information) to the President of Belarus, the National Assembly of Belarus, Council of Ministers, Presidential Administration, the State Control Committee of Belarus, republican government authorities and other state organizations subordinate to the Council of Ministers, regional and Minsk City executive committees;
- Dissemination of the summary of statistical data (information).

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The main principles of state statistics are: objectivity and reliability, stability and comparability of statistical data, its accessibility and openness within the boundaries established by the legislation of the Republic of Belarus, the integration of statistics into accounting as the main source of economic information.

Science-based solution of the formulated problems, thread management, statistical information, the systematic organization of employees of the state statistics in accordance with its scientific principles, the development of statistical work plans and monitoring their performance are inextricably linked with the assessment of complexity of statistical work. Publications on this subject in the Republic of Belarus are almost absent but seem relevant delineated on the background theme of the present paper.

Defining the methodological framework for evaluation of labor input of statistical work described in this paper is currently one of the primary tasks of the state statistics bodies in Belarus in connection with the transition to a unified system of electronic documents and justification of the effectiveness of the system implementation.

2. Categories of Time Costs

The evaluation of labor input of statistical work needs identification and quantitative measurement of productive time employees of the statistics.

The proposed assessment suggests that the total unit of statistical work is divided on operation of the input and output information. Working with the input information includes collecting, recording, organizing statistical data, etc. Working with the output information is represented by processing, accumulation, storage and presentation of summary statistics on economic, demographic, social and environmental situation in Belarus.

The complexity of statistical work depends on the time-consuming structure of state statistical bodies. Our study has the dual purpose of evaluating the value of the operational costs per work unit and the subsequent adjustment to a number of factors that take into account the special properties and components of the work.

On the basis of a survey conducted in government statistics and presented in this study, the author proposes that the following correction factors are developed:

Input information:

1. complexity (Kc);
2. value (Kv);
3. occupancy (Ko);
4. amount of information (Kai).

Output information:

1. amount of information (Kao).

In assessing the complexity one should distinguish the following categories of the working time: operative time, set-up time, while observing the operation of the equipment. In this set-up time and time monitoring of equipment operation the categories of input and output information should be considered. At the same time the operational statistical work must be allocated to time, which is directly aimed at the implementation of the set tasks.

We define the operative time with the input includes time required for registration and reporting questionnaires and other statistical microdata, transferring primary input records to electronic media, merging of sets of information on state statistical reports received from districts (at the National Committee - from the statistical bodies), editing and checks of micro and macrodata and forming output tables.

Operative work with the output is represented by time-consuming tasks of the executive bodies, analytical writing and briefing notes, writing and editing of publications as well as the work with the statistical registers..

Set-up time is the time for preparation before the implementation of a given work but also the time associated with their ending. The set-up time is divided between input and output information.. Set-up time for the input includes consultations in the area (businesses) on issues arising in the process of monitoring, the workers' press reports and organization of materials for controlling details of statistical reporting.. Set-up while working with the output information includes decisions on what materials to write, on analyzing methods, and other materials for the statistical publications, documentation and methods for archival storage and systematization. We included also the time to perform other operations such as monitoring the operation of the equipment when working with input and output information.

The labor input of statistical work is proposed to be modeled by the following formula:

$$T_i = Top_i \times K_c \times K_v \times K_o \times K_{ai}, \quad (1)$$

where Top_i – is the average operative time for work related to the processing of input data in hours.

The output information is modeled as:

$$T_o = Top_o \times K_{ao}, \quad (2)$$

where Top_o – is the average operative time for work related to the processing of output information, hour.

The total operative time is defined as their sum: $Top = T_i + T_o$.

Finally the time required to set-up work and work on the supervision of equipment is modeled as follows:

$$T_s + T_m = T_o \times K_l, \quad (3)$$

where T_s is the value of cost set-up time; T_m the value of time spent on monitoring the operation of the equipment; T_o the total operative time work and K_l the ratio of working time (proportion of work that is not directly associated with an operative time), determined on the basis of photo of working day.

The overall complexity of the statistical work is determined by summing the operating times for input and output information, set-up time costs and also time costs to perform work for the supervision of equipment

3. Quantification of the Labor Input of Statistical Work

Collection of baseline data to determine the above staff times is performed in the “Photo of Working Day Professional Bodies of State Statistics Survey”. It is recommended that this evaluation should be done every three years. It should be noted that self photo with a list of activities (components of labor costs) is more convenient to process data, but does not fully reflect the use of time since it allows for subjectivity. However, for large scale monitoring and long-term use of it is considered to be feasible.

When carrying out this study it is important to properly define the scope of work (photo of working day of employees of state statistics including managers and specialists). The author has found that to get results with sufficient precision it is necessary to conduct observations on a random sample of 10-15 per cent of the specialists for this population. Because of the great complexity the method should be used with care as a tool to specify or check the time spent on certain types of work.

To test the sampling methodology for this study the Minsk Regional Statistics Department has been chosen. It is a regional agency of the State Statistics of the Republic of Belarus which is responsible for collecting and consolidating statistical information for Minsk. It is subordinate to the National Statistics Committee of Belarus, along with six other regional departments.

Information about the structure of the working time selective data on the time spent on different tasks was obtained as a result of photo of working day, (including data on time spent on tasks related to processing the statistical forms). The data was extended to the general population which amounted to 127 managers and specialists of the Minsk regional department at the time of photography. Photo of working day was carried out of the Minsk regional statistics department. A stratified random sample of 15 people was selected in three divisions of the department.

Photo of working day was carried out during one day by the staff of the Research Institute of Statistics by means of questionnaires tailored to the subdivision procedures for all types of statistical work in the category of working time.

The grouping of the working time is presented in Table 1. Thus, e.g. a manager/specialist in the sample spent on average $5023/15 = 334.9$ minutes. (5.58 hours) to perform the specified work during the studied day, 118.6 minutes (1.98 hours) to prepare for the implementation of a given work and activities related to its end, and 15.5 minutes (0.26 hours) to monitor the operation of the equipment.

Table 1. The grouping of working time of the sample of workers of the Minsk regional statistics department

Category of working time	Recur- rence of the time	The total time for 15 pers. minutes	Overlapping time, minutes	Per cent
Set-closing time (T_s)	131.00	1779.00	63.50	25.23
Operative time (T_o)	120.00	5023.00	36.00	71.25
Supervision of equipment time (T_m)	0.34	248.00	0.00	3.52
Total	X	7050.00		100.00

The time is divided into different categories of work in Table 2. For example the managers,/professionals in the sample spent 54.61 per cent of the total time on the processing of statistical reporting forms (the checks, writing analytical, explanatory notes), 43.34 per cent of the total cost set-up time - to prepare for the processing of forms (receipt, the union body of information, service print reports for follow-up, getting jobs, study guides, ordering information prior to the array of control) and actions related to its completion (for file transfer to the archive), 87.5 per cent of the total time spent observing the operation of equipment - to monitor the operation of the equipment (official seal records for transfer to the archive).

As follows from Tables 1-2, the differences in the structure of time-consuming to work with the forms of state statistical reporting and in the total working time categories are insignificant: if the overall proportion of staff time to set-up time was 25.23 per cent, in investment of time to work with the forms of statistical reporting, the same category of working time is 20.66 per cent, the share of operating time in the value of total working time is 71.25 per cent, the largest amount of time on form processing of statistical reports - 73.52 per cent, the share of time monitoring of performance of equipment in the magnitude of the total cost of working time is 3.52 per cent, and in the value of time spent on work with the forms of statistical reports 5.82 per cent.

The precision of these figures are presented in Table 3 based on the unrealistic assumption that the sample was a simple random sample. For example the

average operative time for a specialist in the sample was 334.87 minutes (5.58 hr.). The variation coefficient of cost of operative time was 31.64 per cent. The standard deviation of cost of operative time is 105.95 minutes and the average sampling error for the operative time costs of managers, specialists is 25.69 minutes. From this table it is also seen that the sampling error does not

Table 2. Grouping of the staff working time according to the photo survey of workers of the Minsk regional statistics department, minutes

Three divisions of the Minsk regional statistics department	Category of working time			Total
	Set-closing time (T_s/f)	Operative time (T_o/f)	Supervision of equipment time (T_m/f)	
Total time spent on work with statistical forms	771	2743	217	3731
The structure of time spent on work with statistical forms, %	20,66	73,52	5,82	100
Total working time	1779	5023	248	7050
The structure of working time, %	25,23	71,25	3,52	100
Percent of time to work with statistical forms	43,34	54,61	87,50	52,92
Percent of time spent on work not related directly to the processing of statistical forms	56,66	45,39	12,50	47,08

Table 3. The variation of working time of a simple random sample of workers of the Minsk regional statistics department

Category of working time	The total cost for a manager, a specialist in a sample, minutes	Coefficient of variation, per cent	The average sampling error, minutes	The limit sampling error, minutes	Standard deviation, minutes
Set-closing time (T_s)	334.87	31.64	25.69	54.72	105.95
Operative time (T_o)	118.60	67.98	19.55	41.64	80.62
Supervision of equipment time (T_m)	16.53	227.05	9.10	19.38	37.53

exceed 54.7197 minutes ($25.69 \times 2.13 = 54.72$ minutes, where $t=2.13$) at a confidence level of 95 per cent [2]. The boundaries for the operative time in the general population are from 280 to 389 minutes. The other figures in the table are interpreted accordingly.

For the total sample the proportion of work not directly associated with an assignment is:

$$K1 = (Ts + Tm) / To = (118.6 + 16.53) / 334.87 = 0.404. \tag{4}$$

For the total population it is in the range of 0.2747 to 0.5035. Thus, for every 10 minutes of operative time cost a specialist of the Minsk statistics department spends from 2.80 to 4.98 minutes on set-up work and monitoring of the equipment.

Table 4. Results of the general population on the value of staff time

Index	Category of working time	The average for a sample (15 pers.), minutes	The boundaries of the average for the general population (127 pers.), minutes		The average for a sample (15 pers.), hour	The boundaries of the average for the general population (127 pers.), hour	
			Bottom	Top		Bottom	Top
A	B	1	2	3	4	5	6
Total working time	Operative time (To)	334.87	280.1503	389.5897	5.58	4.67	6.49
	Set-closing time (Ts)	118.6	76.9585	160.2415	1.98	1.28	2.67
	Supervision of equipment time (Tm)	16.53	0	35.913	0.28	0.00	0.60
	Total	470	357.1088	585.7442	7.83	5.95	9.76
Time spent on statistical forms processing	Operative time (To _f)	190.07	104.9126	275.2274	3.17	1.75	4.59
	Set-closing time (Ts _f)	65.13	28.0467	102.2133	1.09	0.47	1.70
	Supervision of equipment time (Tm _f)	14.47	0	33.9808	0.24	0.00	0.57
	Total	255.2	132.9593	411.4215	4.25	2.22	6.86

The same proportion for work connected with the input is $K2 = (Ts_f + Tm_f) / To_f = (65.13 + 14.47) / 190.07 = 0.42$. For the total population of managers(specialists the proportion lies in the range of 0.2673 to 0.4948. (Still assuming Simple random sampling)

For every 10 minutes of operative time costs connected with the state statistical reporting staff of the Minsk regional statistics department spends from

2.7 to 4.9 minutes on set-up work with forms and monitoring of the equipment in the processing of statistical reporting forms.

Thus, as the result of the survey the time-consuming structure of the general population of specialists of the Minsk regional statistical office has been determined using the methods of sampling; the resulting ratio of working time may be used for subsequent calculation of labor costs and labor regulation of the state statistics.

4. Conclusions

As a result of a simple random sample of workers of the Minsk regional statistics department the following conclusions can be obtained:

1. For every 10 minutes of operative time cost a specialist of the Minsk statistics department spends from 2.80 to 4.98 minutes on set-up work and monitoring of the equipment.
2. For every 10 minutes of operative time costs connected with the state statistical reporting staff of the Minsk regional statistics department spends from 2.7 to 4.9 minutes on set-up work with forms and monitoring of the equipment in the processing of statistical reporting forms.
3. The resulting ratio is necessary for the further isolation operative working time category from the total statistical working time for the subsequent adjustment for the coefficients of the complexity, value, occupancy and the amount of information and an objective assessment of the distribution of statistical work on time costs directly aimed at the implementation of the set tasks.

REFERENCES

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