Conception of Local Budgeting Performance Indicators Storage*

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Abstract

The paper is devoted to the collecting, analyzing and publishing of performance information in public budgeting with new information technologies applying importance. Its implementation is proposed through the concept of using an interactive data warehouse on a countrywide scale with the local budgeting in Ukraine as an example case. The model of data storage and using concept has relied on implementation of the local budget programs performance indicators formulated. The scientific and technical conditions of data utilizing is described. The proposed model shows that the scheme of performance information flows on an example of particular types of the performance indicators, the conditions for their directly beneficial uses are determined; and the levels of qualitative and quantitative data composition for the information system were specified. In support of the data storage model conception implementation author systematizes the benefits of budget entity's performance information publicity and exploits for the further enhancement of performance information analysis in the multicriteria-based decision-making.

Keywords: local budgeting; local finance; performance budgeting; performance indicators; data warehouse; DID method; MCDM methods.

Introduction

Performance information is a cornerstone of the modern local budgeting worldwide. Citizen-oriented public service budgeting approach is gaining popularity, therefore local authorities should be interested in good image. In addition, public performance information allows the entity to compare own achievements and performance of the neighbors to see the best ways in efforts organizing. The performance indicators transparency and usefulness could be ensured by their accumulating, storage, interactive processing and further public reporting by a specialized data storage system.

This paper is devoted to the conception of creating such a system and its capabilities. We chose the performance indicators of the local budget programs in Ukraine to describe such a system with a data warehouse utilizing. Performance indicators are set from the standard list of samples in all regions and local budgets for the delegated by the state common functions (services) such as education, healthcare etc., so input data should be easily imposed into an

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interactive system, be compared and transposed to perform the other types of analysis. Therefore, following these unified indicators, one can monitor the applying of the budget programs by local authorities, the similar functions at the different local communities providing, compare the homogeneous indicators of the costs in communities and assure the local authorities with actual information about the performance indicators benchmarks over the whole country.

The author hopes that such a system will be advantageous for the motivation to engage in efficient public spending and involvement of all the budget process participants in it. The territorial communities will get the new opportunities for making decisions at a new level through the estimation methods for multi-criteria systems analysis in local finances for the local budgeting applying as well.

The Performance Information Estimation Necessity

Along the line of reasons to provide the performance indicators collection, Ukraine in particular, has gathered below based on the different topics research papers but with the lead question about performance. The first reason is that the budget process participants could increase their consciousness and discipline in general. Performance indicators that can be compared through disclosure by the regions, separate local communities and body executors' types liaise with the mitigation of the problem formulated by Throsby and Withers (1986) about "nonexcludable nature of a pure public good" and each taxpayer liability weakening in person. Development of e-governance and updated financial infrastructure require an information exchange between citizen and government in order to implement a certain chosen model of the citizens' involving into the budget process, as noted by Chadwick and May (2003).

The second reason is the budget body's activity consequences information needs the objectivity and transparency adding. Requirement of the unprejudiced data about the local budgets performance detract the "managerial games" effects with performance indicators had mentioned by Bevan and Hood (2006), when the indicators have been formulated more for third-party auditors, but not for the helpful assessment of the reaching objectives results. Lee at al. (2012) emphasized the exchange of performance information in the public sector necessity to avoid subjective electoral information and its one-sided distortions by the politicians toward citizens. Using benchmarking in the public sector, one can predict the future effectiveness of budget programs or identify effective or inefficient performers from similar institutions in such services as education, health care, social security or governance.

The third reason is a positive pattern and self-motivation for the local authorities. Moynihan and Pandey (2010) have determined that the authorities, in particular the local communities had been more successful applying of the completed and gathered performance indicators at the budgeting decisions afterwards, because managers had been looking for an efficient action examples around. This method has been used for target budgeting trough the executive contracts for the public goods serving in Denmark, when performance indicators utilized as a marker for identifying the most successful performers and drawing on their experience. Ammons and Rivenbark (2008) highlighted that managers with broad capabilities and deeper understanding of processes are more willing to use information about performance: their own internal indicators and indicators from another budget bodies as well. Publishing information at the public network increase the "transparency and accountability of the Public Administration", and the trust of people. Corruption and (or) lacking of professionalism among the government and civil servants could be minimized by increasing the transparency of providing decision's causes and consequences on the public funds spending, which it's an additional important consequence of the performance indicators publication on public.

The features of performance information applying have been identified as "a form of organizational behavior" of the public employees as discussed in Moynihan and Pandey (2010)'s model of the performance information use on local authority's example. The authors of the model found that the properties of the information depend on its provision information source. Information sharing in the public sector and the performance information exploitation directly depends on the "leadership and political support for performance management issues, and goal-oriented cultures matter, and that citizen support for and involvement in performance management processes matters". Therefore, published performance information has an affirmative impact on the moral grade of the participants, and hence behavior in the public sector in general.

The fourth reason is the New Public Management (NPM) or results-based management, which brings a huge advantage – it sets objectives, despite the disadvantages of technology. The objectives and targets are defined and, accordingly, their achievement indicators are appeared in the multiplied policy papers of many countries. NPM has such essential components as "performance-based budgets, benchmarking, activity-based costing, balanced scorecard", as well as policy objectives—quantitative ones, such as raising the literacy rate by a certain amount, or qualitative ones, such as correcting market imperfections. Performance indicators and specific objectives are primarily set by the executors in examined countries, but external centralized control is carried out in different ways: both the responsible executor and the Ministry of Finance, or by special committees, as well as by the US President or Prime Minister Offices. Performance-based budgeting and performance indicators separated out on the features in researches show that the combination of objectives, their achievement indicators and current performance indicators allows more efficient the public funds usage by getting rid of inefficient performers and unnecessary expenditures. The legal requirement for public finance transparency and public funds using assessment provided in Chapter 3 of Section 5 of the Association Agreement between Ukraine and the EU.

Example of the Performance Indicators Estimating Method

In the consideration of Ukraine's local budgeting experience, the implementation of the local budget expenditures execution in form of the budget programs in Ukraine cause the executives transition to enlarge responsibility. Local communities with their own authorities and budgets have been established within the decentralization process. Local authorities obtain the delegated obligation too. So, in Ukraine local authorities mostly lack of experience in devising of the budget programs besides the standard summary of templates provided by central authorities on the delegated functions in addition. The performance indicators data storage supposes the methods of current and final evaluation applying. The maximum global budget transparency is very important.

Today, the local budgets revenues of the territorial communities in Ukraine depend on their fiscal capacity calculation and inter-government transfers (subventions) from the central budget for the infrastructure development during the delegated functions provision, such as education, health care, social protection, environmental protection etc. Amount of this central budget support will construct a financial equalization system that has been depended on the fiscal capacity of the territorial communities in the future. The public services cost will depend on the estimation results of the received and own funds using. So, the factor of unskilled management should be eliminated as much as possible to prevent backward tendencies and equalize the fiscal capacities of the local communities.

Performance results of the budget programs are grouped according to typical examples, and each of the form has four groups of the performance indicators. The two last groups of the performance indicators are the indicators of effectiveness and the indicators of quality during

the year activities within the program boundary. We could observe, for example, the performance indicators that refer to expenditures for energy and water services (utilities). Assembled in the budget programs, indicators of efficiency and quality can be collected in a data warehouse, which also help to assess the energy saving policy of the local authorities to compare utility costs by regions. An example of the performance indicators is Table 1.

Table 1. An Example of the Performance Indicators

Performance indicators of effectiveness – The utility consumption level	**The norm indicator (N) in the whole country or in a particular region**	**Indicator accomplished in the budget program for period 1**	**Indicator accomplished in the budget program for period 2**
Heat supply (H_3) Gcal per 1 m3 of heated space.	N_h	H_1	H_2
Electricity (E), kWh/m^2	N_o	E_2	E_2
Water supply (W), cubic meters per square meter.	N_g	W_1	W_2
Quality performance indicators – the level of savings.	Based on cost savings for a specific region or the country	Indicator accomplished in the budget program for period 1	Indicator accomplished in the budget program for period 2
The level of heat supply saving (H), %	NE	EH_1	EH_2
The level of electricity saving (E), %.	NE	EE_1	EE_2
The level of water supply saving (W), %	NE	EW_1	EW_2

Simultaneously, there are the performance indicators of norm for this type of budget entities activities in comparing the results of local government energy efficiency policies with declared energy saving measures and without them by regions.

When collecting and accumulating the performance indicators of budget programs in the data warehouse, we can use different methods of estimating the outcomes of authorities implementing these budget programs. As an example, we use Difference-in-Difference (DID) estimation described in Wooldridge (2009)'s publication to evaluate performance data laid in the data warehouse. The DID method allows the data customer to compare homogeneous indicators in a service group over the years and to change the results of using services in the required group due to active energy efficiency policies of the local authorities. The method of comparing the difference in differences shows the changes in energy efficiency occur in each separate region in time. It distinguishes regions with different experiences in order to take into account its impact on the typical change of indicators in the period. The programmed estimation by the groups of typical budget programs indicators by this method focuses attention on the exceptions in the performance indicators of consumption or economy of consumption utilities between the regions. The outcomes of consumption assessing by region could become the presence or absence indicator of the changes to the energy efficiency in dynamics. Interpreting the results will depend on the tasks and conditions for receiving utilities. "Norm" in using this method can be considered a country-specific norm or performance indicators in any region in relation to which the estimation of the efficiency and quality of consumption utilities complete.

Consequently, we compare the change in the indicators in dynamics between 1 and 2 periods by regions A and B with region C, which in this case appears as "normative". For

example, regions A and B proclaim that they are pursuing an energy efficiency policy, while Region C uses energy in the usual way. Alternatively, on the contrary, region C shows the best energy savings projections from the planned ones - does it really overstate the planned performance indicators to get the best savings (quality) in their budget programs?

An adapted sequence of formulas for calculating the difference between the performance indicators of spending public funds in the community, summarizing the impact not only energy efficiency measures, will look like this:

$$\Delta uA = (I_1 - I_2) - (N_1 - N_2)$$
$$\Delta uB = (I_1 - I_2) - (N_1 - N_2)$$
$$P(AB) = [\Delta uA] - [\Delta uB]$$

Where 1 and 2 are the periods when the performance indicators were completed, A and B – the comparable regions, I – the performance indicator within a certain group, N – the indicator of a comparable certain group from the standard (neutral) region C.

The local budget program's performance indicators data storage model conception offered model proposed the continuously updated information system for providing data store with the planned and actual indicators of the local budget programs. Its concept stipulates accumulating the performance information from all local budgets and regions by exploiting any budget program's executing bodies as the first source with the putting performance indicator's attribution together in the dynamics at first. Incoming information will be supplied with the following features: by groups of the local budget programs performance indicators (under current regulations these groups are costs, product, effectiveness and quality indicators), by budget program executors, by functions that these budget programs serve, and by types (titles) of budgets and by territories. The information will be stored in a data warehouse where it should be updated in a timely manner and have basis general interactive processing of the input and current data. Output information will be displayed on a special publics accessible webpage and will be divided into the outcome of the automatic monitoring and assessment in graphic form as well as data and its analysis according to a specific user's request.

Corrado lo Storto (2014) had rated the websites by “the user cognitive system”, which enables us to adapt his inference to the baseline of using performance indicator's website. The form of information submission will vary for different user groups. For example, the representatives of the authorities need information that will immediately form overall view of the state and local authority’s policy implementation. This is, primarily, the rate of planned indicators compliance, strategies benchmarks implementing, a sample of indicators by type in the dynamics with grouping by administrative-territorial units or budgets etc. For analysts and scholars, information can be submitted in detail, unprocessed, and grouped according to the general criteria if needed: period, level of budget, budget programs objectives, planned and actual performance indicators by groups. For the citizen, information should be generalized in graphical form with low level of details and maximum visibility. These data will serve as an objective source for informing citizens about meeting their individual, special, local needs in comparison to other regions and the whole country in general. Therefore, the completed version of data warehouses' website will require the output information sorting into different levels depending on the type of user in the future.

Technical support for the data entry in the proposed model includes: (i) body’s of the State Treasury Service of Ukraine software modernization for collection of periodic reports of the spending unit's actual performance indicators; (ii) information processing, performance indicators data storage, links between the servers with information throughout the country and

common software system will furnish by local financial authorities at pattern like of the existing unified e-data portal. The State Treasury Service local bodies will provide actual information on the indicators of budget programs, and program's executors will introduce planned indicators during the development and approval of budget program passports directly in local financial authorities, as shown in Fig. 1.

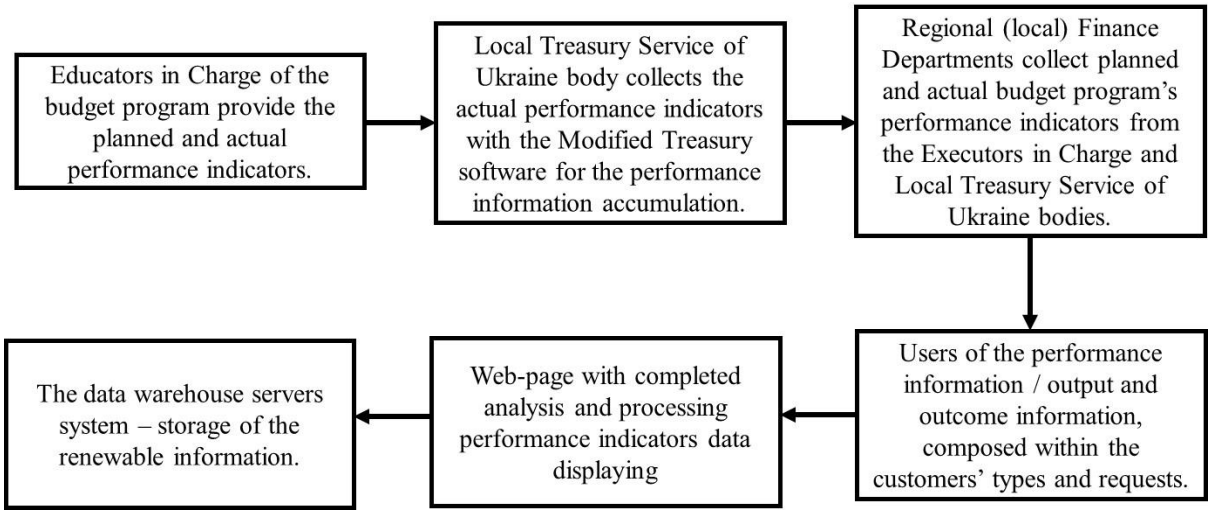

Fig. 1. Flow of information in the model

The software application and the information medium creation for data sequential input by various entities with further processing and obtaining the necessary information on the output was described by Ludwig at al. (2004). Software modules should provide a connection between territorial units, but with the possibility of layout, or switching on only selected functions such as: input, sampling, outputting information on a specified feature without processing, outputting information with the analysis results. The unified webpage needs the separately support providing.

The complications of Local Budgeting Performance Indicators Data Storage Model in Ukraine:

1. Should begin with an analysis of simple and unambiguous indicators of budget programs - performance indicators of the costs and product, which could be display in dynamics by type and territory, with the benchmarks given. Only over time, after a weighed revision, one can recommend to take into account the analysis of qualitative indicators.

2. According to the information dimensions in the accumulation of results, it is reasonable to consider the future system as Big Data in public sector under characteristics. Fig. 2 is the local performance indicators Big Data system architecture.

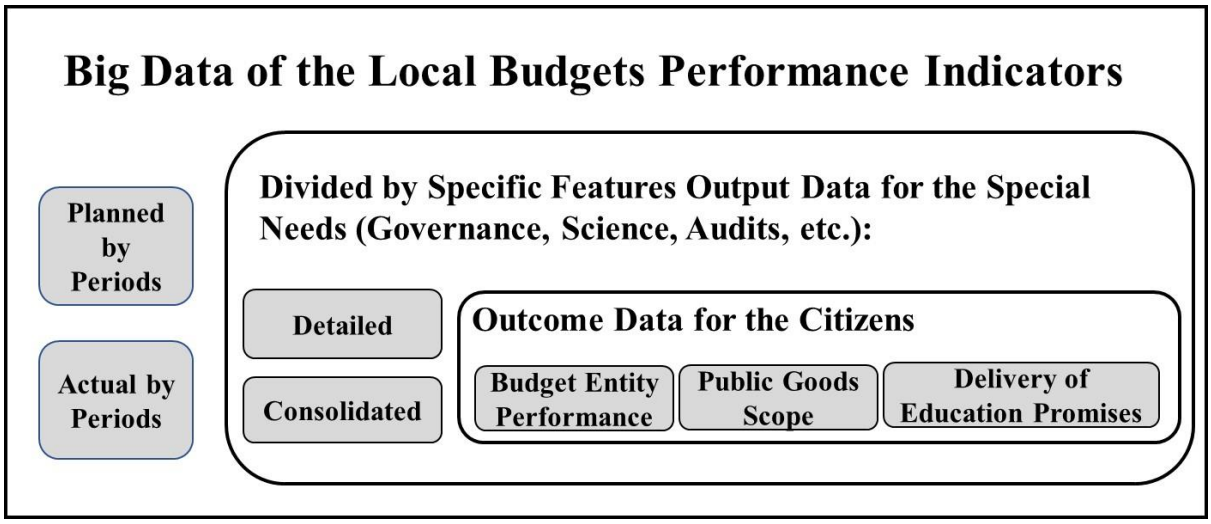

Fig. 2. Local performance indicators big data system

Further Analysis and Applying of the Performance Information

The performance indicators are divided (according to the legislation of Ukraine) into quantitative and qualitative ones. The quantitative performance indicators could be evaluated by comparing them with the averaged indicators or benchmarks for the country as a whole. DID analysis was applied to local budget programs performance indicators of utility supply among 9 regions in Ukraine. Eight of them had been compared with the 9th capital region indicators of utilities consumption after performance budget programs in 2016-2017. The results of the comparison calculations are shown in Table 2.

Table 2

Group of regions and types of the utilities	DID estimation result for the performance indicators of effectiveness	DID estimation result for the quality performance indicators
1. Heat	0,2	6,6
2. Heat	2,4	3,6
3. Heat	1,1	8,1
4. Heat	0,95	4,6
1. Electricity	6,3	11,3
2. Electricity	1,8	12,5
3. Electricity	6,3	15,8
4. Electricity	9,7	16,1
1. Water	0,07	3,0
2. Water	0,03	9,2
3. Water	0,01	7,4
4. Water	0,01	4,3

A universal user of monitoring data and estimating the contents of the data warehouse will see that the results of the electricity consumption estimate show the greatest really

significant deviations aside both the increase in consumption and the economy. Thus, it is the consumption of electricity that local authorities should give the priority in verifying.

Not only the acquisition of information about performance indicators is important, but also properly interpreting it and applying in the future. For example, the number of employees in the authority or the social assistance payment sum per the beneficiary in the community could be compared with the typical indicators for the all communities. Thus, in the list of typical budget programs and performance indicators for the service "Education", the line ministry had approved the quality indicator of secondary and primary education as the number of days the child was in the institution per year, and the product indicator - the number of children. The number of days the child was in the school, at our opinion, measures the product. Moreover, the number of students, lessons (hours) and teachers are auxiliary indicators for calculating costs. The grade of children success, the teacher qualifications and work experience, the number of students enrolled at University after school could be the qualitative indicators. Therefore, genuine quality measures need the proper development first, but the actual quality indicators should be included in data warehouse and used for monitoring until then.

The qualitative indicators assessment can be reconciled with the welfare indicators of the territory. The local authorities need such assessment to implement the most informed and cost-effective decisions. Municipal managers are forced to simultaneously evaluating various options on purpose of making such decisions for many parameters, some of them contradictory, sometimes interference factors on the final decision increase or disappeared at all. Therefore, the decision correctness and efficiency strongly depend on the formed indicators usefulness and the estimating method.

The multi-criteria decision making (MCDM) methods will provide the best further estimation under these conditions in our opinion. They allow evaluating and analyzing multi-purpose tasks with utilizing variety criteria combinations. The solution-making process constitutes a system with many inputs and outputs, so method invents criteria in the decision-making. This classical now approach serves a tool for comparing the alternatives in multi-criteria circumstances.

A number of MCDM methods usually assess and rank alternatives in the decision-making process today, and they mostly focused on the future. In this case, the alternatives integral estimation is obtained by aggregating evaluations according to the separate criteria. These methods include MOORA, ARAS, SAW, ELECTRE, TOPSIS, COPRAS, PROMETEE I, II, TOPSIS, CORPAS, VIKOR and others. Each of these methods has its own distinctions, advantages and peculiarities of application that we will consider in our further researches of this topic.

Conclusion

The proposed information system with the data warehouse creates a number of advantages in the performance information utilizing. First, the independence of local government is not violated, but its accountability is ensured. Second, performance indicators collecting and analyzing for a specific period makes possible their quantitative and qualitative composition estimating and adjust it if necessary. Thirdly, the use of modern MCDM methods for analyzing performance indicators, in combination with other economic indicators and benchmarks, will create new opportunities for researchers in order territorial and public policies formulation. The proposed system is based on only implemented in the regions local budget programs performance indicators because of the unified data. In the future, with the Big Data applying in the public sector, these storage data systems could be extended with the performance indicators of budget institutions, indicators of staff assessment, indicators of

economic progress etc. This will enhance the information evidence and its analysis possibilities.

The local budget program's performance indicators storage in form of the interactive data with open access from the moment of its setting in the plan about citizen-oriented services should become an indispensable according to the current rhetoric of the government in the near future. This data store should become the basis for monitoring and benchmarking of the particular executor's results in dynamics and the homogeneous activity of the communities too in relation to, for example, financial provision of health care or state-guaranteed education by the regions.

At the same time, it is not necessary to multiply the numbers of indicators. Perhaps such information system will be an incentive for further rational determination of the most necessary information of the budget programs indicators. Performance information should not be overburdened, and thus, the subjective internal and external influences must be eliminated. Performance indicators can be efficiently utilized only in case of clearly defined targets of activity.

In the absence of informational system, the main risk for the local budgets budget programs in Ukraine is their further formalization, which will not provide adequate information, either the efficiency of budget funds using, or effective management.

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