REPORT 6

MUNICIPAL DEBT RESTRUCTURING:

DESIGN A TOOL FOR THE EVALUATION OF THE LONG RUN SUSTAINABILITY OF LG'S FINANCIAL STRUCTURE

FINAL REPORT

GRANT AGREEMENT No SRSS/S2018/028

CONTENTS

Glossary

AEN	Actual Expenditure Needs
GDP	Gross Domestic Product
LG	Local Governments
LQI	Life quality index
PIT	Personal income tax
RCA	Regression-based Cost Approach
RFCA	Regression-based Fiscal Capacity Approach
RTS	Representative Tax System
SEN	Standard expenditure needs
SLS	Standard levels of services
SOSE	Soluzioni per il Sistema Economico S.p.A.
SRSP	Structural Reform Support Programme

Cluster

Clusters are conceptually and statistically meaningful groups of subjects (i.e. municipalities). It can be defined as the task of classifying a sample of subjects (i.e. municipalities) based on a set of measured variables into a number of different groups such that similar subjects are placed in the same group. Items inside a cluster are very similar (but not identical) to one another and very different from the items in other clusters.

Fiscal capacity

Fiscal capacity is the ability of the government to raise revenues to provide public goods and carry out other functions. Fiscal capacity may be referred to as tax capacity, extractive capacity or the power to tax, as taxes are a main source of public revenues.

Fiscal effort

Fiscal effort is the difference between the actual revenue collected by each local authority and the potential revenue evaluated in terms of fiscal capacity. It corresponds to the amount of fiscal resources that resident citizens provide above (positive fiscal effort) or below (negative fiscal effort) a standard level.

Fiscal equalization

Fiscal equalization is a fiscal program that involves the distribution of intergovernmental grants to compensate fiscal disparities generated by differences in standard expenditure needs and/or revenue fiscal capacity among local governments.

Fiscal gap

Fiscal gap is a mean of quantifying long-term fiscal and debt sustainability (also called "resource-requirements gap" or "needs capacity gap") and it is basically equal to the difference between expenditure needs and revenue raising capacity.

Horizontal fiscal imbalance

Horizontal fiscal imbalance is a measure of inequality in the distribution among jurisdictions of the difference between own tax revenue and own expenditure needs.

Infrastructure endowment

Infrastructure endowment constitutes a measure of the capital installed in a specific jurisdiction to provide local public services. It includes different kind of facilities and capital goods such as school buildings, roads, recycling facilities, landfills etc.

Infrastructural gap

Infrastructural gap is the gap between infrastructure available and needed, therefore it could be interpreted as the difference between offer and demand of infrastructure.

Standard expenditure needs

Standard expenditure needs of a local government is the level of expenditure necessary to finance a standard level of services taking also into account differences in the provision cost, such as labour and energy costs, and assuming efficient managerial choices. Usually it is evaluated through statistical methods that approximate the cost function.

Standard level of services

Standard level of services of a local government is a measure of the potential demand for local services compatible with the characteristics of the local population. Usually it is evaluated through statistical methods that approximate the demand function.

Vertical fiscal imbalance

Vertical fiscal imbalance is the difference between own tax revenue and own expenditure of a jurisdiction.

EXECUTIVE SUMMARY

Municipalities in Lithuania are facing financial imbalances generated, among other factors, by the ageing of the population and the intense migration flows both towards foreign countries and from rural area to big cities. In the past two decades Lithuania's population has decreased by more than 20 percent. Increasing labour mobility not only affects emigration, but also fosters transfer and concentration of economic power within the country in several main centres. Ageing population in certain regions will increase the demand of public services (public costs) within those regions, while their income tax base may be eroding due to decreasing population in those regions. This may raise a need to review current functions of the municipalities, as well as reconsider territorial consolidation issue in order to increase the availability and quality of the regional service provision. Therefore, the long-term sustainability of Lithuanian public finance and the provision of local public services, together with a heterogeneous demand over the country, are two policy goals that can be achieved through a reform process aiming to increase: efficiency of public finance management and municipalities' autonomous revenue sources.

The OECD (2017), in a recent report, highlighted the importance of sub-national governments, especially in the aftermath of the 2008 financial crisis, in implementing sound policies to support the economic recovery. Again in 2020, OECD (2020) remarks the crucial role of local governments in contrasting the Coronavirus outbreak and the disastrous economic consequences that the pandemic is generating all over the world.

A general consensus, consolidated among practitioners and politicians (e.g. art. 9 of the European Charter of Local Self-Government, OECD 2007), supports that, without a well-operating equalization system, local authorities will not be able to fulfil their tasks. As reported by OECD (2008), fiscal equalization aims at reducing or eliminating the differences in the local fiscal gap measured, in each local authority, in terms of the difference between revenue-raising capacity and expenditure needs.

When intergovernmental grants are not able to close the fiscal gap, two types of imbalances may arise, usually known as the vertical and the horizontal fiscal imbalance. Bird (2006) defines the vertical fiscal imbalance as the differences between the expenditure of sub-central governments and their fiscal revenues. It exists since grants from higher levels of government finance only a portion of the local government's expenditure. The horizontal fiscal imbalance, instead, depends on the differences among the fiscal capacities and standard expenditure needs of each local authority. It exists because some jurisdictions are relatively richer than others and can spend more with the same level of fiscal effort.

As discussed by Di Liddo et al. (2016), especially the measurement of horizontal imbalance is not an easy task as it entails the evaluation of the revenue-raising capacity of each jurisdiction, as well as the assessment of their standard expenditure needs. Although the measurement of the vertical imbalance is more straightforward, the problem of measuring horizontal fiscal imbalance is still a controversial issue in public finance.

When, after the distribution of equalization grants, one of the two fiscal imbalances is still far from zero, there is a clear symptom of the necessity to reform the existing system of intergovernmental relations. However, it is not easy to detect the magnitude, the distribution and the possible causes of the fiscal imbalances, unless you can rely on sound data and advanced statistical methodology to analyse them. The main problem is to identify if the imbalances are generated by the lack of resources or by inefficient management choices.

The European Commission (2008) recognizes that monitoring the efficiency of local governments is a necessary condition for improving the quality of public finances, and thereby achieving a sustained long-run economic growth (for a general analysis of performance analysis methods in the sector of local governments

see Porcelli-Vidoli 2020, Porcelli at al. 2016, Lockwood-Porcelli 2013). Moreover, these policy actions, as recognized by the literature on fiscal federalism, are necessary to help citizens to hold governments and their agencies accountable for their actions.

Difficulties regarding mainly the measurability of outputs and inputs employed for the provision of local services highlight the importance of sophisticated statistical techniques and microdata collection. Without adequate information, policymakers may be unable to make a decision or, in the worst-case scenario, can make wrong decisions implementing wrong reforms.

In order to ensure the sustainability of intergovernmental fiscal relations, Lithuania has requested support from the European Commission under Regulation (EU) 2017/825 on the establishment of the Structural Reform Support Programme ("SRSP Regulation"). Following the Lithuanian request, the European Commission has considered several options and selected "S*oluzioni per il Sistema Economico – SOSE SpA*" within the Italian Ministry of Economy and Finance (SOSE) to deliver the requested technical support to Lithuania because it has a well-established practice in assisting public bodies. In addition, SOSE has a well-established expertise on econometric methodologies to estimate expenditure needs and revenue capacity of various typologies of local governments.

The Agreement, entitled "*Municipal Debt Restructuring and Asset Management Facility Evaluation of the long run sustainability of the municipal financial structure in Lithuania*" (reference number SRSS/S2018/028), was officially signed in December 2018 between the Italian General Accounting Office of the State and the SRSS of the European Commission. From December 2018, the activity in favour of the Lithuanian government has being carried out by SOSE through the coordination of the Italian Ministry of Economy and Finance, in strict cooperation with the Lithuanian authorities and under the supervision of SRSS.

As displayed in ***Figure 1***, SOSE has implemented a specific methodology to evaluate the sustainability of the current financial structure of each Lithuanian municipality through five main action lines.

Current expenditure analysis, based on the evaluation of standard expenditure needs and the standard level of services in the sectors of General administration, Housing and utilities, Recreation, culture and religion, Education and Social security.

Revenue analysis, based on the evaluation of the fiscal capacity related to the municipalities' own-source of revenues (property tax, land tax and fees).

Performance analysis, based on the comparison between the expenditure gap (difference between standard and actual expenditure) and output gap (difference between standard and actual level of services) in a four-quadrant model of performance evaluation.

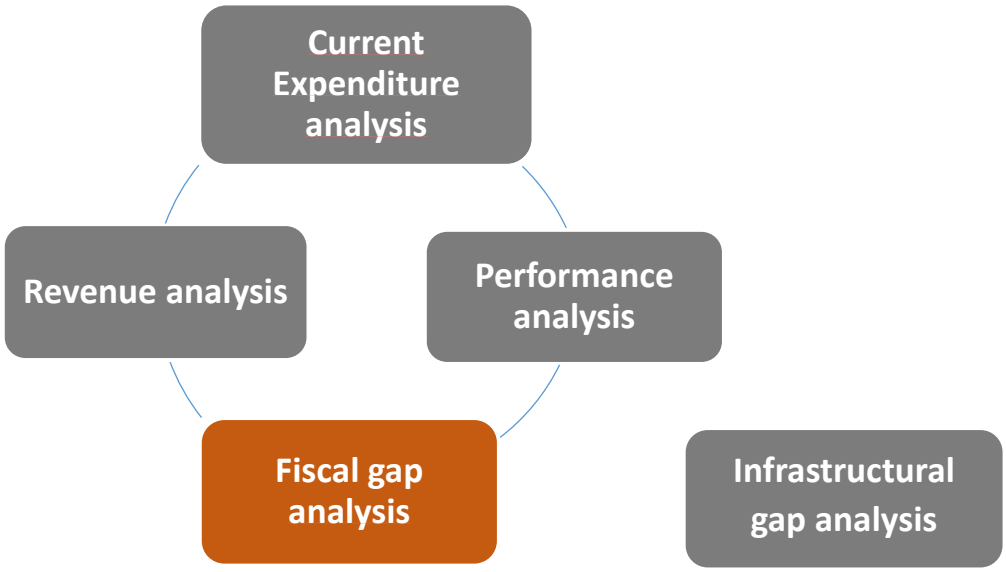
Fiscal gap analysis, based on the evaluation of the vertical and horizontal fiscal gaps considering the difference between standard expenditure needs and fiscal capacity and taking into account the actual level of equalization grants.

Infrastructural gap analysis, based on the computation of a synthetic index of the local capital endowment in the sectors of heating, water management, education, recreation & culture and road network.

During the implementation of the action, the Lithuanian Authorities requested to expand the original set of activities. Consequently, an amendment to the original Grant Agreement has been put in action in order to extend the duration of the contract for additional 10 months postponing the deadline from the 4th October 2019 up to the 4th August 2020, and expanding the scope of the contract to a new set of activities requested by the Lithuanian authorities.

The new set of activities has involved a refinement of all results including a new wave of data, the 2018, that has been added to the original dataset in order to cover a period of 6 years starting from 2013, thus providing up-to-date information and analysis to support policy development.

Figure 1 Structure of the project



The full set of outputs that SOSE has produced to achieve the goals of the project, that also represent the main deliverables of the action, can be summarized as follows.

The construction of a municipal database for the evaluation of the municipal performance *(Output 1a)*, this database includes data on current expenditure, structural information of inputs and outputs and on a wide range of context variables that aim to capture the socio-economic environment that surrounds the provision of services by each local authority. The database has been constructed including six years from 2013 to 2018.

The evaluation of standard expenditures *(Output 1b)*, through the estimation of a cost/expenditure function for each group of homogenous services, and the analysis of the expenditure gap, i.e. the difference between actual and standard expenditure.

The evaluation of standard level of services *(Output 2)* for each group of homogenous services through the estimation of a demand/output function, and the analysis of the output gap, i.e. the difference between actual and standard level of services.

The analysis of municipal performance *(Output 3)***,** based on the construction of a benchmarking tool that has been used to analyse jointly the expenditure gap and the output gap so to generate a comprehensive performance assessment of municipal activities.

The construction of a municipal database for the evaluation of the municipal fiscal capacity *(Output 4a)*, this database includes data on the entire set of municipal revenues over six years from 2013 to 2018.

The evaluation of municipal fiscal capacity *(Output 4b)***,** based on the evaluation of the standard level of municipal own tax revenues and the analysis of the tax effort (difference between actual and standard tax revenues).

The analysis of municipal fiscal gap *(Output 5)***,** based on the computation and analysis of the difference between potential revenues and efficient standard expenditures.

The construction of a municipal database for the evaluation of the municipal infrastructural gap *(Output 6a)*, this database includes structural data on municipal infrastructural facilities for the sectors involved for the evaluation of the investment capacity.

The analysis of municipal infrastructural gap *(Output 6b)* based on the definition of the methodology for the evaluation and analysis of the infrastructural gap of each municipality.

The analysis of Social security function *(Output 7)*, based on the estimation of a cost function using additional data related to the output variables used for the measurement of the level of services provided by Lithuanian municipalities. Additional data have been collected directly through the submission of a specific questionnaire to all Lithuanian municipalities.

The equalization exercises *(Output 8)*, in order to simulate the results of different policy decisions. These exercises involve the proposal of alternative technical solutions for the implementation of a reform of the actual Lithuanian equalization system. The proposals are based on the results and outputs obtained for the evaluation of the fiscal gap of each municipality.

The training sessions *(Output 9)*, based on the organization of training sessions requested by the Lithuanian Authorities in order to enable them to use independently the methodology and the tools prepared by SOSE.

Concerning the completion of the policy-training, also in connection to the mobility restriction generated by the Coronavirus outbreak, the Lithuanian authorities have formally requested a second extension of the project only and exclusively with regard to the carrying out of this activity. Therefore, **the completion of the project, scheduled for the 4th August 2020, has been finally postponed to the 4th December 2020**.

Simulations of the current financial structure of Lithuanian municipalities have been obtained in a dynamic environment through the construction of a **Micro-simulation model**. In this way the models developed by SOSE do not provide just a set of static results, but a sort of toolbox that policymaker can use to evaluate the fiscal gap of each municipality under different policy goals. In particular, policymakers can formulate different assumptions on the standard level of services, standard level of expenditure and fiscal capacity. Subsequently they can identify the direction and the cost of future possible reforms of the existing equalisation system.

The simulations can be interpreted as short-run policy scenarios focused on the computation of the fiscal gap for each municipality. The analysis aims at evaluating the level of the vertical and the horizontal fiscal unbalances that should be equalised to provide a similar minimum standard level of services in all municipalities also considering the same level of fiscal effort exerted in all local authorities. In conclusion, the policy scenarios are focused on the current financial structure of each municipality and the analysis highlights which local authorities are underfinanced.

To be able to run policy scenarios independently, the training goals involve not only the technical aspects of the use of the analytical tool, but also its applicability in the process of budget reviewing cycle and in taking public policy decisions on the scope of public interventions in the areas analysed. This would ensure the applicability of the methodology and tools developed, which is one of the main results and added value of the project.

As a starting point for the use of the micro-simulation model we have developed 12 policy scenarios modulating the level of standard services and standard current expenditure, from historical to national average, and the level of fiscal capacity, from a minimum to the historical level in accordance with the provisions of the tax code.

Final policy recommendations include general suggestions for the implementation of future reforms of the actual equalisation system to eliminate the distortions of the current redistribution of resources for the provision of local services. According to the 12 policy scenarios already implemented we have formulated the following recommendations.

The existing equalization system is able to reduce most of the fiscal gap of Lithuanian municipalities evaluated considering the historical level of services and the actual level of fiscal effort exerted in 2018. However, some municipalities, especially concentrated in the cluster of *Predominantly rural* authorities, present a resource deficit. The deficit and the disparity in the distribution of resources become more evident when we set uniform standards for the provision of services and fiscal capacity is taken into account considering a uniform level of fiscal effort. Therefore, a reform of the equalization system would be necessary to ensure a more equal and efficient redistribution of intergovernmental grants, especially towards rural area of the country. The building blocks of the reform can be identified in the revision of the standard expenditure needs and in the introduction of fiscal capacity in the allocation formula.

When the policy goal is the provision of a uniform standard of service equal to the national average we observe a resource deficit of 115 million (4% of total current standard expenditure) that can be compensated through the revision of the equalisation system to redistribute more resources mainly towards *Predominantly rural* municipalities, *Big cities* and *Predominantly urban* municipalities. However, considering fiscal capacity in the equalisation system would ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, 40 million of deficit can be financed by municipal funds. Mainly *Predominantly urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate financial resources to provide more services above their cluster average. Instead, standard fiscal effort fixed at the minimum level would generate the necessity of 118 million euros of new equalisation grants (mainly towards *Predominantly rural* municipalities, *Big cities* and *Resorts*) to finance a total deficit of 232 million euros (8% of total current standard expenditure).

When the policy goal is the provision of a uniform standard of service by cluster, equal to the cluster average, we observe a resource deficit of 40 million (1.5% of total current standard expenditure) that can be compensated through the revision of the equalisation system to redistribute more resources mainly towards *Predominantly rural* municipalities and *Big cities*. However, considering fiscal capacity in the equalisation system would ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, the deficit can be reduced to 24 million euros using municipal funds. Mainly *Predominately urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate financial resource to provide more services above their cluster average. Instead, standard fiscal effort fixed at the minimum level would generate the necessity of 90 million euros of new equalisation grants (mainly towards *Predominantly rural* municipalities, *Big cities*) to finance a total deficit of 130 million euros (5% of total current standard expenditure).

In conclusion, it is essential to highlight the potential further developments of the model constructed by SOSE. First, the Database should be updated yearly to provide a useful source of information that can also be used for other types of policy analysis. Moreover, additional data should be collected to acquire information regarding the outsourced sectors such as waste management, transport and water management. A second improvement can be developed to connect the fiscal gap analysis with the performance analysis, that at the

moment remain different results. Policy scenario can be devised to identify to what extent the lack of resources can also affect efficiency in the provision of local services and vice versa. Finally, the fiscal gap analysis can be linked to the infrastructural gap analysis; however, to do that we need to collect more data to convert the physical infrastructural gap into a monetary measure.

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INTRODUCTION AND CONTENTS OF THE REPORT

The general objective of the this final report, according to the scope of the Action, is to analyse all the components of the provided tools that can contribute to the evaluation of the long run sustainability of the financial structure of each local government and efficiency of local public spending in Lithuania, in order to enhance sustainable growth, job creation and investment, in line with Article 4 of the SRSP Regulation.

The core of the Action, on which all the results depend on, is the **Database**. A centralized data collection process has been implemented to carry out all the analyses and finalize the planned outputs of the project. Lithuanian authorities, with the support of SOSE, have produced a considerable effort to collect useful data. The result is a substantial and remarkable dataset both in terms of quality and quantity for all 60 municipalities of Lithuanian territory within a range of time that mainly covers a period of 6 years, from 2013 to 2018. Data collection has also generated the evaluation of a specific **Life quality index** at municipal level.

The first building block of the Action concerns the **Analysis of municipalities' expenditures efficiency** that is based on the comparison between current and standard costs. Standardized functions cover 90,5% of municipal current expenditures and the fundamental municipality functions that have been considered for the process of standardization are: General administration; Housing and utilities; Recreation, culture and religion; Education; Social security.

The second building block of the Action concerns the **Analysis of the fiscal capacity** at municipal level, which can be defined as municipalities' own revenue raising capacity (14% of total revenues), i.e. the potential ability of a municipality to raise revenues.

The first and the second blocks converge to the **Analysis of municipality fiscal gap** that is based on the computation and analysis of the difference between potential revenues and efficient standard expenditures.

Most of the results at macro level have been elaborated according to two dimensions to which the municipality itself is referred to, i.e. the whole territory and the reference cluster. **Cluster analysis**, which divides municipalities into conceptually meaningful groups, represents an additional fundamental component of the project that has proved useful as structural information both in the "*ex-ante*" phase (estimation phase) and in the "*ex-post*" phase for the analysis and segmentation of final results. The possibility to identify meaningful groups of municipalities provides a way to monitor and account for shifting imbalances. In addition, *within* and *between* cluster analysis provides a remarkable qualitative achievement of the project itself.

According to the scope of the Action most of the outputs implemented for the project converge to the final dynamic tool that could be defined as a **Micro-simulation model** simply named as *Dashboard*. The Dashboard provides policymakers with the toolbox to assess municipalities' expenditure efficiency, to measure the fiscal capacity at municipal level and to evaluate the sustainability of the financial structure of each local government. For each local authority and available year, the Dashboard will provide a full analysis useful to evaluate the fiscal gap corresponding to the difference between standard expenditures and fiscal capacity. In addition, the Dashboard can also be used as a useful presentation tool to display all the components of the project. For each municipality and for each of the benchmarks included, Lithuania and clusters, all results can be visualized through a step by step process.

The Action also includes an additional analysis related to infrastructure endowment of Lithuanian municipalities, giving an overview of the **Infrastructural gap** among different areas. Infrastructure endowment has been quantified with simple and synthetic indexes of infrastructure based on physical data

only. The possibility to rely on a synthetic index approach has the advantage to merge together different information.

The Grant agreement that assigns to SOSE the task of financial sustainability analysis of Lithuanian municipalities includes also the organization of **Training sessions**. The goal of the training sessions, organized by SOSE, is to review all the main Outputs of the project (estimation of standard expenditure, estimation of fiscal capacity, fiscal gap analysis, infrastructure gap analysis) in order to enable Lithuanian authorities to use independently the methodology and tools prepared by SOSE, and for this purpose they have been divided into two parts. First, the **Technical and econometrics training** focused on the provision of the skills to understand and master the individual analytical details of the econometric instruments implemented by SOSE. Second, the **Policy training** focused on political training with the aim of exploiting the full potential of the instrument to support political decisions, including the equalisation exercise.

The aim of this final report is to summarize all the outputs implemented for the Action agreement, where the main scope is the development of different methods to identify the magnitude of municipal structural imbalances, i.e. fiscal asymmetries which can be measured through vertical and horizontal approaches comparing total expenditures to total revenues.

In addition, the report is presenting the detailed results of the policy scenarios, which were not yet covered by previous reports.

The report is mainly focused on 2018 results and it must be mentioned that all analytical choices have been made in agreement with Lithuanian authorities.

The report is structured as follows.

Chapter 1 provides a detailed description of the available **dataset** which includes a large variety of information collected at municipal level, focusing on two macro variables which are Cluster and Life quality index.

Chapter 2 is related to the explanation of the methodological frameworks used for the estimation of **Standard expenditure needs**, **Fiscal capacity** and for the implementation of synthetic indexes and **Infrastructural gap** analysis.

Chapter 3 provides a detailed **description of the final results** related to standard expenditure needs, performance analysis, revenues analysis and infrastructural gap analysis.

Chapter 4 provides a detailed focus on overall results related to **Fiscal gap analysis**.

Chapter 5 is focused on the estimations of different **Policy scenarios** and formulates the **Policy recommendations** for future reform of the Lithuanian intergovernmental fiscal relation and the fiscal equalization system.

Chapter 6 briefly describes the functionalities of the **Micro-simulation model** implemented for the visualization and estimation of the outputs included in the project.

Chapter 7 summarizes the sessions of the **Technical/Econometrics training** and **Policy training** carried out for Lithuanian authorities.

1. DATABASE

In accordance with the scope of the Action a unique dataset has been built including accounting information from the archives of municipality Budget Sheets, structural information and information related to socio-economic context derived from official sources.

A centralized data collection process has been implemented in order to carry out all the analyses and finalize the planned outputs of the project. Lithuanian authorities, with the support of SOSE, have produced a considerable effort to collect useful data. The result is a substantial and remarkable dataset both in terms of quality and quantity.

The dataset provides different information for all the 60 Lithuanian municipalities, within a range of time that mainly covers a period of 6 years, from 2013 to 2018.

The dataset includes data on current expenditure, structural information of inputs, outputs and a wide range of context variables that aim to capture the socio-economic environment that surrounds the provision of services by each local authority.

The collected dataset, which is a structured collection of data, will be turned, in accordance with the scope of the Action, into a database, i.e. an organized collection of data stored as multiple datasets, that are generally accessed electronically from a computer system that allows the data to be easily accessed, manipulated and updated.

In this way, for the first time in Lithuania for all the 60 municipalities, a new consistent database that provides the most accurate possible picture of the socio-economic context and territorial characteristics of each local authority will be available.

The consistency of the database allows a detailed analysis of inputs and outputs related to the production process of local services by local governments. The amount of data collected and processed for the scope of the Action, in addition to representing valuable information in itself, gives to the valuation procedures a considerable degree of robustness. The availability of a consistent database allows the use of advanced statistical and econometric techniques that can be used to transform this information into expenditure needs or potential revenues as accurately as possible.

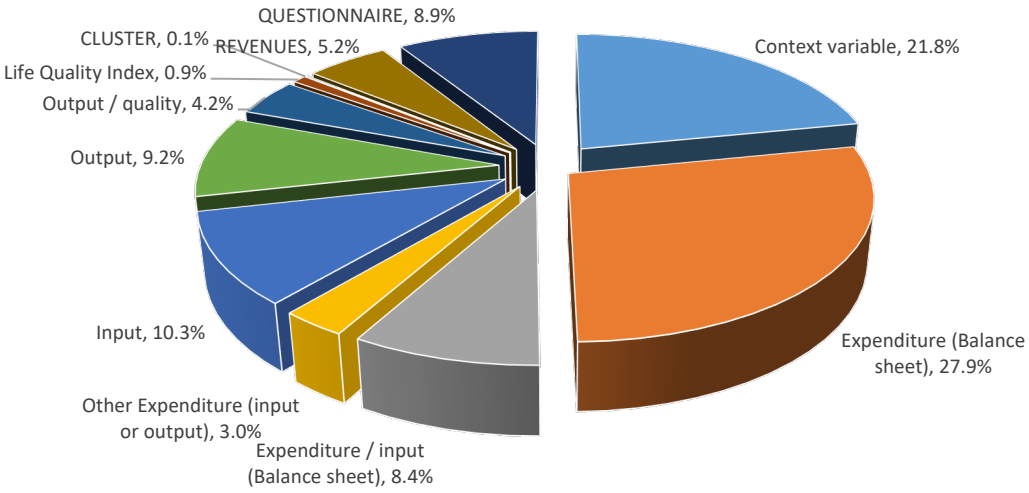
The table below (***Table 1***) shows the different categories of variables included in the implemented database. The set of information is particularly wide and concerns context variables, as well as expenditures variables (current expenditure from municipality balance sheets and other kind of expenditures) and input and output variables related to the provision of the services.

Table 1 Category of variables

VARIABLE CATEGORY	NUMBER OF VARIABLES
Context variable	176
Expenditure (Balance sheet)	225
Expenditure / input (Balance sheet)	68
Other Expenditure (input or output)	24
Input	83
Output	74
Output / quality	34
Life quality index	7
CLUSTER	1
REVENUES	42
QUESTIONNAIRE	72
TOTAL	806

Information from municipality Budget Sheets on Expenditures and Wages (expenditure inputs) represents the biggest proportion (***Figure 2***) of the overall set of available variables.

Figure 2 Composition of variables



Context variables represent a heritage of information of absolute importance within the aim of the project and contain information related to supply and demand of services. The first ones refer to demographic and socio-economic factors of resident population that directly influence the level of the demand; the second ones summarise morphologic aspects of municipalities that do not directly influence the demand, but they may favour or hinder the provision of local public services by modifying their unit cost of production.

Among context variables information related to the macro variables reported as Cluster and Life quality indexes could also be included. Details on computation of Cluster and Life quality indexes are reported in the next paragraphs.

Specific structural information has been collected for each of the municipal function included in the analysis. Such variables refer to different aspects directly or indirectly related to the demand and supply of municipal services. In particular, the set of information includes the level of public services provided by municipalities, i.e. outputs of the production function characterized by a certain level of endogeneity according to the discretion associated to the provision of the services. An additional set of information concerns variables related to exogenous factors, i.e. activities not directly depending on local administration decisions. Finally, in the dataset are included variables that capture the impact of the average level of local income on demand as well as input prices (labour cost).

Expenditure information has been gathered from municipal budgets according to the economic classification of expenditures.

In particular, the data contained in the Budget Sheets provided by Lithuanian Ministry of Finance proved adequate in determining the actual expenditures of services object of the standardization analysis.

The use of Budget Sheets as a starting point has the unquestionable advantage of providing greater stability for gathered information due to the homogeneity of the criteria for recording accounting data.

The municipal functions considered for the collection of the municipal current expenditures are:

- **01. GENERAL STATE SERVICES**
- **02. DEFENCE**
- **03. PUBLIC PROCEDURE and PUBLIC PROTECTION**
- **04. ECONOMY**
- **05. ENVIRONMENTAL PROTECTION**
- **06. HOUSING AND UTILITIES**
- **07. HEALTH PROTECTION**
- **08. RECREATION, CULTURE AND RELIGION**
- **09. EDUCATION**
- **10. SOCIAL SECURITY**

For each of the mentioned municipal functions the following table (***Table* 2**) reports the specific number of variables collected from Budget Sheets.[1]

[1] Expenditures from municipality Budget Sheets have been classified both as *pure* expenditure and as *input* expenditures (Wages and social security).

Table 2 Expenditure variables

FUNCTION	NUMBER OF EXPENDITURE VARIABLES
01. GENERAL STATE SERVICES	34
02. DEFENCE	21
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	25
04. ECONOMY	43
05. ENVIRONMENTAL PROTECTION	25
06. HOUSING AND UTILITIES	25
07. HEALTH PROTECTION	25
08. RECREATION, CULTURE AND RELIGION	25
09. EDUCATION	33
10. SOCIAL SECURITY	37
TOTAL	293

Specific structural information details are reported in the following table (***Table 3***) just for the municipal functions included in the process of standardization (SEN).

Table 3 Specific variables

FUNCTION	NUMBER OF SPECIFIC VARIABLES
GENERAL ADMINISTRATION	12
HOUSING AND UTILITIES	8
RECREATION, CULTURE AND RELIGION	32
EDUCATION	57
SOCIAL SECURITY	51

For the same functions the following table (***Table 4***) reports further details on categories of variables.

Table 4 Category of variables by Function

VARIABLE CATEGORY	Other Expenditure (input or output)	Input	Output	Output / quality	QUESTIONNAIRE	TOTAL
GENERAL ADMINISTRATION		11	1			12
HOUSING AND UTILITIES			6	2		8
RECREATION, CULTURE AND RELIGION		22	10			32
EDUCATION	8	10	7	32		57
SOCIAL SECURITY	15	3	33		72	123

For **Social security** function, structural information has been integrated with additional data collected through questionnaires submitted to local authorities. Through a survey, which was prepared in collaboration with Lithuanian authorities, local municipalities were requested to provide information relating to accounting and structural factors in the implementation of social services at municipal level according to the following matrix:

Table 5 Social security Questionnaire

TARGET	INSTITUTIONS (long term)	DAY CARE (short term)	HOME CARE (short term)
Elderly people	X	X	X
Elderly people with disabilities	X	X	X
Working age people	X	X	X
Working age people with disabilities	X	X	X
Children	X	X	X
Children with disabilities	X	X	X

The **questionnaire** represents an innovation for the Lithuanian system and responds to the need of integrated information already available from official sources, allowing elements such as outputs (services implemented) to be assembled into a unitary framework. On total, 72 additional indicators have been collected through the questionnaire system related to the combination of number of users (Elderly people, Elderly people with disabilities, Working age people, Working age people with disabilities, Children and Children with disabilities) and macro areas of intervention (Institution-long term, Day care-short term and Home care-short term). For each combination of users and macro areas of intervention also municipality expenditure for the provision of the services and staff information have been collected through the questionnaire.

The Database includes also components related to municipality **Revenues** which can be divided into different blocks:

1. Local government own incomes;
2. Special targeted grants from the state budget;
3. European Union financial support funds;
4. Revenues from Personal income tax (PIT).

Local government own incomes include:

- Tax on immovable property;
- Tax on land;
- Fees:
    - State fee;
    - Revenue from fines and forfeiture;
    - Revenue from goods and services;
    - Local fee;
- Inheritance tax, estate;
- Other revenues not elsewhere classified;
- Out of fiscal capacity:
    - revenue from dividends;
    - revenue from interests and deposits;
    - revenue from sales of long-term tangible and intangible assets;

- Lease tax on state owned land and water bodies;
- Tax on State-owned natural resources;
- Pollution taxes.

Special targeted grants include:

- State delegated functions;
- Student basket;
- Grants for investment projects;
- Other grants.

Personal income tax can be furtherly split into the following items:

- Personal income tax (PIT) received from State Tax Inspectorate;
- Equalization component to 90% of PIT average;
- Equalization component according to expenditure needs.

The massive amount of information of the Database requested also an activity of data cleaning to detect incomplete, incorrect or inaccurate information.

One additional achievement related to the structure of the database, which includes information from 2013 to 2018, is that it combines cross-section and time-series data which means that the collected database belongs to the "*panel*" data family.

Panel data contain observations of multiple phenomena obtained over multiple time periods for the same units (namely municipalities).

There are many advantages associated with panel data:

- panel data can take explicit account of individual-specific heterogeneity ("individual" means related to the micro-unit);
- by combining data in two dimensions, panel data give more data variation, less collinearity (correlation between two or more explanatory variables) and more degrees of freedom (minimum number of data sufficient to assess the amount of information contained in the statistics);
- panel data is better suited than cross-sectional data for studying the dynamics of change;
- it is better in detecting and measuring the effects that cannot be observed in either cross-section or time-series data;
- panel data enable the study of more complex behavioural models;
- panel data can minimise the effects of aggregation bias;

The set of information included in the database is supplemented with additional key components, **Cluster analysis** and **Life quality index**, which are not just additional variables of the database, but they are the results of the application of specific techniques to the available information.

Cluster analysis and Life quality index can be defined as *macro variables* and they both represent valuable supplementary achievements of the Action that can be considered to all intents and purposes as additional outputs of the project.

Summarizing, further collection of data (included the questionnaire submitted to local authorities for the analysis of Social sector) is a key element for the sustainability of the project and the institutionalization

of the tools developed. The maintenance of a significant database, both from a quantitative and qualitative point of view, should be addressed by Lithuanian authorities not only for the update of the procedures implemented for the achievement of the different outputs but for future developments as well. Missing information on capital expenditures represent, for example, a limitation of the nevertheless substantial archive implemented. Additional surveys could be run in order to collect and detect information on further functions as Public transport or Waste management. The project itself could be even improved according to future availability of data.

From a technical point of view different software are required to ensure the continuation of the tools on annual basis. *Excel* software has been used for the operational data storage (data warehouse). The small number of Lithuanian municipalities did not require the use of more complex software, despite the large number of variables collected and the range of historical series analysed. On the contrary, data mining activities, such as estimation of Standard Expenditure Needs or estimation of potential Fiscal capacity, have been run mainly through *STATA* software. Stata is a widely used statistical software able to perform a variety of functionalities: database management, statistical-econometric analysis and graphic analysis. Stata is able to respond to the most diverse statistical-econometric problems, thanks to commands already available, continuously updated by the scientific community, and to its own programming language that allows advanced users to create customized routines. Finally, maps have been implemented using both GeoDa and SaS software. GeoDa is a free software package that performs spatial data analysis, geo-visualization, spatial autocorrelation and spatial modelling. SAS (originally "Statistical Analysis System") is a complex of integrated software products (developed by the SAS Institute) that allow data input, search and management of data, report and graph generation, statistical analysis and geo-visualization maps.

1.1 CLUSTER ANALYSIS

Cluster analysis represents an additional fundamental component of the project that has proved useful as structural information both in the "*ex-ante*" phase (estimation phase) and in the "*ex-post*" phase for the analysis and segmentation of results.

The possibility to identify meaningful groups of municipalities provides a way to monitor and account for shifting imbalances. In addition, *within* and *between* cluster analysis provides a remarkable qualitative achievement of the project itself.

Cluster analysis divides data into conceptually meaningful groups (clusters), it is a multivariate method that aims to capture the natural structure of the data. Additionally, it can be defined as the task of classifying a sample of subjects (i.e. municipalities) based on a set of measured variables into a number of different groups such that similar subjects are placed in the same group. Items inside a cluster are very similar (but not identical) to one another and very different from the items in other clusters.

This analysis is a main task of exploratory data mining and a common technique for statistical data analysis (statistical classification technique), it is a useful tool that reveals associations, patterns, relationships, and structures in masses of data.

A good clustering method will produce high quality clusters with:

- high intra-class similarity
- low inter-class similarity

Cluster analysis groups data objects based only on information found in the data that describes the objects and their relationships. The goal is that the objects within a group be similar (or related) to one another and

different from (or unrelated to) the objects in other groups. The greater the similarity (or homogeneity) within a group and the greater the difference between groups, the better or more distinct the clustering.

The quality of a clustering result depends on both the similarity measure used by the method and its implementation. The quality of a clustering method is also measured by its ability to discover some or all the hidden patterns.

Cluster analysis itself is not one specific algorithm, but the general task to be solved. It can be achieved by various algorithms that differ significantly in their understanding of what constitutes a cluster and how to efficiently find them. Popular notions of clusters include groups with small distances between cluster members, dense areas of the data space, intervals or particular statistical distributions. Clustering can therefore be formulated as a multi-objective optimization problem. The appropriate clustering algorithm and parameter settings (including parameters such as the distance function to use, a density threshold or the number of expected clusters) depend on the individual data set and on the intended use of the results. Cluster analysis as such is not an automatic task, but an iterative process of knowledge discovery or interactive multi-objective optimization that involves trial and failure. It is often necessary to modify data preprocessing and model parameters until the result achieves the desired properties.

Inside the wide basket of clustering techniques, a **model-based clustering**, and in particular a Gaussian Mixture model, has been chosen to implement the purpose of the project.

Gaussian mixture model is obtained by the mixture of multiple Gaussian distributions according to a probabilistic approach. The data set is usually modeled with a fixed number of Gaussian distributions that are initialized randomly and whose parameters are iteratively optimized to better fit the data set.

The assumption is that a model is hypothesized for each cluster. In particular, the assumption implies that Gaussian distribution is more prominent with a fixed number of distributions and all data is fitted into it such that the distribution of data may get maximized. The maximization is obtained through the Expectation-maximization algorithm.

Gaussian mixture model is a probabilistic approach to clustering where each cluster is described by its centroid (mean), covariance and the size of the cluster (weight).

Clustering can be considered as a fixed structural feature of the municipality that can remain constant in the short-medium term.

The assumptions are multiple and can be found in the nature of the data used for the analysis. From this point of view, the discriminant variables inserted in the computation of the clustering are "*slowly*" time variant (for example the morphology of the land or the resort "status"), making unnecessary the revision of the clustering for each of the years included in the analysis[2].

Cluster results are one of the pillars of the project. Clustering enables the differentiation and the segmentation of the results associated to all outputs that have been carried out in the framework of the Action. The grouping of municipalities, according to different contextual attributes, gives the possibility to highlight shifting effects both in terms of expenditure and in terms of costs sustained for the provision of the services.

The strategy followed for the identification of Lithuanian municipalities' clusters is based on a **two stages approach**. The final result is the partitioning of the entire territory of Lithuania into 4 clusters.

[2] The computation of the clustering associated to Lithuanian municipalities is based on 2017 data.

The first stage could be addressed as "*fast calculation*", depending on administrative territorial division of the Republic of Lithuania that led to the identification of 3 main groups.

The first cluster is composed of municipalities that can be identified as Big cities (districts areas are not included in this cluster), with high amount of population and high population density. The municipalities included in this group are 6: Vilniaus m., Alytaus m., Kauno m., Klaipėdos m., Panevėžio m. and Šiaulių m..

The second cluster consists of 4 municipalities strongly oriented to touristic activities: Birštono m., Druskininkų m., Neringos m., Palangos m.. In particular, the municipalities of this group are administratively attributed of the "Resort" status. Resorts are locations where priority is given to the development of health tourism and active recreation. The objective of the Ministry of Economy and Innovation is to use the potential of resorts to reduce tourism seasonality, to promote the development of complex, high-quality tourism services and to improve healthcare infrastructure.

The final cluster of the first clustering process stage takes into account all the remaining municipalities, 50 in total, identified as "*Other*" with no further distinctions. The residual group identifies the starting point of the second stage process.

The second stage could be addressed as "*slow calculation*" in which the initial centers are taken from the first stage with the aim to divide "Other" municipalities into 2 groups according to contextual features. In particular the additional clusters have been identified taking into account both demographic elements of municipalities (as young population, elderly population, working age population) and type of the land (as the percentage of agricultural land over total area of municipality, the percentage of forest land, the percentage of built-up area and finally the percentage of water land). As result, additional 2 clusters are obtained with the second step of the clustering:

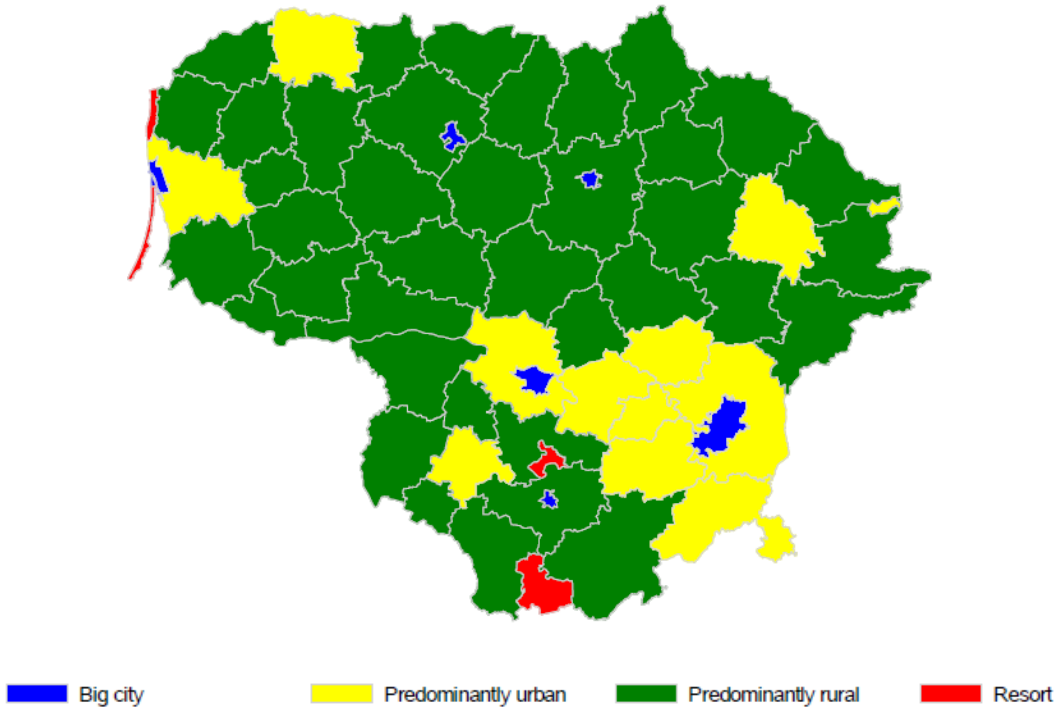
- Predominantly urban (12 municipalities);
- Predominantly rural (38 municipalities).

In the end, merging together the results of the first and second stage, Lithuania municipalities are grouped into 4 clusters:

1. Big cities (6 municipalities);
2. Predominantly urban (12 municipalities);
3. Predominantly rural (38 municipalities);
4. Resorts (4 municipalities).

The following figure (***Figure 3***) shows the complete map of the clusters identified for the Lithuanian territory. It can be clearly seen there is a prevalence of rural municipalities and how the predominantly urban area develops mainly around Vilnius.

Figure 3 Maps of Lithuanian Municipalities Clusters



Cluster analysis has no mechanism for differentiating between relevant and irrelevant variables. Therefore, the choice of variables included in a cluster analysis must be underpinned by conceptual considerations.

The cluster analysis executed for Lithuanian municipalities is based on a mixture model clustering and the full set of original discriminant information used can be divided mainly into three blocks.

From this point of view the most relevant features that mainly differentiate all the Lithuanian municipalities can be summarized as: characteristics and composition of the population, type of the land and touristic orientation of municipalities.

The first block refers to the composition of the population:

- Resident population;
- Density of population;
- Population 0-19;
- Population over 65;
- Working age population;

The second block relates to the structure of the land of municipalities:

- Area (squared km of land);
- Agricultural land (hectares);
- Forest land (hectares);
- Built-up area (hectares);

- Waters (hectares);

The final block looks at the touristic nature of municipalities:

- Number of tourists accommodated in accommodation establishments;
- Number of overnight stays in accommodation establishments;
- Number of visitors of tourism information centers.

Big cities and predominantly urban municipalities are properly diversified from the rest of the municipalities showing a higher concentration of population both in terms of amount of people and in terms of density. In addition, the percentage of built-up area over the total area and the portion of roads are higher. If compared to predominantly rural areas, urban municipalities show a lower dependency ratio of working-age population, meaning that there are sufficient people working who can support the dependent population. These results have a direct impact on financial expenditures of municipalities. In addition, the percentage of agricultural land contributes to better identify predominantly rural areas.

Finally, information related to touristic activity cover a main role to identify and distinguish municipalities officially attributed of the "Resort" status.

The following table (***Table 6***) shows the attribution of each municipality to the corresponding cluster.

Table 6 Municipality Cluster

Municipality	Cluster (Description)
Vilniaus m.	Big Cities
Alytaus m.	Big Cities
Birštono m.	Resort
Druskininkų m.	Resort
Kauno m.	Big Cities
Klaipėdos m.	Big Cities
Marijampolės m.	Predominantly urban
Neringos m.	Resort
Palangos m.	Resort
Panevėžio m.	Big Cities
Šiaulių m.	Big Cities
Visagino m.	Predominantly urban
Akmenės raj.	Predominantly rural
Alytaus raj.	Predominantly rural
Anykščių raj.	Predominantly rural
Biržų raj.	Predominantly rural
Ignalinos raj.	Predominantly rural
Jonavos raj.	Predominantly rural
Joniškio raj.	Predominantly rural
Jurbarko raj.	Predominantly rural
Kaišiadorių raj.	Predominantly urban
Kauno raj.	Predominantly urban
Kėdainių raj.	Predominantly rural
Kelmės raj.	Predominantly rural
Klaipėdos raj.	Predominantly urban

Municipality	Cluster (Description)
Kretingos raj.	Predominantly rural
Kupiškio raj.	Predominantly rural
Lazdijų raj.	Predominantly rural
Mažeikių raj.	Predominantly urban
Molėtų raj.	Predominantly rural
Pakruojo raj.	Predominantly rural
Panevėžio raj.	Predominantly rural
Pasvalio raj.	Predominantly rural
Plungės raj.	Predominantly rural
Prienų raj.	Predominantly rural
Radviliškio raj.	Predominantly rural
Raseinių raj.	Predominantly rural
Rokiškio raj.	Predominantly rural
Skuodo r.	Predominantly rural
Šakių raj.	Predominantly rural
Šalčininkų raj.	Predominantly urban
Šiaulių raj.	Predominantly rural
Šilalės raj.	Predominantly rural
Šilutės raj.	Predominantly rural
Širvintų raj.	Predominantly urban
Švenčionių raj.	Predominantly rural
Tauragės raj.	Predominantly rural
Telšių raj.	Predominantly rural
Trakų raj.	Predominantly urban
Ukmergės raj.	Predominantly rural
Utenos raj.	Predominantly urban
Varėnos raj.	Predominantly rural
Vilkaviškio raj.	Predominantly rural
Vilniaus raj.	Predominantly urban
Zarasų raj.	Predominantly rural
Elektrėnų sav.	Predominantly urban
Kalvarijos sav.	Predominantly rural
Kazlų Rūdos sav.	Predominantly rural
Pagėgių sav.	Predominantly rural
Rietavo sav.	Predominantly rural

1.2 LIFE QUALITY INDEX

The **Life quality index** (LQI) is a synthetic indicator that takes into account different aspects of infrastructural and economic situation as well as social life conditions, wealth and educational system.

The computation of Life quality index for Lithuanian municipalities is a supplementary output inside the framework of the database that gives further value added to the quality of the database itself.

Basic information is represented by initial 38 simple indicators grouped into 6 main categories that refer to:

1. Material living conditions (employment, income, housing);
2. Entrepreneurship of inhabitants and business competitiveness;
3. Health services;
4. Educational services;
5. Demography, civil and public activity;
6. Public infrastructure, quality of urban territories and safety.

All data used for the computation of LQI were provided by Lithuanian authorities and data were taken from official statistics department database on years 2013-2018.

Since indicators represent different aspects of Lithuanian life in terms of economy, education and wealth conditions, a process finalized to comparability is needed in order to merge data into a more comprehensive and complex index. For all indicators not directly comparable, recalculation was performed through two different steps: the first one identifiable as "*standardization*", the second one as "*normalization*".

Standardization was performed reporting all single indicators' values to "*per capita*" scale, that is dividing each value by the resident population of the municipality for the correspondent year. Indicators are standardized to ensure comparability in the change of population. There was no standardization of indicators that were available in relative terms.

For the second step all the indicators must be converted to a scale that includes values within a comparable range [0, 100] and for this purpose the Min–Max method of normalization has been used[3]. Such a method normalizes indicators to have an identical range [0, 100] by subtracting the minimum value, dividing by the range of the indicator values and finally multiplying by 100.

Normalized values are obtained through the following formula:

$$Indicator_{year}^{NMZ} = \frac{(Indicator_{year}^{STD} - Indicator_{2013}^{MIN})}{(Indicator_{2013}^{MAX} - Indicator_{2013}^{MIN})} \text{ x } 100 \qquad \text{where year= 2013, ..., 2018}$$

For all the proposed indicators, higher values must reflect a better quality of life and, for the rest, a lower quality of life. In order to be able to aggregate the indicators into the overall synthetic quality of life index, the increase in the value of each indicator should reflect a positive change in the quality of life. For this reason, it is necessary to standardize the direction of indicators (by inverting direction of the values of the indicators, so that a higher value reflects a better quality of life).

After standardization, normalization and re-direction processes are all concluded it is possible to aggregate indicators using a system of weights[4].

The aggregation process is divided into two steps:

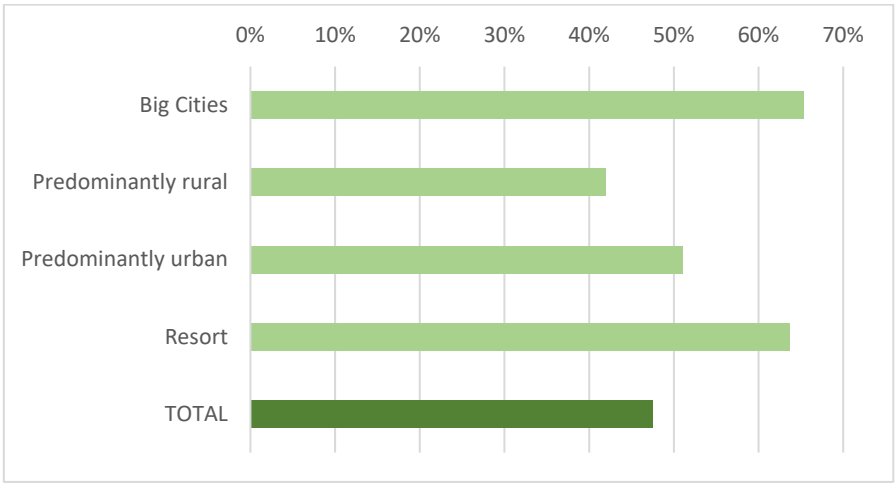
1. aggregation of all the 38 simple indicators into 6 categories indexes;
2. aggregation of the 6 categories indexes into the final Life quality index.

[3] The baseline for the minimum is 2013 value.

[4] For both aggregations steps the system of weights has been provided by Lithuanian authorities.

For each cluster and for the whole territory of Lithuania, the following graphs show the level of the total Life quality index (***Figure 4***) and the levels of the single category indexes (***Figure 5***).

Figure 4 Life quality index by Cluster (2018)

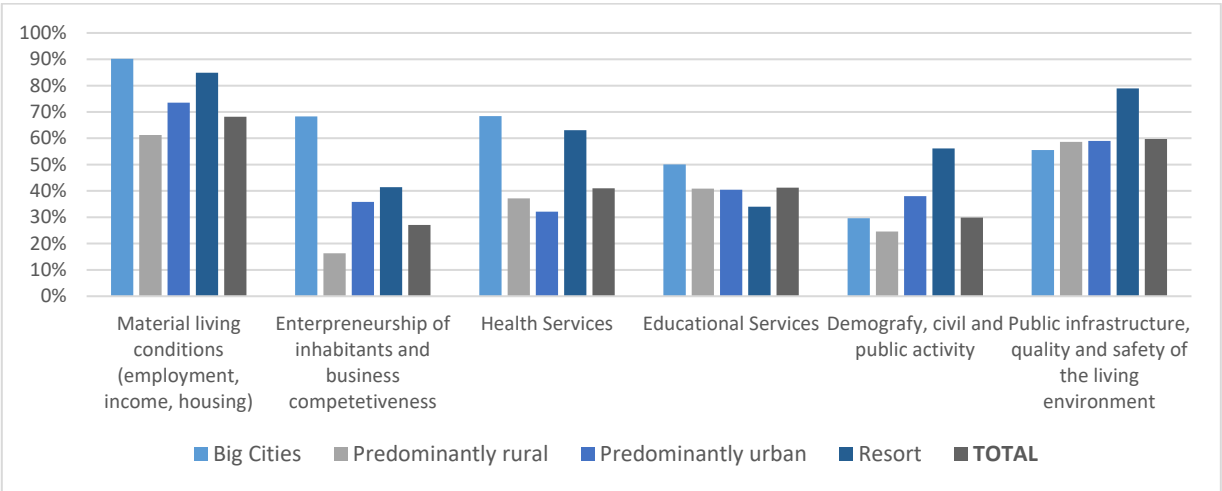


The synthetic Life quality index shows a noticeable territorial differentiation among Lithuanian municipalities with higher values for *Big cities* (65%) and for "*Resort*" (64%). "*Predominantly rural*" municipalities (42%) display, on average, lower values.

The average levels of the single category indexes (***Figure 5***) that contributes to the composition of the overall synthetic Life quality index show a remarkable distinction among clusters.

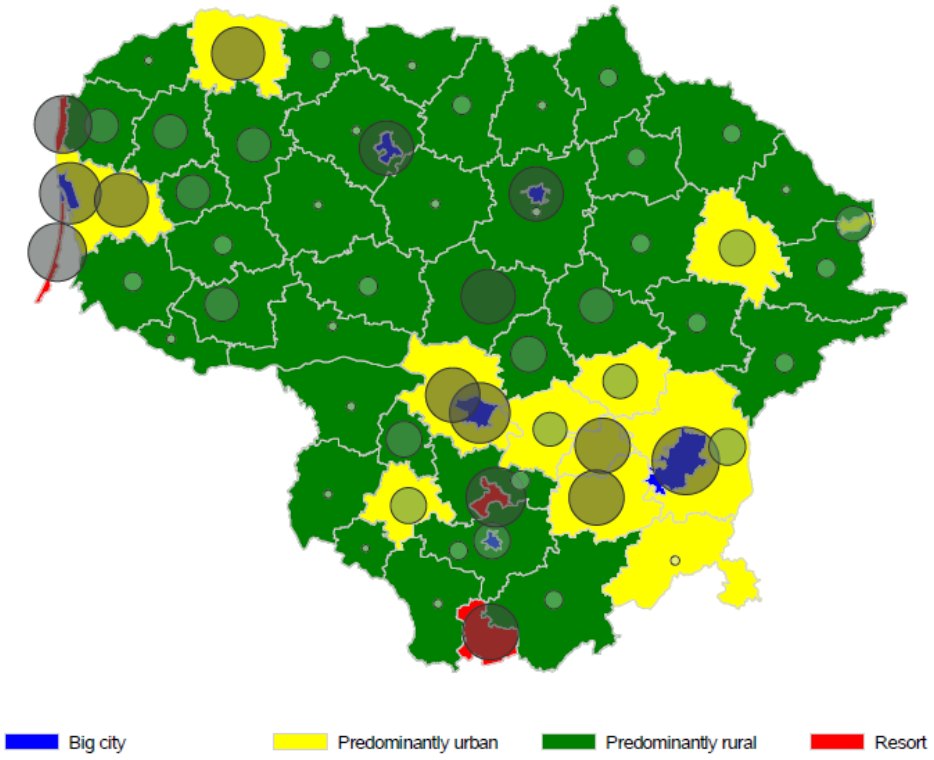
If from one side material living condition (employment, income, housing) plays a relevant role within each of the clusters, a between insight underlines a heterogeneous distribution for the remaining categories.

Figure 5 Category Index by Cluster (2018)



The following map (***Figure 6***) shows the territorial distribution of the synthetic Life quality index merged with cluster distinction. The intensity of the Life quality index value is directly proportioned to the dimension of the bubbles. Big cities and "*Resorts*" show the highest values while "*Predominantly rural*" municipalities have lower values.

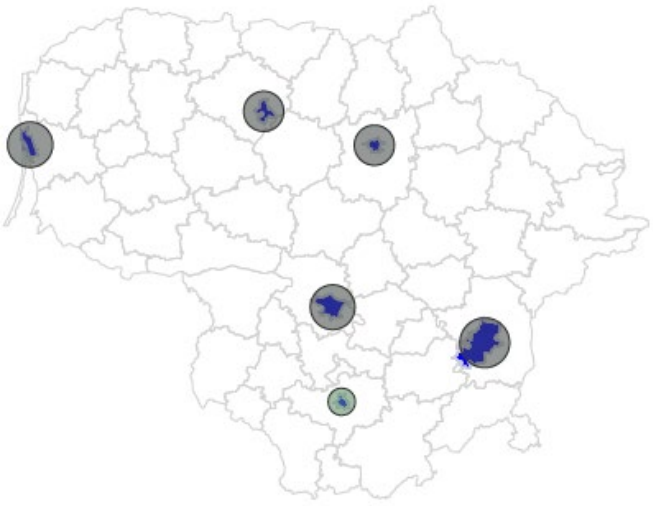
Figure 6 Map of Life quality index by Cluster (2018)



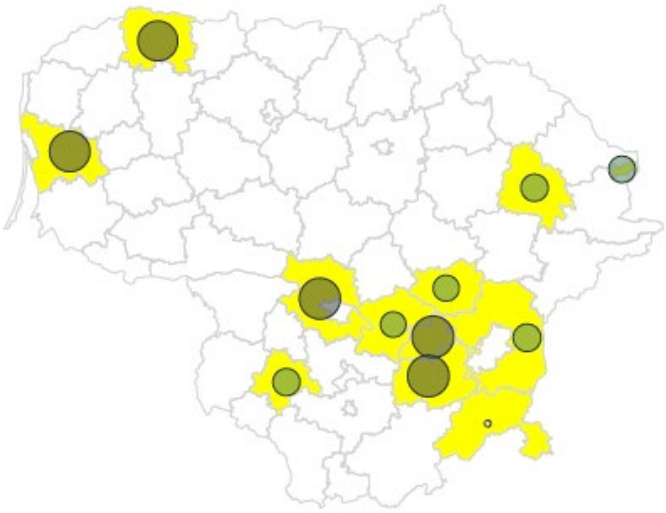
The same picture can be split (***Figure 7***) to better display a *between* cluster group differentiation.

Figure 7 Map of Life quality index by distinct Cluster (2018)

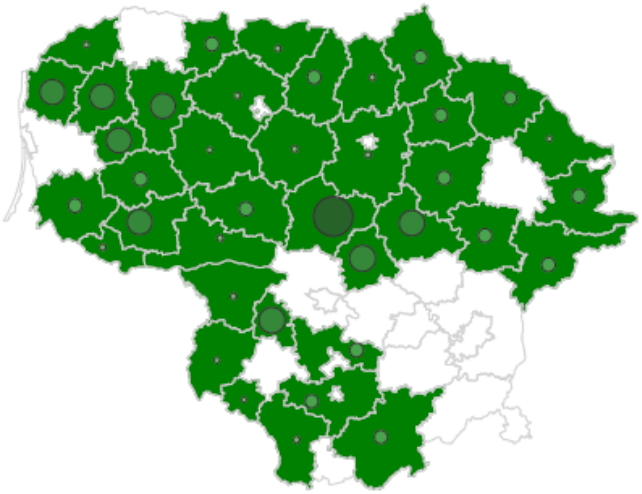
BIG CITIES



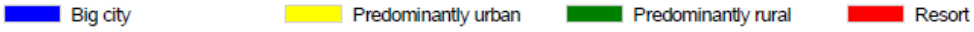
PREDOMINATLY URBAN



PREDOMINANTLY RURAL



RESORT



2. METHODOLOGY

The general objective of the Action is to contribute to the implementation of a system of performance analysis based on the estimation of Standard expenditure needs and fiscal capacity, in order to combine the analysis of structural fiscal imbalances with the monitoring of Local Governments' performance.

Monitoring the efficiency of Local Governments is a necessary condition for improving the quality of public finances and thereby achieving a sustained long run economic growth.

The measurability of the outputs produced by public sector organizations characterized by multidimensional goals imply sophisticated statistical techniques and the collection of local data for a successful performance assessment.

In detail, the analysis, at macro and micro level, of the sustainability of the current financial structure of each local government involves:

- the analysis of municipalities' expenditure efficiency and productivity based on the comparison between actual and standard costs, taking into account the local demand in the long run;
- the analysis of the fiscal capacity at municipal level, defining municipalities' revenue potential and additional revenue sources;
- analysis of municipal infrastructural endowment and evaluation of the infrastructural gap.

The following paragraphs give a detailed description of the methodologies and statistical techniques used for the implementation of the goals of the Action.

2.1 Measuring expenditure efficiency and productivity

The assessment of Standard expenditure needs for local authorities is the main component of all fiscal equalisation systems (Blöchliger *et al*., 2007).

The evaluation of expenditure needs is mainly based on two approaches (OECD, 1981, Blöchliger et al., 2007, Reschovsky, 2007, Dafflon and Mischler, 2007):

- Actual expenditure needs (**AEN**);
- Standard expenditure needs (**SEN**).

The AEN approach does not require any specific statistical or econometric methodology because expenditure needs are determined according to previously accounted expenditures. The risk of inequity in the distribution of grants over time and the possibility of financial non-sustainability in the long run are the main jeopardies associated to this approach.

The SEN methodology aims to measure the expenditure needs taking into account different characteristics of each local authority (Porcelli F., 2015). One of the main difficulties of calculating SEN using statistical techniques is the lack of information. The collection of a consistent dataset for all Lithuanian municipalities allows to overcome this obstacle, taking into account for the mixture of local authorities with markedly varied characteristics.

The OECD (OECD, 1981) includes the adoption of the calculation of SEN within the best practices related to the planning of financing systems for local government. In particular, it is argued that the provision of equalization grants based on mathematical formulas that measure institutions' expenditure needs is

preferable to systems based on actual expenditures or on discretion of the central government, since the mathematical formula approach guarantees greater transparency in the flow of grants, greater equity in the redistribution of resources, and greater efficiency in managing public expenditures, thanks to more rigid budget constraints for local governments.

The calculation of SEN is based on the idea that the financial needs of a local authority are an expression of the services provided, of the territorial features and of the social-economic and demographic characteristics of the resident population. The SEN of each authority are assessed as the expected value for a cost function (i.e. linked to the efficient behaviour of the local government), estimated using multiple linear regression techniques defined as Regression-based Cost Approach (**RCA**).

The result is that the efficient cost of supplying a given service depends on three essential groups of variables: the optimal quantity of service offered (it refers to services that best satisfy the preferences and/or needs of resident citizens); prices for the inputs used in the production process (primarily labour costs); and the context variables related to the supply side, i.e. external factors that, with other conditions being equal, can favour or hinder the supply of local public goods (e.g. the morphological characteristics of the territory, or the extension of its surface area). The weight with which each variable affects the determination of SEN is estimated in a statistically robust manner through multiple regression techniques. In this way all factors for calculating cost differentials are determined within a model that is capable of correctly representing the variables that identify the real determinants of expenditure needs, especially in the case of extremely heterogeneous local authorities.

In particular, the presence of public service output variables within the estimation model for SEN presents two problems. Firstly, the outputs are not always measurable and there may be therefore a very serious lack of information. Secondly, even if the public service outputs are observable with extreme accuracy (e.g. in situations in which the state establishes basic levels of services to which individual local authorities must conform) they can be endogenous, since the supplied quantity is determined jointly with the level of expenditures.

A commonly used solution for both problems mentioned above is to estimate a variant of the cost function, known as expenditure function. An expenditure function is a cost function in which the optimal quantity of the service provided is substituted by its determinants, represented by the background variables that impact the demand of citizens.

For this reason, in the end, an RCA methodology based on the estimate of an expenditure function is the most complete and robust approach for evaluating SEN, and it is therefore the approach that is commonly used globally.

By following this general approach, SOSE has developed an econometric methodology specific for the Lithuanian system based on the Regression-based Cost Approach methodology for determining the expenditure needs of local governments.

The theoretical framework followed by SOSE is based on the interaction between the supply and the demand of local public services, both expressed in per capita terms with respect to the number of beneficiaries identified here as the client group. The client group generally corresponds to the total resident population[5].

The demand for local public services (g_e) in the equation (1) depends on: the background variables related to the demand for local public services (***Q***), which capture the demographic and socio-economic aspects

[5] For Education function the client group corresponds to the total number of pupils and the total number of teaching hours.

influencing the demand; the average income (***R***); and the per capita cost (with respect to the client group *N*) of local public services (*y*):

$$g_e = d(\boldsymbol{R}, \boldsymbol{Q}, y) \qquad (1)$$

The supply for local public services (*y*), expressed in terms of per capita costs , is reported in the equation (2) and depends on the following variables: the level of exogenous load factors (g_s)[6]; the level of endogenous outputs for public services (g_e); input prices (***p***); and background variables related to the supply (***A***)[7]:

$$\left(\frac{Y}{N} =\right) y = s(g_e,\ g_s, \boldsymbol{p}, \boldsymbol{A}) \qquad (\mathbf{2})$$

Therefore, the optimal level of local public services and their supply costs (both expressed in per capita terms) are simultaneously determined within a structural model of equations (1) and (2). Both the cost and the demand for public services are endogenous variables whose optimal values derive from the interaction between local administrators and citizens, in the process of allocating resources among the public and the private sectors.

In some case the estimation of SEN can be performed directly using the cost function reported in the equation (2): this model multiplies the quantities of the service provided by coefficients expressing the standard average cost of individual outputs comprising the services implemented (pure RCA).

To circumvent the problem of output and cost endogeneity, it is possible to estimate Standard expenditure needs (SEN) and Standard Levels of Services (SLS) following a reduced form approach. In particular, the evaluation of SEN can be obtained estimating an empirical model based on the reduced form of the cost function reported in equation (3), which is obtained substituting equation (1) into (2) thus expressing the relationship between the costs for the provision of local services and the local context in which the local government operates:

$$y = f(\boldsymbol{Q},\ \boldsymbol{R},\ \ \boldsymbol{p},\ \boldsymbol{A},\ g_s) \qquad (\mathbf{3})$$

Equation (3) no longer has the properties of a cost function, since it does not include the quantity of local public services among the independent variables. However, it expresses the per capita cost for services in relation to all exogenous variables.

The empirical version of equation (3) is usually named the expenditure function. The evaluation of SEN thorough the estimation of an expenditure function is the simplest and most robust empirical strategy to follow for estimating SEN in line with the regression-based cost approach (RCA), and for these reasons it is also widely used at the international level.

Regardless of the theoretical model selected (cost function or expenditure function), the estimation of SEN is implemented through the calculation of the expected values from an empirical model that identifies the

[6] These are, for instance, services provided by local authorities for higher-level administrations and, generally, activities not directly attributable to the decisions of local administrators.

[7] These are, for instance, morphological and socio-economic factors that do not affect preferences regarding the level of public services (i.e. those exogenous factors that can favour or hinder the supply of local public goods, such as economies of scale measured through the size of resident population).

relationship between the current per capita actual expenditures (dependent variable) and a set of independent variables within a multivariate regression model.

Usually the following groups of independent variables have been used:

– *Output variables* (specific to the cost function approach), measuring the quantity and quality of the services provided;

– *Demand background variables* (specific for the expenditure function approach), measuring the demographic and socio-economic aspects required to capture local preferences/needs regarding the demand for public services;

– *Supply background variables*, including environmental characteristics that impact the total productivity of input factors (e.g. the numerousness of the resident population, which captures congestion phenomena and/or economies of scale, the morphological characteristics of the territory etc.);

– *Exogenous load factors*, capturing the impact of services provided by local authorities on behalf of higher-level administrations, or of activities not directly attributable to the decisions of local administrators;

– *Input prices*, represented in the majority of cases by the average staff expenditures per employee computed as the ratio between the total labour costs and the total equivalent number of employees.

The estimation of SEN is conducted using the following empirical linear model:

$$y_{it} = \alpha_i + \tau_t + \rho C_i + \beta' \mathrm{X}_{it} + \delta' W_{it} + \varepsilon_{it} \qquad (4)$$

- where *i* corresponds to the local authority index;
- t is the year index;
- $\alpha_i, \tau, \rho, \beta, \delta$ are the coefficients to be estimated;
- y_{it} is the dependent variable corresponding to the current per capita expenditure;
- C_i is the dummy Cluster;
- $\boldsymbol{X}_{it} = [Q,\ R,\ p,\ A,\ g_s]$ is the vector of independent variables. These variables are used both in the estimation and in the subsequent stage of calculating SEN;
- vector **W** includes the independent variables that identify expense or cost shifts that are considered necessary to be only partially recognized in the calculation phase of the Standard expenditure needs, which means that they become *"target" variables* when computing the SEN. In the computation of the fitted values they will be recognized on the basis of a W^* value that can be prefigured as a *target* to be achieved by the local authority. Typically, this group includes the input prices when their variability is recognized within specific thresholds and the variables that measure the level and intensity of the services offered, when they can be standardized through the identification of certain essential levels of the services that the local authority is required to provide;
- ε_{it} represents the idiosyncratic error term, with zero mean, uncorrelated with $\boldsymbol{X}_{it}$ and $\boldsymbol{W}_{it}$, but potentially heteroscedastic[8].

[8] In statistics a vector of random variables is *heteroscedastic* if the variability (variance) of error terms is different across elements of the vector.

Once the coefficients of the empirical model of SEN reported in equation (4) have been estimated, the expected values ($\hat{y}_{it}$) of the current expenditure of each local government are obtained as follows:

$$\hat{y}_{it} = \hat{\alpha} + \hat{\tau}_t + \hat{\rho}C_i + \hat{\beta}'X_i + \hat{\delta}'W_i^* \quad (\mathbf{5})$$

Subsequently $\hat{y}_{it}$ can be interpreted as the level of *standard expenditures* of each local government at year t.

The evaluation of the standard level of service (SLS) could be based on the estimation of the reduced form of the demand function. Differently from the evaluation of the level of standard expenditure, the output analysis has been conducted using the same model for all type of services. This choice has been justified by the impossibility of estimating directly a demand in a robust way given the multi-output structure of all services and the difficulties associated to the estimation of simultaneous functions. Basically, a fixed proportion equal to the median value of the level of the services provided has been identified as the standard of the output. In particular, the benchmark for each category of provided service has been identified in correspondence of the clusters of Lithuanian municipalities.

For the analysis of performance it is important to note that, although the gap between the standard and actual expenditure for each service provides a good reference point to judge the level of expenditure of each municipality, it is not a good indicator of local governments' efficiency in the provision of local services.

The crude comparisons between standard expenditures and actual expenditures do not provide enough information to infer the ability of local governments and the effort they exert in the production of local services for two main reasons: the level of actual expenditures for a particular year may be affected by special events beyond the control of local governments and most importantly, the level of actual expenditures is influenced by the quantity and/or the quality of services produced that can be above or below the standard level compatible with the standard expenditures.

Consequently, a reliable performance evaluation should consider two indicators: the expenditure gap and the level of services (output) gap. Both indicators are based on the computation of the difference between actual and standard values.

$$Expenditure\ gap = \frac{(Actual\ Expenditure - Standard\ Expenditure)}{Standard\ Expenditure} * 100 \quad (\mathbf{6})$$

$$Output\ gap = \frac{(Actual\ Output - Standard\ Output)}{Standard\ Output} * 100 \quad (\mathbf{7})$$

Both for expenditure and level of services, the higher the gap the greater the value of the actual expenditure or output compared to the standard (positive gap). The smaller the gap the lower the historical expenditure or output compared to the standard (negative gap).

For each municipality and for each available year of data, expenditure gap and output gap have been calculated both for each standardized function and for the total of the standardized functions. The evaluation of the total performance is equal to a weighted sum of the percentage deviations of the single functions.

Expenditure gap (percentage deviation) and output gap (percentage deviation) are automatically converted into standardized scores with values between 1 and 10. The computation of standard scores within a range

of values (1-10) ensures a reduction of measurement errors and results variability; it is also a communicable and useful method to guarantee comparability between municipalities.

For the expenditure score:

- the higher the score the greater the value of the actual expenditure compared to the standard (positive expenditure gap);
- the smaller the score the lower the historical expenditure compared to the standard (negative expenditure gap).

For the output score;

- the higher the score the greater the value of the actual level of services provided than the standard;
- the smaller the score the lower the historical level of services provided compared to the standard.

Expenditure score and output score can be merged together for the computation of an overall performance score which ranges from 1 to 10:

$$OVERALL\ SCORE = (11 - \ Expenditure\ score) * 0{,}4 + Output\ score * 0{,}6$$

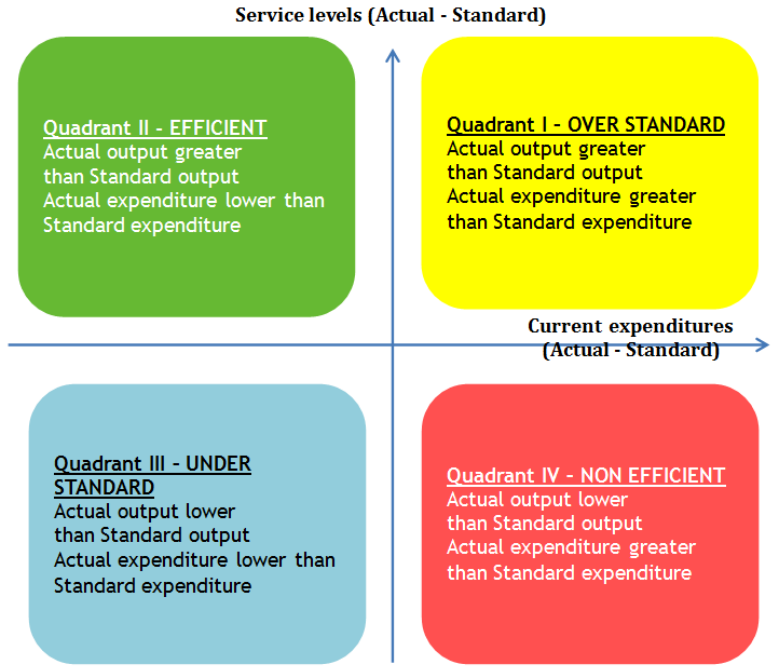
In conclusion, with the accordance and supervision of Lithuanian authorities, the performance analysis of each municipality has been conducted using the segmentation of local governments in four groups as described in the following ***Figure 8***.

The allocation of local authorities into four groups is related to two dimensions: the difference between theoretical Standard expenditure needs and actual expenditures measured on the horizontal axis, and the difference between standard outputs and actual outputs measured on the vertical axis.

Local authorities represented in quadrants I (High service provision) spend more than the standard and, at the same time, produce more services than the standard; on the opposite, local authorities in quadrant III (Low service provision) are spending less than the standard but are also providing fewer services than the standard. These cases can be seen as "normal" under the principle that local governments should be left free to exercise their autonomy in order to satisfy the local demand for public services.

On the other hand, local authorities located in quadrant II (High performance) can be considered as potential benchmarks for identifying best practices, given that these administrations are able to provide services above standard spending less than their expenditures needs. On the opposite, local authorities in quadrant IV (Low performance) are potential cases that may improve their performance since exhibiting a level of services below standard and a level of current expenditure above their Standard expenditure needs.

Figure 8 Performance analysis, segmentation of municipalities in four quadrants



2.2 Measuring fiscal capacity

For Lithuanian municipalities the analysis of municipal revenues has been focused on the evaluation of the level of fiscal capacity, which provides an assessment of the standard level of municipality own tax revenues and the analysis of the tax effort (difference between actual and standard tax revenues).

Fiscal capacity (FC) of local governments can be defined as the potential ability to raise revenue from its own sources by means of a *standard* tax effort. So far almost in all countries it has been measured in three ways: Historical revenue approach, Macroeconomic indicators methodology and Representative Tax System (RTS).

According to the ***Historical revenue approach***, FC is measured by the actual amount of own source tax revenue recorded in the budget. When employed for equalisation purposes, this approach has a strong drawback, because it generates incentives for the local authorities to reduce the fiscal effort. In fact, if local governments collect less tax revenue, they may have access to more equalising transfers, thus reducing the political cost of raising revenue.

Using the ***Macroeconomic indicators' methodology***, the FC is approximated by some measure of local wealth (per capita GNP, GDP, personal income etc.). Measures based on GNP or personal income could underestimate FC in regions where significant taxable economic activities involve non-resident persons, such as regions with important tourist attraction places, where the local governments collect relevant amounts of revenue taxing tourists by means of sales taxes, hotel taxes etc. It must be mentioned that macro indicators may not be available at micro-level or may be subject to massive approximation.

The ***Representative tax system (RTS)*** approach is based on the evaluation of tax revenues that different jurisdictions can collect by imposing taxes at the standard rate on the actual value of the tax bases. There is

no incentive for local administrations to reduce the fiscal effort since all tax revenues above the standard are not considered for equalization purposes, and at the same time tax revenues below standard are not compensated through grants. For these reasons the RTS approach is strongly recommended – by both Council of Europe and OECD - as a best practice that should be adopted to enhance efficiency and fairness of the equalization system. The formula is given by:

STANDARD TAX REVENUE = STANDARD TAX RATE x ACTUAL TAX BASE

Although the RTS approach provides the good incentive to maximise the tax effort at local level, it presents high operational costs because it requires the evaluation of the actual tax base for each source of revenue and for each local authority, which can be difficult when a complex set of laws and rules are in force. RTS cannot be properly used when the tax legislation does not establish a standard rate while it recognises to the local government the power to choose the rate within a given range. To overcome the problem, the literature suggests using the national average of local tax rates. Moreover, RTS cannot be used when the tax base does not exist or cannot be properly evaluated. Let us consider, for example, the case of local fees and tariffs covering just a fraction of the cost of local services, which therefore cannot be considered as prices, or the case of minor local taxes (municipal advertising tax, taxes on the occupation of public spaces, on the use of public billboards etc.).

In order to overcome the limits of the RTS approach, the economic literature[9] suggests new methods for the evaluation of fiscal capacity based on regression analysis. One method has been named ***Regression based Fiscal Capacity Approach (RFCA)*** after the Regression-based Cost Approach used in the literature with reference to expenditure needs.

According to this methodology, actual local revenues are regressed over a set of explanatory variables, as shown in the following equation:

$$T = \beta_1{}'R + \beta_2{}'S + \beta_3{}'A + \alpha + \varepsilon$$

In the equation, **T** represents the actual local tax revenue, **R** is a vector of socio-economic variables, which can be used as proxies for the tax bases, **S** are proxies of intergovernmental grants and **A** is the vector of socio-demographic variables that captures local preferences and allows to control the tax effort. The stochastic component includes two terms: **α**, which measures the level of efficiency or ability of the local administration, corresponds to municipal unobserved heterogeneity and/or tax evasion; **ε** is the idiosyncratic error with zero mean and homoscedastic variance.

The RFCA offers many advantages, when compared to the traditional approaches, if it is possible to rely on large samples (panel data) and on a correct specification of the model. In detail, RFCA generates finer estimates of FC if compared with the macro-indicators approach and can be even used when the actual tax bases are difficult to be computed or when a standard tax rate has not been established.

Within the aim of the project the methodologies adopted for the standardization process of municipal tax revenues can be divided as follows: for Tax on immovable property and Tax on land the Representative tax system approach has been used, while the analysis of Fees has been implemented using the Regression based Fiscal Capacity Approach.

[9] For more details see Di Liddo et al. 2016.

2.3 Measuring Fiscal gap and Fiscal imbalance

The Fiscal gap analysis is based on the computation, for each municipality, of the fiscal imbalance in terms of difference between "Standard Expenditure Needs" and "Standard revenues and Grants". The latter component includes both municipal fiscal capacity and all types of intergovernmental grants as reported in the following formula.

$$Fiscal\ gap = \frac{Total\ Standard\ Expenditures - Total\ Standard\ Revenues\ and\ Grants}{Total\ Standard\ Revenues\ and\ Grants} * 100$$

A positive value of fiscal gap identifies a deficit of resources, while a negative value indicates a surplus of resources.

Total expenditure includes the standard expenditure needs for General administration, Housing and utilities, Recreation, culture and religion, Education and Social security (measured as explained in **2.1 Measuring expenditure efficiency and productivity** and **3.1 Analysis of Expenditure**). Instead, for the rest of the functions, where the standardization procedure could not be applied, we have considered the historical expenditure.

Total standard revenues include both central and local sources as reported in the following list:

- Revenues from Personal income tax (PIT), furtherly subdivided into:
  - PIT received from State Tax Inspectorate;
  - Equalization component to 90% of PIT average;
  - Equalization component according to expenditure needs.

- Local government own incomes, for with we have computed the level of fiscal capacity (measured as explained in **2.2 Measuring fiscal capacity** and **3.2 Analysis of Revenues**) furtherly subdivided into:
  - Tax on immovable property;
  - Tax on land;
  - Fees;
  - Lease tax on state owned land and water bodies;
  - Tax on State-owned natural resources;
  - Pollution taxes.

- Special targeted grants from the state budget, furtherly subdivided into:
  - State delegated functions;
  - Student basket;
  - Other grants.

Moreover, we have also computed the two main fiscal imbalances usually discussed in the literature (see Di Liddo et. al 2016): the Vertical Fiscal Imbalance (**VFI**) and the Horizontal Fiscal Imbalance **(HFI).**

Conventionally, **VFI** is measured using multiple techniques, based on combinations of fiscal aggregates. One possible criterion for this purpose is given by the difference between expenditure of local governments and their own fiscal revenues, as reported in the following formula which represents the approach followed in our analysis:

$$\boldsymbol{Vertical\ Fiscal\ Imbalance} = Total\ Standard\ Expenditures - Municipal\ own\ Fiscal\ capacity$$

The possible evidence of vertical fiscal imbalance is justified because this measure does not consider a portion of local government's expenditure that is financed by central government grants.

The Horizontal fiscal imbalance (**HFI**), instead, is based on the evaluation of inequality in the distribution of resources among local authorities. The Horizontal fiscal imbalance, unlike VFI, may also include the portion of local government's expenditure that is financed by central government grants. The index used in our analysis is equal to the ratio between standard expenditures and the sum of municipalities' revenues generated by three main sources: standardized own revenues in terms of fiscal capacity, intergovernmental grants and tax sharing.

The *Base Horizontal fiscal imbalance* is computed without equalization grants. In this case, differences between municipalities may exist because some jurisdictions are richer than others and can therefore spend more with the same level of fiscal effort (Bird 2006).

In particular, in the base approach equalisation components have been excluded, instead we have taken into account special targeted grants (earmarked grants that incudes revenues for State delegated functions, Student basket and Revenues from other grants of the State budget), and revenues from the tax sharing on the national Personal Income Tax, as reported in the formula below.

$$\boldsymbol{Horizontal\ Fiscal\ Imbalance\ base} = \frac{Total\ Standard\ Expenditures}{Fiscal\ capacity + Earmarked\ Grants + PIT\ received\ from\ State\ Tax\ Inspecorate}$$

The target value of the Horizontal fiscal imbalance should be 1, which would represent a perfect equilibrium between expenditures and revenues. If HFI is greater than 1 then there is evidence of deficit of resources, which should be financed with the equalisation components, on the contrary if the index is less than 1 there is evidence of surplus of resources.

In addition to the indicator itself, equally important is the analysis of the index deviation measured through the dispersion (standard deviation) of municipalities' Horizontal fiscal imbalance values around its mean. Standard deviation provides a measure of such dispersion and it is calculated as the square root of the variance by determining the variation between each municipality relative to the mean.

$$Standard\ deviation = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(HFI_i - \mu)^2}$$

where *i*= Municipality, N= 60 municipalities and μ= mean of HFI.

If the municipalities' Horizontal fiscal imbalances are further from the mean, there is a higher deviation within municipalities; thus, the more spread out the data, the higher the standard deviation. The optimum should be a standard deviation of Horizontal fiscal imbalance very close to zero, meaning a very uniform distribution of resources that can guarantee a balanced redistribution of resources.

An additional measure of the Horizontal fiscal imbalance is obtained by including also equalisation components (Equalization component to 90% of PIT average and Equalization component according to

expenditure needs) among the resources distributed by the central government. The computation is shown in the following formula:

$$\boldsymbol{Horizontal\ Fiscal\ Imbalance\ (CORRECTED)} = \frac{Total\ Standard\ Expenditures}{Fiscal\ capacity + Earmarked\ Grants + PIT + Equalisation\ components}$$

The changes to the amending formula should improve the equilibrium between total expenditures and total revenues, which means that values of *Corrected Horizontal imbalance* should converge to 1 for all municipalities.

2.4 Measuring Infrastructural gap

The methodological steps followed for the computation of the infrastructural gap are firstly based on an intermediate step which is related to the computation of synthetic indexes of municipality infrastructure endowment.

Synthetic indexes that compare the performance of different entities, such as different countries or distinct areas of the same country, are increasingly recognized as a useful tool in policy analysis. Such indexes, widely used in the economic, social and environmental fields, are useful to illustrate complex phenomena by providing simple comparisons. Their application is also common in the evaluation of infrastructure endowment where synthetic indexes represent a double dimension: a sectorial dimension (the category of infrastructure) and a territorial one (differences between municipalities). It is then possible to create a synthetic index from the aggregation of multidimensional concepts.

According to the scope of the action, synthetic indexes methodology has been implemented with the aim of evaluating the level of infrastructure endowment of Lithuanian municipalities for each analysed sector. A higher synthetic measure of the level of infrastructure could be interpreted as a high existing infrastructure endowment taking into account both population and municipality surface. On the contrary, a low value of the synthetic indicator could be a clue of an infrastructure gap that should be filled with investments.

Summarizing, the success of synthetic indexes, both in literature and in policy field, is due to their usefulness in benchmarking different entities, also through time, and to their easiness of interpretation for the general public. Despite that, synthetic indexes may be misleading if the methodological aspect is neglected.

In addition to represent valuable information in itself, synthetic indexes methodology can be also useful for the evaluation and analysis of the infrastructure gap.

The infrastructure gap has been measured through the comparison between municipality infrastructure endowment and national and cluster infrastructure average. National and cluster averages identify the *standard* level of infrastructure endowment that each municipality should guarantee. The distance to the standard can be assumed to be a proxy of the infrastructure gap. In particular, the use of cluster results provides an additional and extremely significant qualitative contribution to the analysis by focusing on the comparison between municipalities with the same contextual and structural characteristics.

The infrastructure gap has been measured using both simple infrastructure indicators and synthetic indexes. The combination of synthetic indexes, infrastructure gap and cluster methodology provides the analysis with a remarkable value added and represents an innovative path for further implementations.

The results obtained in this report are based on a revised OECD methodology (2008) and it is frequently used for the construction of synthetic indexes of infrastructure endowment based on physical data only, that are not evaluated in monetary terms.

The methodology is composed of two main phases:

1- Construction of a synthetic index of infrastructure endowment for each selected function;
2- Construction of a total synthetic index of infrastructure endowment considering all the selected infrastructural functions together.

The process has followed the steps below:

- **Data selection**

A set of municipal services have been chosen in order to include the correspondent set of infrastructural functions in the evaluation of infrastructure endowment of Lithuanian municipalities:

- Heating and hot water;
- Drinking water;
- Sewage water;
- Education;
- Culture and recreation;
- Road network.

It would be interesting to extend future analysis to other services not considered here (such as municipal public transport and social security[10]) because of a lack of information that does not allow a complete dataset at the moment. For each of the selected services and for each municipality some data on physical infrastructures have been considered (see ***Table 7***). Infrastructural data used have been collected from Lithuanian authorities[11].

Table 7 – Infrastructural information used for the index construction

Service		Infrastructural data selected for the index construction
Heating and hot water	Production	• MW capacity of installed boilers
	Distribution	• Length of heat transfer net • Length of conditional heat transfer net
Drinking water	Production	• Number of wells • Number of pumps installed in wells
	Preparation	• Number of water aeration units • Number of towers • Number of tanks • Number of pumps installed
	Distribution	• Number of water pipes • Number of water lift stations • Number of pumps installed at water lift stations • Length of groundwater networks (km) • Number of water supply connections • Number of individual dwellings • Number of introductory (including sub -) accounting devices • Subscriber counters

[10] The available data on Social security infrastructure does not allow a complete analysis.
[11] For some of the functions included in the analysis (Heating and hot water, Drinking water and Sewage water) data have been originally collected from the companies providing the services.

Service		Infrastructural data selected for the index construction
Sewage	Collection	• Number of sewer systems • Number of sewage pumping stations • Number of pumps installed at pumping stations • Length of sewage networks (km) • Lumber of sewer outlets
	Treatment	• Number of biological treatment plants with mechanical treatment • Number of denitrifications with biological and mechanical treatment facilities • Number of pumps in sewage treatment plants • Number of other working machinery and equipment
Education		• Total area of premises • Laboratories • Places in hostels • Gyms • Libraries • Reading Rooms • Dining Rooms • Medical offices • Swimming pools • Stadiums • Number of school buses • School Museums
Culture and recreation		• Cultural centres, branches and other cultural institutions • Stadiums, swimming pools, other sport infrastructure • Branches of public libraries • Total area of museums
Road network		• Roads

The possibility to rely on a synthetic index approach has the advantage to use different information (number of facilities, km of net, squared meters of premises) thus mixing together quantitative and qualitative information. For each function, dimensionality of the infrastructure is mainly captured with specific indicators (km of net, squared meters of premises, capacity of facilities) to which other types of information must be added to capture the real size of the overall infrastructure.

- **Construction of simple indicators**

Based on data received, some simple physical indicators for each category of infrastructures have been constructed, keeping into account in the standardization both population and land of each municipality. Therefore, infrastructural data regarding heating and hot water, sewage and drinking water, culture and recreation and road system have been divided by both population and land for each municipality, making it possible to keep into account the two dimensions in an indirect way. Population and land represent the most reliable exogenous targets to be used for the identification of the infrastructural gap. The base assumption is that analysed services could be extended to the entire population covering the whole territory. The only exception concerns education, where the target population is represented by children 0-19 and therefore, the reference measure for the standardization of the infrastructural data of education is the population 0-19 for each municipality.

- **Normalization of the simple indicators**

Normalization was required prior to any data aggregation as the indicators in the data set have different measurement units. The Min–Max method of normalization has been used. Such a method normalizes

indicators to have an identical range [0, 100] by subtracting the minimum value, dividing by the range of the indicator values, and multiplying by 100.
Each basic indicator x_{im}, where *i* identifies the infrastructure and *m* the municipality, is normalized as follows:

$$X_{im} = \frac{x_{im} - \min_m(x_i)}{\max_m(x_i) - \min_m(x_i)} \times 100$$

- **Weighting and aggregation of the normalized simple indicators**

The synthetic indexes (one for each function) have been calculated through a linear aggregation method (arithmetic average) of the normalized indicators, relying on a uniform distribution of weights:

$$s_{im} = \frac{\sum_{i=1}^{n} X_{im}}{n}$$

- **Normalization of the synthetic indexes**

A further process of normalization for calculated synthetic indexes has followed using the Min-Max method. Each synthetic index s_{im}, where *i* identifies the function and *m* the municipality, is transformed in:

$$S_{im} = \frac{s_{im} - \min_m(s_i)}{\max_m(s_i) - \min_m(s_i)} \times 99 + 1$$

Such a method normalizes indexes to have a range between 1 and 100 because the method used for the next aggregation, the geometric average, only allows positive values, and zero is not included among those values.

- **Weighting and aggregation of the normalized synthetic indexes**

The geometric average has been used to aggregate the synthetic indexes of the various functions in one total index of infrastructure endowment for each Lithuanian municipality. A feature of additive aggregations is the implied full compensability, such that poor performance in some indicators can be compensated for by sufficiently high values in others. On the contrary, in aggregating the synthetic indexes of different infrastructure categories, we entail non-compensability. Therefore, the use of geometric average is preferable. Same weights have been assigned to the indexes. The total synthetic index of infrastructure endowment (*E*) for each municipality (*m*) has been computed as follows:

$$E_m = \sqrt[n]{\prod_{i=1}^{n} S_{im}}$$

Following the steps, it has been possible to calculate an overall index of infrastructure endowment for each of the Lithuanian municipalities which summarizes the structures of all the functions considered. The value of the synthetic index ranges from 0 to 100 (where 0 indicates the municipality with the lowest infrastructure endowment and 100 the municipalities with the highest endowment) making the infrastructure endowment comparable among municipalities and easy to communicate.

To have a measurement of the infrastructural gap at a municipal level, some comparisons, through both space and time, have been done.

First, it has been compared the synthetic index value of each municipality to:

- the national average value of the index;
- the average value of the index by cluster.

These comparisons give the possibility to understand the positioning of each municipality respect to the others in terms of infrastructural endowment.

Second, it is possible to compare the present infrastructure endowment of each municipality with the potential infrastructural endowment needed in the future. In order to carry out this comparison it has been necessary to calculate a synthetic index of infrastructure endowment keeping into account the future potential demand of services and, consequently, of infrastructure. The variation of population from 2018 to 2028 has been considered as a proxy of the variation of the potential demand of infrastructure. Therefore, the population in 2028 has been used in the calculation of a new synthetic index of future needed infrastructure endowment. More specifically, for the construction of the simple indicators for the different infrastructural functions, both the number of population 2028 and the land have been used for the standardization of the infrastructural data. For the education service an estimation of the population 0-19 in 2028 per municipality has been done. The infrastructural data used for the construction are the same for both the years. The steps followed for the construction have been the same explained above.

The comparison between the two synthetic indexes referred to 2018 and 2028, changing the reference population but keeping the infrastructural data constant, gives the possibility to understand if a certain municipality is under-structured or over-structured respect to the future demand of infrastructure and to formulate policy indications in this regard.

The **infrastructure gap** has been measured through the comparison between municipality infrastructure endowment and both national and cluster infrastructure average.

The methodology is composed of two main phases:

1- Construction of *basic infrastructure gap*;
2- Construction of *synthetic infrastructure gap*.

The *basic infrastructure gap* consists in a direct approach to measure structural over-equipment or under-equipment through the comparison between the standardized value of municipality infrastructure, controlling for population and territorial extension, and the corresponding national or cluster average. The standardization of each physical infrastructure takes into account both the population and the territory of the municipality. The national average and the cluster average of standardized indicators represent the benchmark to which the value of the municipality is compared to. The basic infrastructure gap could be calculated for each of the infrastructures included in the ***Table 7***.

The comparison to the national mean is the result of the following computation:

$$Basic\ infrastructure\ gap\ from\ National\ mean = \frac{(Standardized\ infrastructure - National\ Mean\ )}{National\ Mean} * 100$$

If the benchmark is the cluster mean, then the gap deviation is calculated as follows:

$$Basic\ infrastructure\ gap\ \ from\ Cluster\ mean = \frac{(Standardized\ infrastructure - Cluster\ Mean\ )}{Cluster\ Mean} * 100$$

In this latter formula each municipality is compared to the mean of the cluster the municipality belongs to.

Positive values of the gap would indicate those municipalities with greater infrastructural equipment while those with lower values would indicate reduced existing endowment compared to the benchmark.

The *synthetic infrastructure gap* is based, for each municipality, on the comparison between the synthetic infrastructure index of each function and the corresponding national or cluster average that represents the benchmarks to which the value of the municipality is compared to. As explained before, synthetic indexes have been calculated for each of the functions included in the report: Heating and hot water, Drinking water, Sewage water, Education and Culture and recreation.

The comparison to the national mean is the result of the following computation:

$$Synthetic\ infrastructure\ gap\ from\ National\ mean = \frac{(Synthetic\ infrastructure - National\ Mean\ )}{National\ Mean} * 100$$

If the benchmark is the cluster mean, then the gap deviation is calculated as follows:

$$Synthetic\ infrastructure\ gap\ \ from\ Cluster\ mean = \frac{(Synthetic\ infrastructure - Cluster\ Mean\ )}{Cluster\ Mean} * 100$$

Positive values of the gap would indicate those municipalities with a greater synthetic infrastructural equipment compared to the standard, while those with lower values would indicate reduced synthetic existing endowment compared to the benchmark.

The gap from national mean gives a general overview of the infrastructural level while the gap from cluster mean provides a more detailed insight, where municipalities are compared to other municipalities with the same contextual and structural characteristics. Finally, a between cluster comparison proves to be extremely useful to have an immediate picture of infrastructures distribution in the territory.

The *synthetic infrastructure gap* combines both methodologies used in the report thus providing to be a particularly interesting approach.

Finally, the *synthetic infrastructure gap* has been implemented also for the overall synthetic index in order to measure an overall infrastructural gap for each Lithuanian municipality.

3. ANALYSIS OF THE SUSTAINABILITY OF THE CURRENT FINANCIAL STRUCTURE OF LOCAL GOVERNMENTS

3.1 Analysis of Expenditure

The first building block of the project concerns the analysis of municipalities' expenditures efficiency which is based on the comparison between current and standard costs.
The following list reports the fundamental municipality functions that have been taken into account for the process of standardization in accordance with Lithuanian authorities:

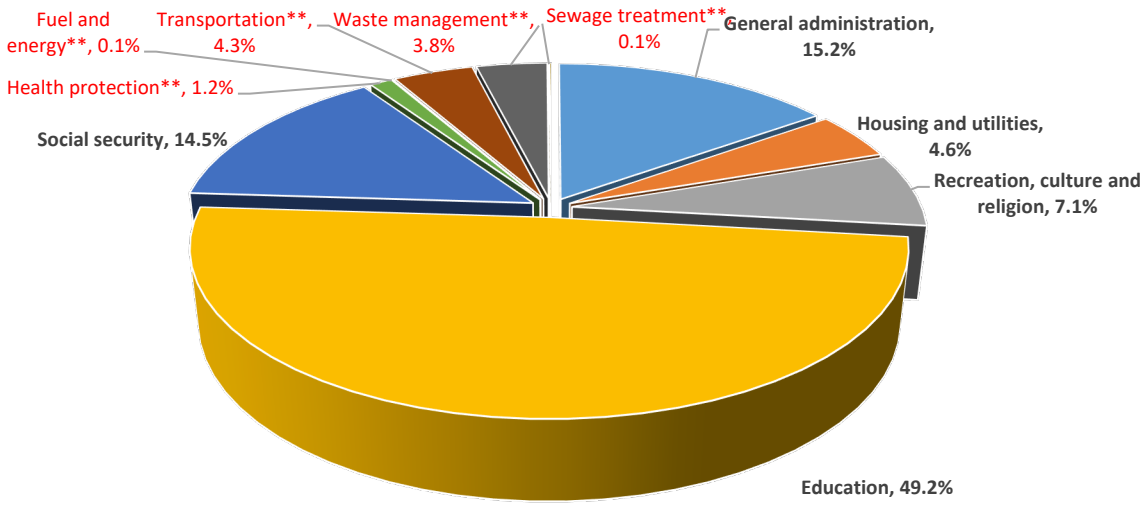
- General administration;
- Housing and utilities;
- Recreation, culture and religion;
- Education;
- Social security.

For the purpose of the project, in particular for the analysis of the fiscal gap, the current expenditures of the remaining functions, which are reported in the following list, have been taken into account directly at actual level:

- Health protection;
- Fuel and energy;
- Transportation;
- Waste management;
- Water and Sewage treatment.

From the expenditure side, previously mentioned standardized functions cover 90,5% of municipal expenditures (***Figure 9***). The activity related to the remaining functions is only partially recorded on municipal balance sheets because it is mainly carried out by companies. Consequently, both for the analysis of current expenditure and fiscal gap, the corresponding historical (actual) level has been measured.

Figure 9 Structure of Current Expenditure (2018)



The following table (***Table 8***) shows the details of the items included in the classification of the current expenditures for each municipal function.

Table 8 Classification of Expenditure

CLASSIFICATION OF MUNICIPAL FUNCTIONS COSTS	
01. GENERAL STATE SERVICES	01.01. Public authorities, financial and fiscal affairs, foreign affairs
01. GENERAL STATE SERVICES	01.02. Economic aid to foreign countries
01. GENERAL STATE SERVICES	01.03. General services
01. GENERAL STATE SERVICES	01.04. Basic research
01. GENERAL STATE SERVICES	01.05. Research and development in the field of public services
01. GENERAL STATE SERVICES	01.06. Other public services not assigned to any group
01. GENERAL STATE SERVICES	01.07. Interest
02. DEFENCE	02.01. Military defence
02. DEFENCE	02.02. Civil safety
02. DEFENCE	02.03. Military assistance abroad and participation in international operations
02. DEFENCE	02.04. Research and development in the field of defence
02. DEFENCE	02.05. Another defence matters not included in any groups
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.01. Police
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.02. Fire-security
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.03. Courts
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.04. Offenders
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.05. Research and development in the fields of public order and public security
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	03.06. Other issues of public order and public security not attributed to any group
04. ECONOMY	04.01. General economic, trade and labour affairs
04. ECONOMY	04.02. Agriculture, forestry, fishing and hunting
04. ECONOMY	04.03. Fuel and energy
04. ECONOMY	04.04. Mining and manufacturing industry and construction
04. ECONOMY	04.05. Transportation
04. ECONOMY	04.06. Communications
04. ECONOMY	04.07. Other economic activities
04. ECONOMY	04.08. Economic research and development
04. ECONOMY	04.09. Other economic matters not belonging to any group
05. ENVIRONMENTAL PROTECTION	05.01. Waste management
05. ENVIRONMENTAL PROTECTION	05.02. Sewage treatment
05. ENVIRONMENTAL PROTECTION	05.03. Reducing environmental pollution
05. ENVIRONMENTAL PROTECTION	05.04. Biodiversity and nature protection
05. ENVIRONMENTAL PROTECTION	05.05. Research and development in the field of environmental protection

CLASSIFICATION OF MUNICIPAL FUNCTIONS COSTS	
05. ENVIRONMENTAL PROTECTION	05.06. Other environmental issues not assigned to any group
06. HOUSING AND UTILITIES	06.01. Housing development
06. HOUSING AND UTILITIES	06.02. Development of municipal economy
06. HOUSING AND UTILITIES	06.03. Water supply
06. HOUSING AND UTILITIES	06.04. Street lighting
06. HOUSING AND UTILITIES	06.05. Research and development in the field of housing and utilities
06. HOUSING AND UTILITIES	06.06. Other housing and communal affairs not included in any group
08. RECREATION, CULTURE AND RELIGION	08.01. Recreational and sporting services
08. RECREATION, CULTURE AND RELIGION	08.02. Cultural services
08. RECREATION, CULTURE AND RELIGION	08.03. Public Information Services
08. RECREATION, CULTURE AND RELIGION	08.04. Religious communities and non-governmental organizations
08. RECREATION, CULTURE AND RELIGION	08.05. Research and development in the fields of recreation, culture and religion
08. RECREATION, CULTURE AND RELIGION	08.06. Other recreational, cultural and religious affairs not included in any group
09. EDUCATION	09.01. Pre-primary, pre-primary and primary education
09. EDUCATION	09.02. Primary and secondary education
09. EDUCATION	09.03 Vocational training
09. EDUCATION	09.04. Higher Education Studies
09. EDUCATION	09.05. Other education-related matters not included in any group
09. EDUCATION	09.06. Additional Educational Services
09. EDUCATION	09.07. Research and development in the field of education
09. EDUCATION	09.08. Other education-related matters not included in any group
10. SOCIAL SECURITY	10.01. Illness and Disability
10. SOCIAL SECURITY	10.02. Old age
10. SOCIAL SECURITY	10.03. Social assistance in case of survivors' death and death
10. SOCIAL SECURITY	10.04. Family and children
10. SOCIAL SECURITY	10.05. Unemployment
10. SOCIAL SECURITY	10.06. House
10. SOCIAL SECURITY	10.07. Other vulnerable persons not included in the group
10. SOCIAL SECURITY	10.08. Research and development in the field of social security
10. SOCIAL SECURITY	10.09. Other social security matters not assigned to any group

Each of the first level item of current expenditure classification could be furtherly split into a second level of classification (***Table 9***) for all fundamental municipal functions.

Table 9 Composition of Expenditure

Level of classification	Expenditure
2.1.	Wages and social security
2.2.	Purchase of goods and services
2.3.	Interest
2.4.	Budget subsidies
2.5.	Grants to Foreign organizations
2.6.	Contributions to the European Union budget
2.7.	Social benefits (benefits)
2.8.	Other expenses
2.9.	Funds from the European Union, other international financial assistance and co-financing are transferred
	Institutional management costs

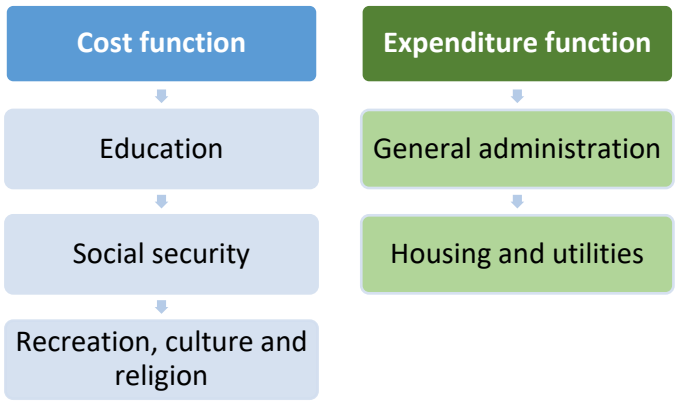
The following table (***Table 10***) identifies the second level items that have been **excluded** from the computation of municipal current expenditure:

Table 10 Items excluded from the composition of Expenditure

Level of classification	Expenditure
3.1.	Acquisition costs of tangible and intangible assets
3.2.	Expenses for financial assets (acquisition / investment costs of financial assets)
3.3.	Financial charges (debt repayments)

As agreed with Lithuanian authorities, ***Figure 10*** displays the structure of analysed services grouped accordingly to the type of model that has been used for the evaluation of Standard expenditure needs.

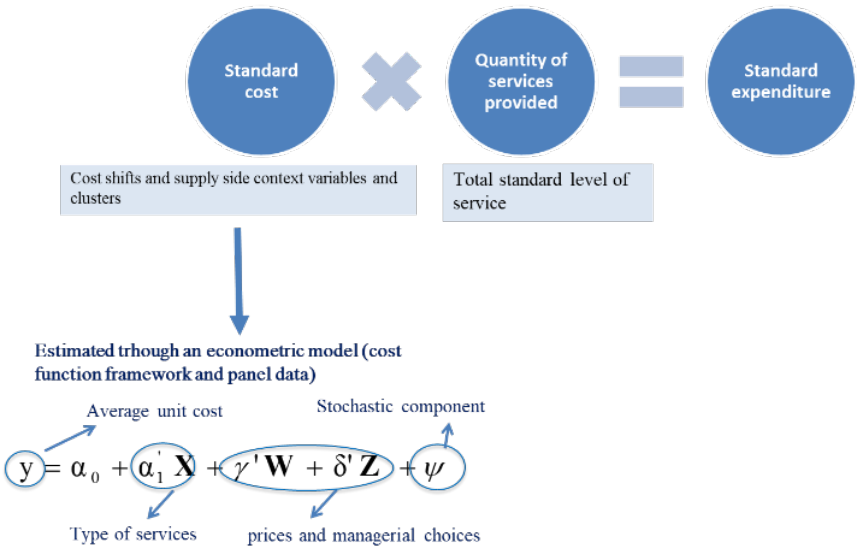
Figure 10 Type of model



The discriminating element for the choice of a specific model is the characteristic of the variables, which can be used for measuring the output provided, i.e. the possibility of considering the quantity of services provided in calculating the Standard expenditure needs (SEN). The two main characteristics of the essential services implemented by local authorities are the level of measurability of the services provided and the extent to which these services are exogenous, with respect to the decision-making autonomy of each local authority.

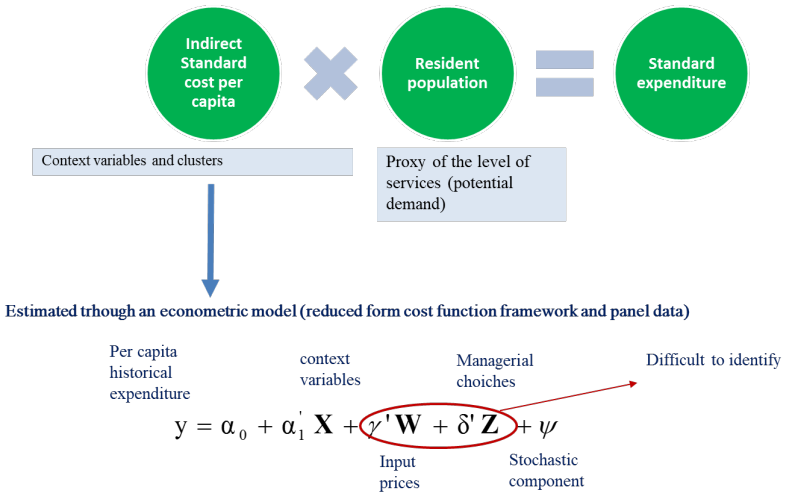
The cost function model has been used for the evaluation of the standard expenditure of the following services: Education, Social security, Recreation, culture and religion. In particular, the structure of the cost function model is described in ***Figure 11*** that shows how, using a pure RCA approach, the estimation of SEN is effectively based on the product between exogenous standard (or minimal) service level and standard average costs.

Figure 11 Cost function model



The expenditure function model has been used for the evaluation of the standard expenditure of the following services as agreed with Lithuanian authorities: General administration, Housing and utilities. In particular, this approach is based on the estimation of the reduced form of the cost function. The adoption of the expenditure function model, in substitution of the cost function model, is justified by the impossibility of measuring in a precise and unambiguous way the level of services provided. The structure of the expenditure function model is displayed in the ***Figure 12***.

Figure 12 The expenditure function model



In the following paragraphs for each of the standardized function, a detailed description of results will be provided together with the instruments used, i.e. type of function used and determinants of the estimation.

3.1.1 Education

Municipal expenditure on **Education** function covers an important share of the total amount of expenditures (49,2% on total municipality expenditure for 2018), thus playing a predominant role inside municipality's financial activity.

Pre-tertiary education in Lithuanian system is free of charge and compulsory from the age of 6 or 7 to 16 (covering "primary" and "basic" education). Education is organized in 4 main cycles: **pre-school** education (until age 5 or 6), **pre-primary** education (1 year, between age 5-7), **primary** education (4 years, between age 6-11), **basic education** (6 years, between age 10-17, which ends on a "basic education certificate"), **upper secondary** education (two years, between age 16-19). Upper secondary education ends on the "*matura*" examination, opening gates to tertiary education (university or college). Vocational and technical education starts from the fifth year of basic education (age 14-15) and the structure is similar to comprehensive education: the program lasts two or three years before the "basic education certificate". Students can then pursue into vocational upper secondary education, that also leads, after two or three years, to a "*matura*" examination.

The variables related to Education function included in the dataset, as explained before, represent a consistent and complete set of information useful for the analysis of the sector. The availability and measurability of the level of services provided enables the use of the cost function for the identification of the efficient level of expenditures (SEN).

Current expenditure computation for Education function takes into account the following (***Table 11***) items of the municipal Balance sheet.

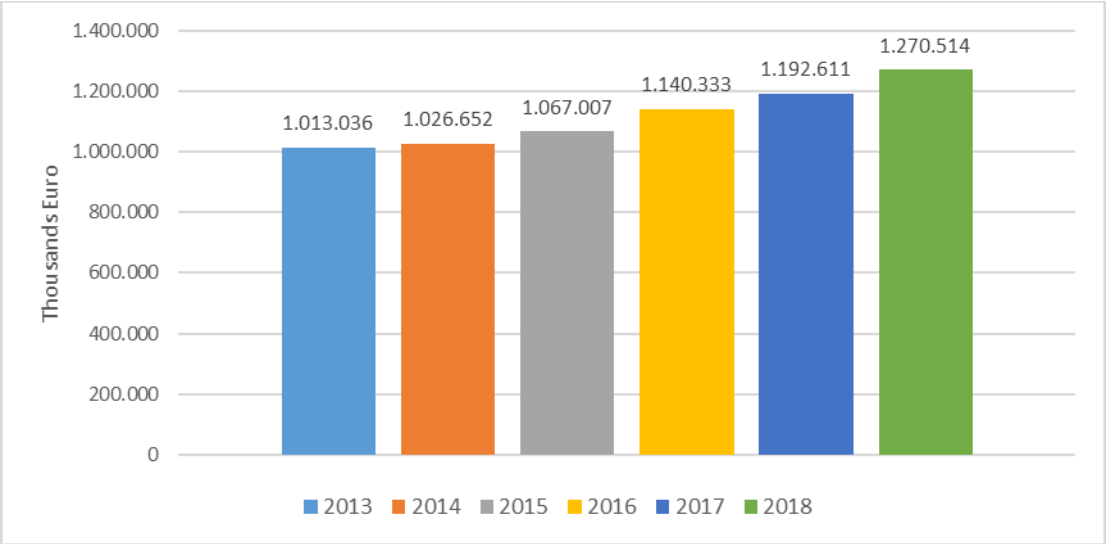
Table 11 Classification of the current expenditure for Education

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
09. EDUCATION	09.01. Pre-primary, pre-primary and primary education
09. EDUCATION	09.02. Primary and secondary education
09. EDUCATION	09.03 Vocational training
09. EDUCATION	09.04. Higher Education Studies
09. EDUCATION	09.05. Other education-related matters not included in any group
09. EDUCATION	09.06. Additional Educational Services
09. EDUCATION	09.07. Research and development in the field of education
09. EDUCATION	09.08. Other education-related matters not included in any group

The total amount of municipal current expenditure on education service has constantly increased during the period of observation, with an overall increase of 25% from 2013 to 2018 as showed below[12] (***Figure 13***).

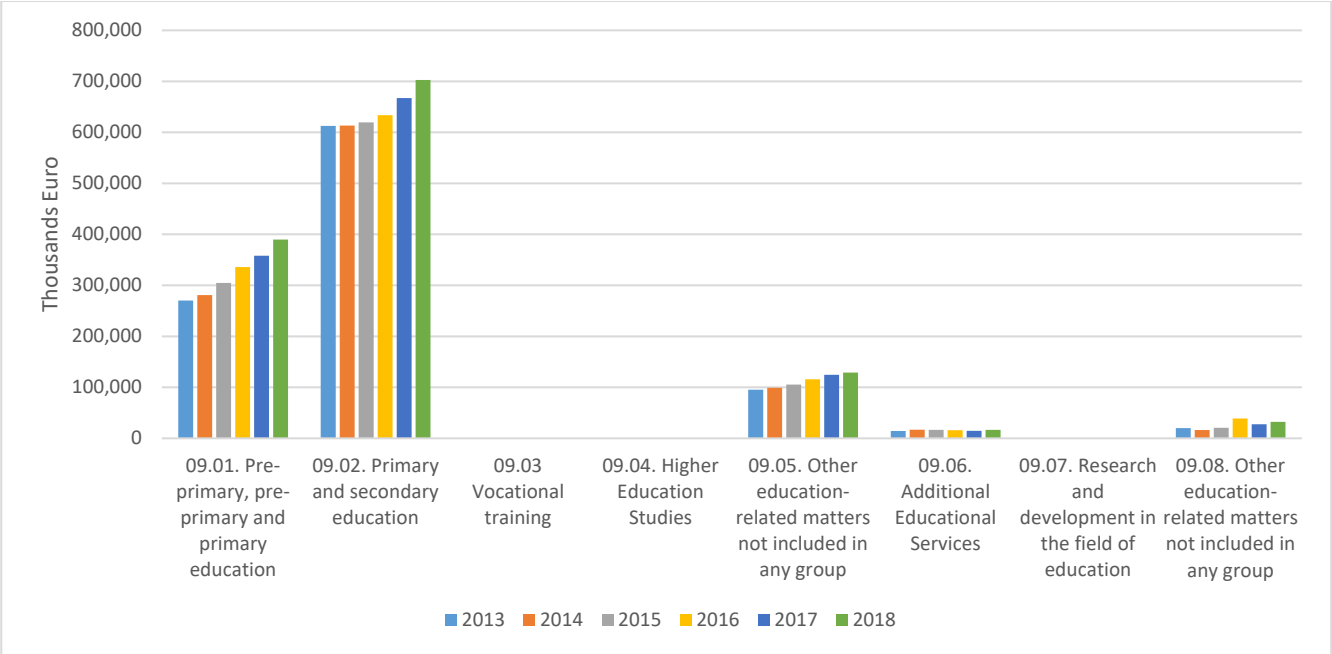
[12] Nominal values.

Figure 13 Education current expenditure evolution



The dynamic of Education expenditure can be furtherly analysed (***Figure 14***) considering the second level items of the expenditure classification.

Figure 14 Education current expenditure evolution and structure



Primary and secondary education absorbs the main part of the current expenditure (***Table 12***) even though the impact on total expenditure has progressively decreased during the years (from 60,48% in 2013 to 55,30% in 2018).

Pre-primary and primary expenditure, which absorbs another important part of the total amount of current expenditure, goes on the opposite direction. The percentage over the total expenditure increases from 26,66% (2013) to 30,68% (2018).

Table 12 Education current expenditure decomposition

	09.01. Pre-primary and primary education	09.02. Primary and secondary education	09.03 Vocational training	09.04. Higher Education Studies	09.05. Other education-related matters not included in any group	09.06. Additional Educational Services	09.07. Research and development in the field of education	09.08. Other education-related matters not included in any group	Total Expenditures %
2013	26,66%	60,48%	0,02%	0,00%	9,42%	1,43%	0,00%	1,99%	100,00%
2014	27,37%	59,73%	0,02%	0,00%	9,66%	1,63%	0,00%	1,59%	100,00%
2015	28,55%	58,07%	0,02%	0,00%	9,88%	1,56%	0,00%	1,92%	100,00%
2016	29,45%	55,58%	0,02%	0,00%	10,14%	1,39%	0,00%	3,42%	100,00%
2017	30,03%	55,96%	0,02%	0,00%	10,44%	1,24%	0,00%	2,31%	100,00%
2018	30,68%	55,30%	0,02%	0,00%	10,16%	1,30%	0,00%	2,55%	100,00%

For the evaluation of the Standard expenditure needs of Education services, a cost function model has been implemented. As for the standardization of the other functions, a "*selection criteria*" has been adopted for the estimation process that is based on the "*general-to-specific"* approach. Different tests have been implemented to check the statistical significance of the variables that, according to the structure of the cost function models, can be included in the set of explanatory variables.

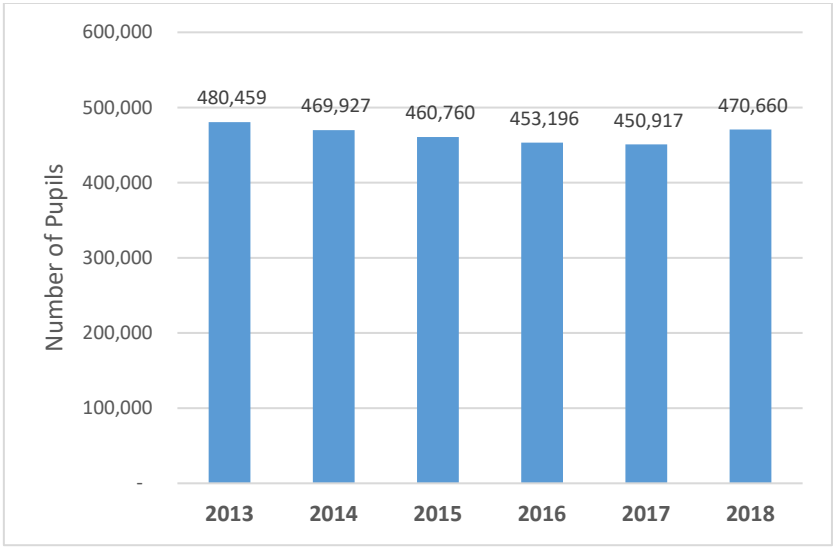
The estimation of the Standard expenditure needs has been implemented in relation to two main output indicators which are represented by:

1. Total number of pupils (age 1-5) studying in pre-school education programs, number of pupils (age 6) studying in pre-primary education programs and number of pupils (age 7-19) studying in primary, basic and secondary education program;

2. Total number of teaching hours (number of hours worked by kindergarten educators per year and number of hours worked by general education school's teachers per year).

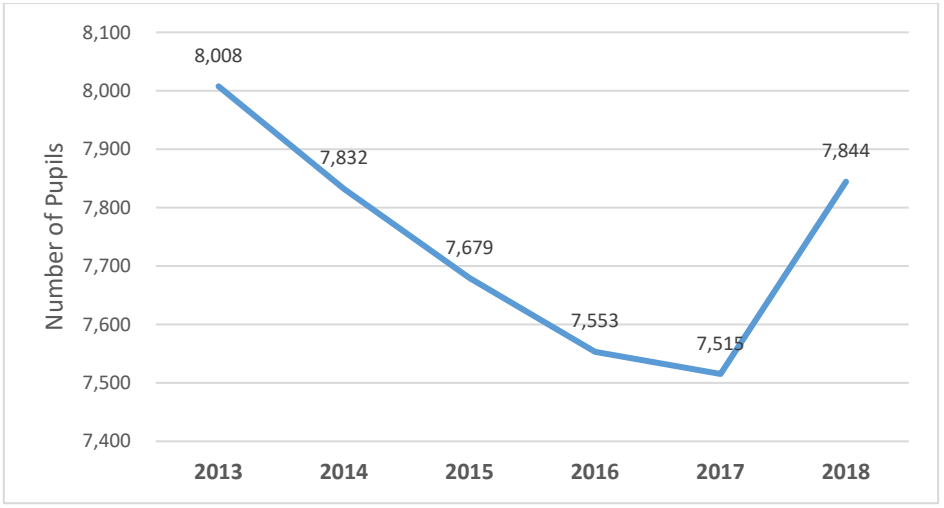
If from the expenditure side the registered trend is positive, the total number of pupils (pupils aged 1-5 studying in pre-school education programs, pupils aged 6 studying in pre-primary education programs and pupils aged 7-19 studying in primary, basic and secondary education program) goes in the opposite direction (***Figure 15***). The trend is decreasing up to 2017 and only from 2018 it starts increasing again. This could be explained considering the better condition and quality of life that has constantly improved, thus allowing an increase in enrolment in non-compulsory education activity (mainly pre-school education).

Figure 15 Total number of pupils



The national average number of pupils for all the Lithuania country confirms (***Figure 16***) the same trend observed for the total number.

Figure 16 Average number of pupils



The trend in teaching hours (number of hours worked by kindergarten educators per year and number of hours worked by general education school's teachers per year) perfectly reflects the one of the students (***Figure 17*** and ***Figure 18***).

Figure 17 Total number of teaching hours

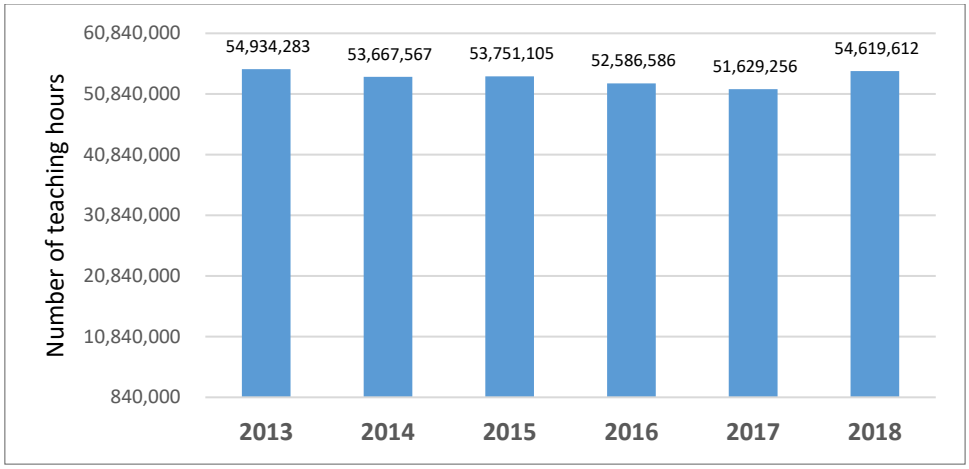
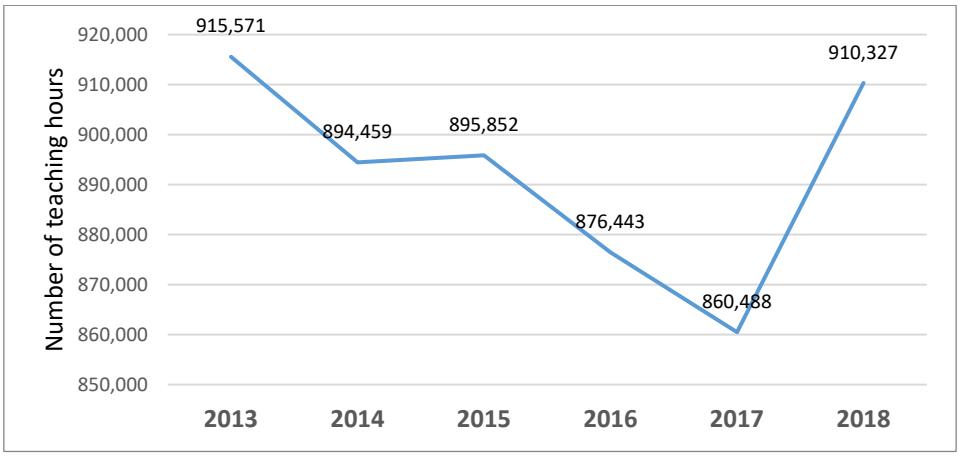


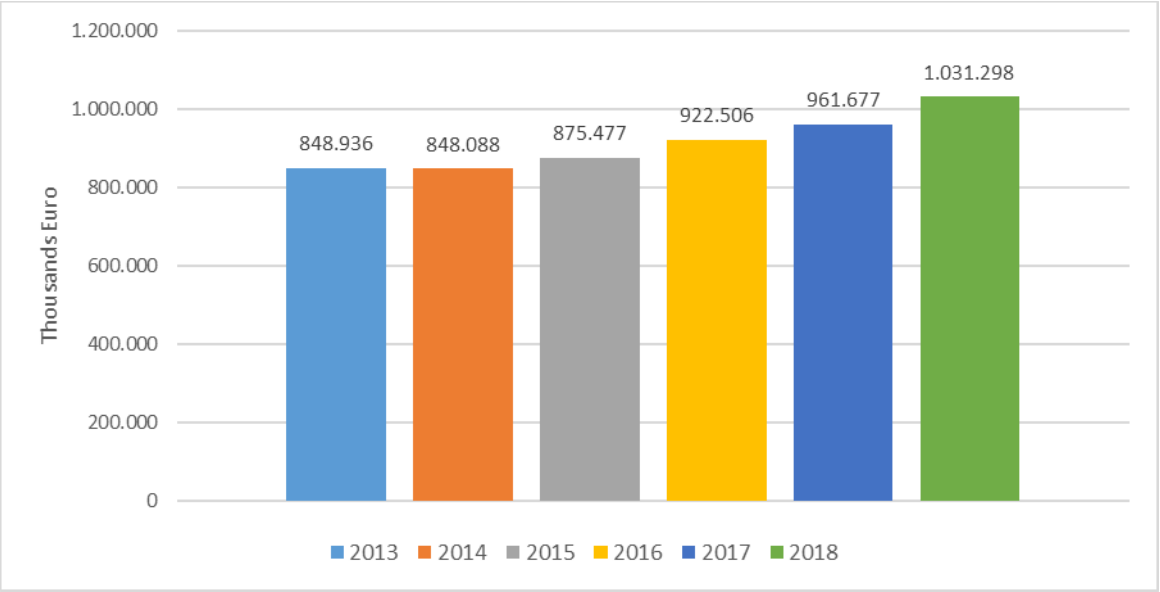
Figure 18 Average number of teaching hours



The deceasing number of pupils and teaching hours, at least up to 2017, was not combined with a decrease in expenses and in the cost of labour. In particular, the trend of the cost of labour[13] (***Figure 19***) is similar to the one registered for total expenditures.

[13] Nominal values.

Figure 19 Education Wages and social security



To take into account both outputs, total number of pupils and total number of teaching hours, a "t*wo step approach*" has been carried out, where a cost function has been estimated for each output through the identification of a range of *cost-shifts* aimed at capturing the intensity and the quality with which the service is offered.

The following table (***Table 13***) reports the list of the variables included in the first model of the cost functions, which could be defined as "*pupils"* model, used for the estimation of the Standard expenditure needs.

The first variable refers to the dependent variable of the Standard expenditure needs model (expenditure per pupil), the others are the explanatory variables belonging to different explicative groups.

Table 13 Education Expenditure determinants (Pupils model)

CATEGORY	Description
DEPENDENT VARIABLE	Actual cost per pupil (euro per pupil)
SERVICES OFFERED	Squared meters area of school premises per pupil
EXOGENOUS LOAD FACTORS	Number of schools per pupil
EXOGENOUS LOAD FACTORS	Use of kindergarten places and facilities
CONTEXT VARIABLES	Share of graduate pupils of general education on population aged 0-19
INPUT PRICES	Share of expenditure out of pupil basket

The following table (***Table 14***) reports the list of the variables included in the second model of the cost functions used for the estimation of the Standard expenditure needs, which could be defined as "*teaching hours*" model. Most of the explanatory variables are the same used for the "*pupils"* model: what changes is just the target output represented by the total number of teaching hours (expenditure per teaching hour).

Table 14 Education Expenditure determinants (Teaching hours model)

CATEGORY	Description
DEPENDENT VARIABLE	Actual cost per hour (euro per teaching hour)
SERVICES OFFERED	Squared meters area of school premises per population 0-19
EXOGENOUS LOAD FACTORS	Number of schools per population 0-19
EXOGENOUS LOAD FACTORS	Share of educators in kindergartens
INPUT PRICES	Labour cost
INPUT PRICES	Share of expenditure out of pupil basket
CONTEXT VARIABLES	Share of graduate pupils of general education on population aged 0-19
CONTEXT VARIABLES	Share of school-age children not attending school on population aged 0-19

The availability of two separate estimated models has proved to be an important advantage for the analysis. This means that it is possible to rely on robust estimates simply joining both information.

Final standard expenditure computation for Education function takes into account results of both cost functions models, the first one related to the standardization of the expenditure by the total number of pupils (age 1-5 studying in pre-school education programs, age 6 studying in pre-primary education programs and age 7-19 studying in primary, basic and secondary education program), the second one related to the total number of teaching hours (number of hours worked by kindergarten educators per year and number of hours worked by general education school's teachers per year).

The final computation of the standard expenditure of Education services can be written as the product of the estimated cost of teaching hours, calculated with the second cost function model, and the standard number of teaching hours, estimated through the combination of the two cost function models:

$$\text{Standard}(Expenditure) = \text{Standard}\left(\frac{Expenditure}{Number\ of\ teaching\ hours}\right) * \text{Standard}(Number\ of\ teaching\ hours)$$

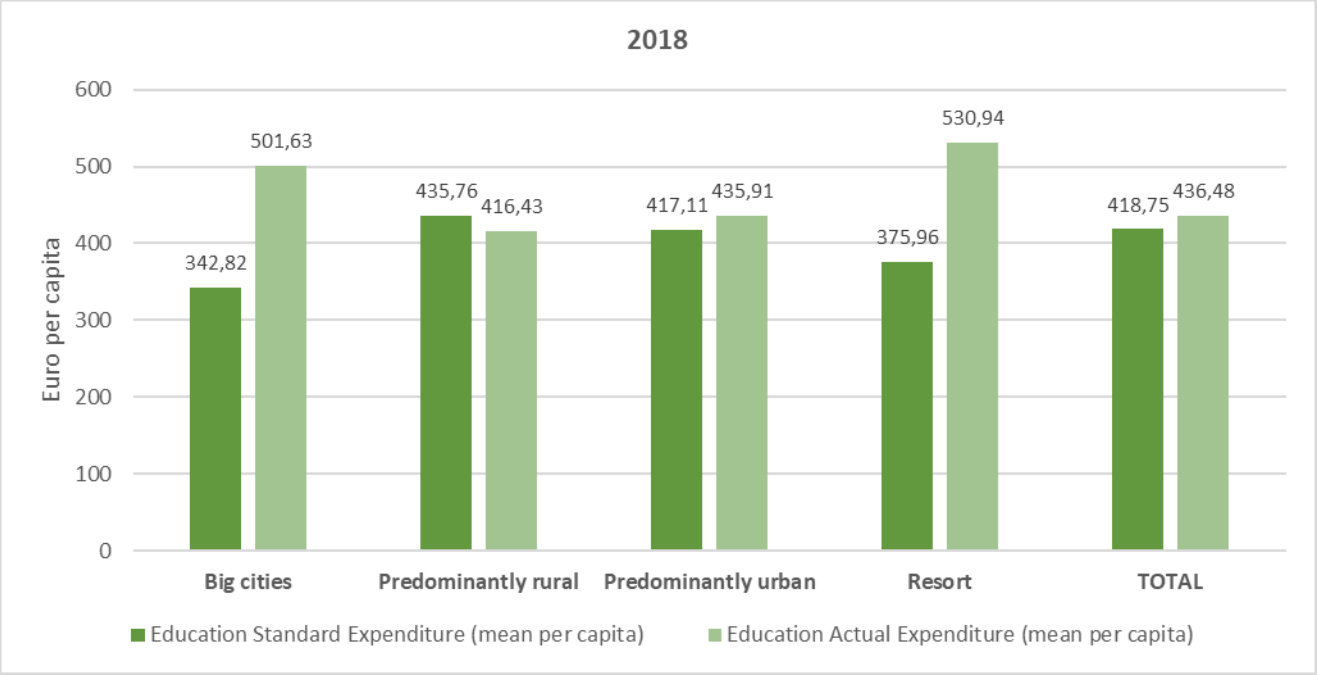
The standard expenditure needs results reported below have been calculated setting a *default* value for what could be defined as policy determinants (***Table 15***), i.e. variables that could be used by the policy maker to estimate different equalisation scenarios. The default setting uses municipal actual values for most of the determinants of the Standard expenditure needs model with the exclusion of two variables. The first one is the explanatory variable related to the percentage of municipal expenditure out of the pupil basket that should be set to the national value because it provides endogenous information. The second one, which is the number of teaching hours, should be considered as a target (standard) to be achieved by the local authority.

Table 15 Education Policy determinants (default)

Policy determinant	Default value
Squared meters area of school premises	Municipality actual value
Number of schools	Municipality actual value
Share of educators in kindergartens	Municipality actual value
Labour cost	Municipality actual value
Share of expenditure out of pupil basket	National mean
Share of graduate pupils of general education on population aged 0-19	Municipality actual value
Share of school-age children not attending school on population aged 0-19	Municipality actual value
Number of Teaching hours	Standard value

Comparing standard expenditure to the total population is fundamental to align Education function results to the other municipal standard functions. The total per capita average of actual expenditure (***Figure 20***) is higher (+4,2%) than the standard value. Average per capita values are furtherly displayed across clusters and the difference between standard and actual expenditure is higher for *Big cities*.

Figure 20 Education Standard and Actual expenditure



The analysis of expenditure is matched with the analysis of the level of services provided for Education function, that have been measured combining quantitative and qualitative information through two different indicators:

1. Number of teaching hours per inhabitant aged 0-19, that takes into account the number of hours worked by kindergarten educators per year and the number of hours worked by general education school's teachers per year;

2. Best school performance, given by the average percentage of graduate pupils who have received grades between 91 and 100 in the following exams: Biology, Chemistry, Physics, Geography, IT, History, Lithuanian, Mathematics and Foreign language.

For both indicators a standard level of services has been calculated in order to allow comparison between actual and standard value.

The computation of the standard level of services provided is based on two different methodological steps.

The first method concerns the computation of the *Standard number of teaching hours per inhabitant aged 0-19* that can be summarised by the following indicator:

$$\text{Standard}(Number\ of\ teaching\ hours\ per\ inhabitant\ aged\ 0-19) = \frac{\text{Standard}\ (Number\ of\ teaching\ hours)}{\text{Population aged}\ 0-19}$$

The Standard number of teaching hours worked per year for kindergarten educators and general education school's teachers has been obtained by multiplying the standard number of pupils by the standard number of teaching hours per pupil.

$$\text{Standard}(Number\ of\ teaching\ hours) = \text{Standard}(Number\ of\ Pupils) * \text{Standard}\ (\frac{Number\ of\ teaching\ hours}{Number\ of\ Pupils})$$

The first item of previous formula is based on a fixed proportion of population that is given by the annual average of the number of pupils (pupils aged 7-19 studying in primary, basic and secondary education program, pupils aged 6 studying in pre-primary education programs and pupils aged 1-5 studying in pre-school education programs) per inhabitant aged 0-19. For each Municipality the fixed average value has been re-proportioned with the number of inhabitants aged 0-19.

The second dimension of the formula takes into account the results of the two cost function models implemented for Education. Based on the assumption that the first model estimates the standard value of expenditure per pupil (pupils aged 7-19 studying in primary, basic and secondary education program, aged 6 studying in pre-primary education programs and aged 1-5 studying in pre-school education programs) and the second model estimates the standard value of expenditure per teaching hour (number of hours worked per year for kindergarten educators and number of hours worked per year for general education school teachers); then the ratio of the two estimates can be assumed to be the estimation of the standard number of teaching hours per pupil:

$$\text{Standard}\left(\frac{Number\ of\ teaching\ hours}{Number\ of\ Pupils}\right) = \frac{\text{Standard cost per pupil}}{\text{Standard cost teaching hour}}$$

$$= \frac{\text{Standard } (\frac{Expenditure}{Number\ of\ Pupils})}{\text{Standard } (\frac{Expenditure}{Number\ of\ teaching\ hours})}$$

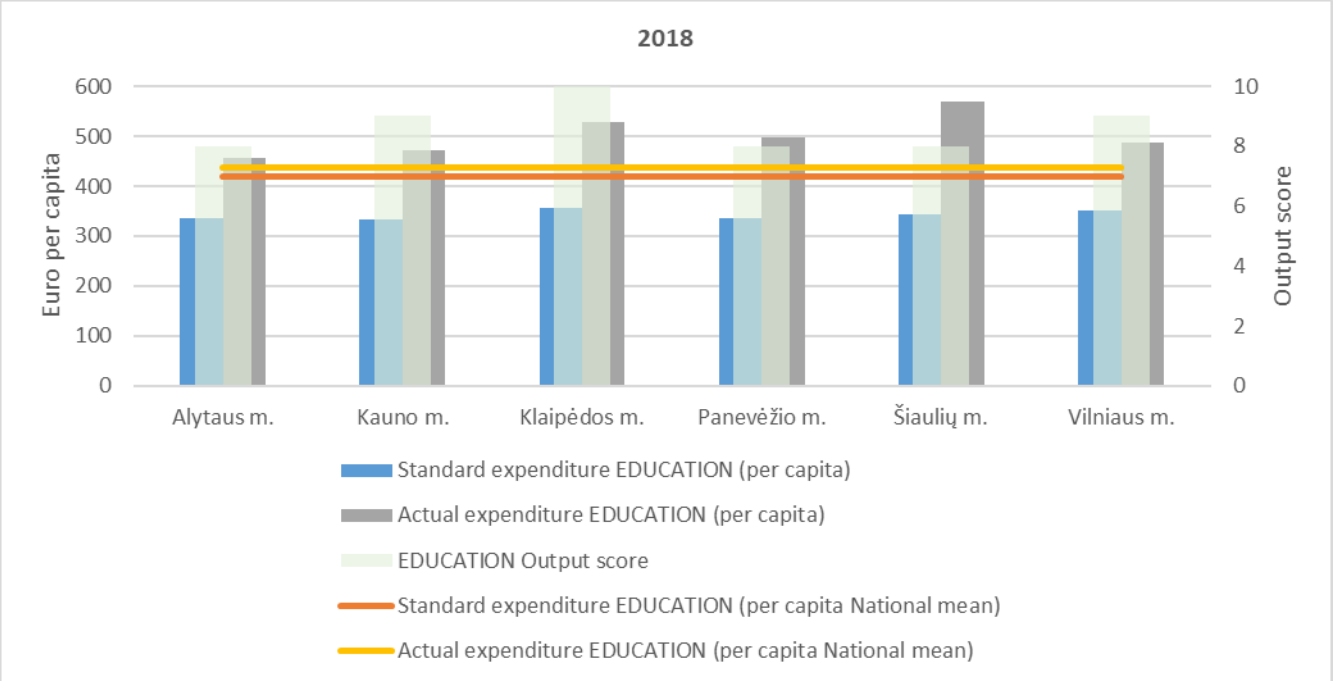
A qualitative measure of the level of services completes the overall computation of the standard level of services provided. The second methodological approach is based on a fixed proportion that has been chosen as value for the identification of the *Standard best school performance,* i.e. the annual mean of the average percentage of graduate pupils who have received grades between 91 and 100 in the following exams: Biology, Chemistry, Physics, Geography, IT, History, Lithuanian, Mathematics and Foreign language.

The final level of services provided is the combination of the quantitative and qualitative measures.

Standard expenditure needs results should be analysed considering also the level of services provided in order to have a complete picture of the municipal financial activity. The between cluster results previously displayed (***Figure 20***) could in fact be furtherly split through a within cluster analysis. Comparison between actual and standard level of expenditure can be combined with output normalized scores ranging from 1 to 10, where higher scores identify municipalities with an actual level of services provided significantly greater than the average.

An insight within each cluster provides also a valuable criterion to detect discrepancies of municipalities with the same structural socio-economic conditions. All *Big cities* (***Figure 21***) show a higher level of actual expenditure for Education than the standard, but they simultaneously display a high level of services provided (*over standard*). The elevated costs could be explained by a high density of population, as well as by a considerable number of students commuting to the big city from neighbouring municipalities and both elements require a high level of services to satisfy the demand.

Figure 21 Education standard and actual Expenditure – Big cities



For *Predominantly urban* (***Figure 22***) and *Predominantly rural* (***Figure 23***) municipalities the level of the expenditure is very close to the correspondent standard values and cluster averages are aligned with national ones. Considering that the two clusters include most of Lithuanian municipalities (over 83%) this result suggests an evident harmonization of the service and the reliability and robustness of the estimation.

Figure 22 Education standard and actual Expenditure – Predominantly urban

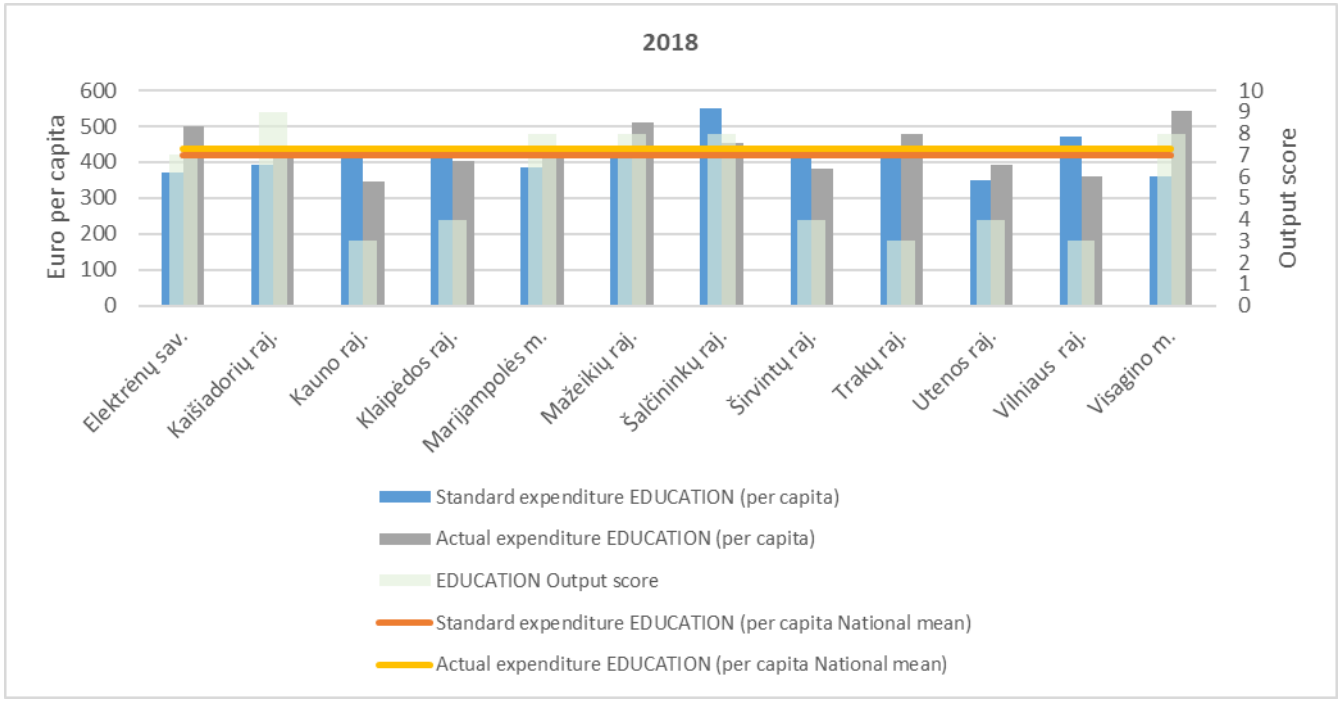
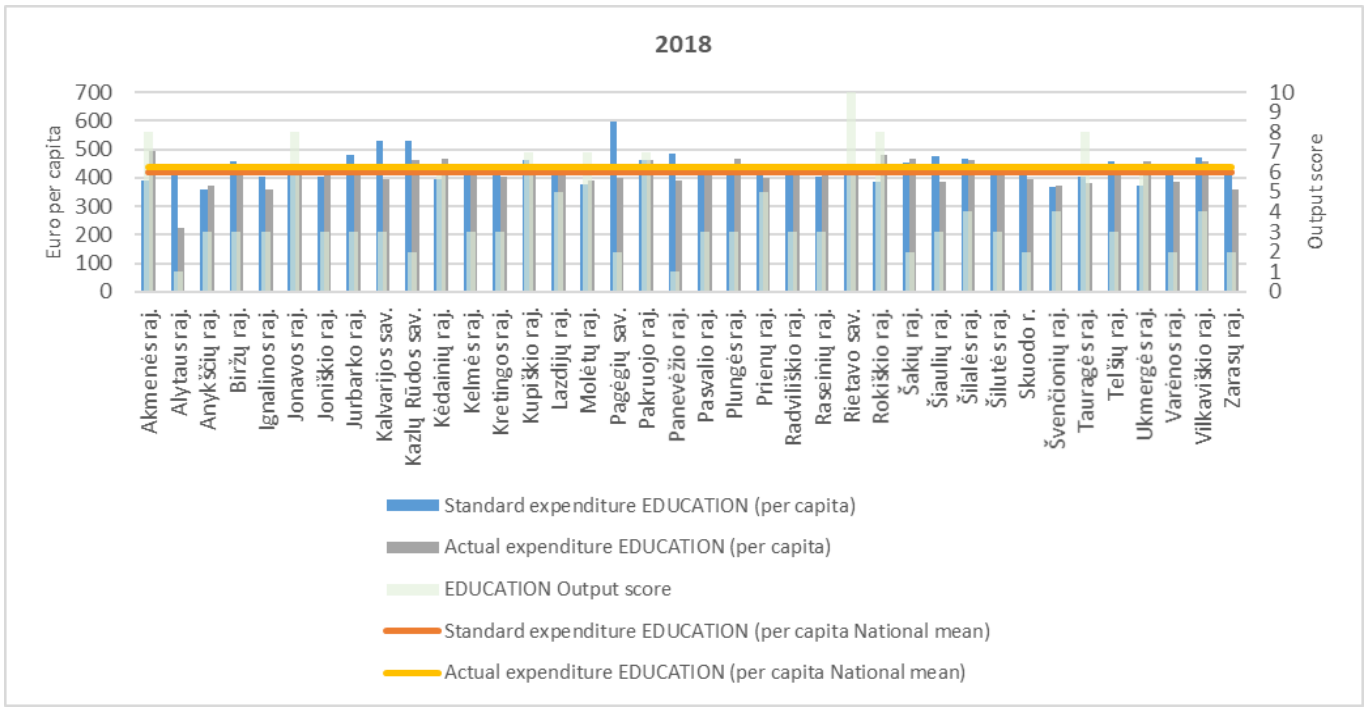
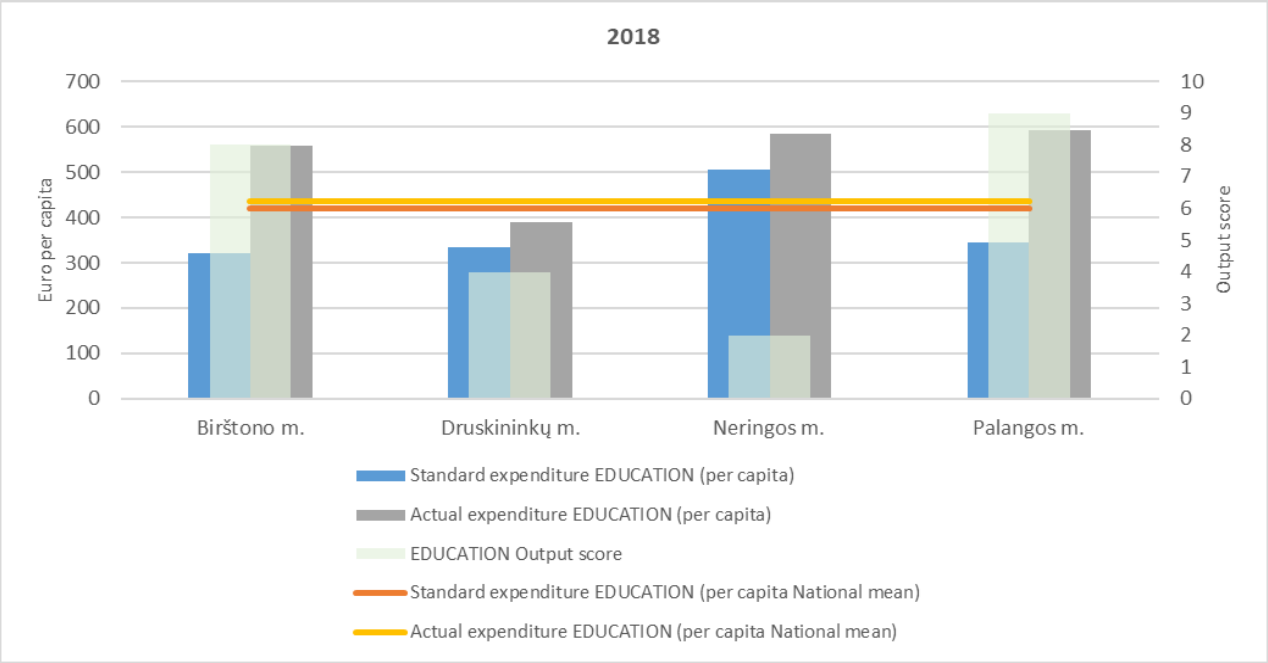


Figure 23 Education standard and actual Expenditure – Predominantly rural



Standard expenditure of *Resort* municipalities is systematically lower than the actual level especially for Birštono m. and Palangos m., justified by a correspondent high level of services provided. Neringos m. and Druskininkų m. show a not remarkable difference between standard and actual expenditure; however, considering that the level of services provided is quite low, both municipalities are inefficient.

Figure 24 Education standard and actual Expenditure – Resort



The methodological steps followed for the performance evaluation are based on the assessment of two indicators: the expenditure gap and the output gap. Both indicators are based on the computation of the difference between historical and standard values.

The expenditure gap is based on the comparison (percentage deviation) between actual level of expenditures and standard level of expenditures, while the final output gap is measured as a simple average of the following two indicators:

1. Percentage deviation between the actual and the standard number of teaching hours per inhabitant aged 0-19, where the number of teaching hours takes into account the number of hours worked per year for kindergarten educators and the number of hours worked per year for general education school's teachers:

$$Quantitative\ Output\ gap = \frac{\left(\frac{Teaching\ hours}{Population\ aged\ 0-19} - \frac{\text{Standard}\ (Number\ of\ teaching\ hours)}{Population\ aged\ 0-19}\right)}{\frac{\text{Standard}\ (Number\ of\ teaching\ hours)}{Population\ aged\ 0-19}} * 100$$

2. Percentage deviation between the actual and the standard value of best school performance indicator given by:

$$Qualitative\ Output\ gap = \frac{(Actual\ best\ school\ performance - \text{Standard}\ (best\ school\ performance))}{\text{Standard}\ (best\ school\ performance)} * 100$$

The final output gap is measured as a simple average of the first indicator, that gives a quantitative measure of the output gap, and the second one that reflects a qualitative dimension of the level of services provided:

$$Output\ gap = \frac{(Quantitative\ Output\ gap + Qualitative\ Output\ gap)}{2}$$

Percentage deviation of both expenditure gap and output gap can be converted into standardized scores with values ranging between 1 and 10 that provide a simple and direct way to analyse the level of the expenditure and the level of services provided for each municipality. The higher the score the higher the value of the actual expenditure or output compared to the standard (positive gap). The smaller the score the lower the historical level of expenditure and services provided compared to the standard (negative gap).

According to the methodology of the four quadrants previously explained, ***Table 16*** displays the distribution of the expenditure and output scores. Local authorities with both scores greater than 5 (which represents the median value), are placed in quadrant I, the top-right of the table, and they could be identified as *High service provision* or *Over standard* municipalities, i.e. administrations spending more than the standard and, at the same time, producing more services than the standard; on the opposite, in quadrant III (bottom-left area of the table) are placed municipalities with expenditure and output scores lower than 5 (*Low service provision* or *Under standard* municipalities), i.e. administrations spending less than the standard and providing also fewer services than the standard.

On the other hand, local authorities located in quadrant II on top-left of the table (*High performance* or *Efficient*) can be considered as potential benchmarks for identifying best practices, given that are administrations able to provide services above standard spending less than their expenditures needs. Finally, local authorities in quadrant IV on bottom-right of the table (*Low performance* or *Non efficient*) are potential cases that may improve their performance since exhibiting a level of services below standard and a level of current expenditure above their Standard expenditure needs.

For Education function most municipalities are distributed in the *over standard* quadrant, providing high levels of services at high costs, and in the *under standard* quadrant where the level of services provided is below the standard.

Table 16 Education Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10							1		1		2
9								1	2	1	4
8			2			1		5	3	1	12
7			1		1		1	1			4
6								2			2
5			1	1							2
4			2	2			1	2			7
3		4	4	2	1	1	2	4			18
2	1		4				1	1			7
1	1	1									2
Total	2	5	14	5	2	2	6	16	6	2	60

Expenditure and output scores can be totally summarized as follows (***Table 17***) or by cluster (***Table 18***). All *Big cities* and most of *Predominantly urban* municipalities are providing high level of services at high costs (*over standard*), while *Predominantly rural* should increase the supply of services (*under standard*).

Table 17 Education Performance (2018)

Performance	Number
Efficient	4
Non efficient	12
Over Standard	20
Under standard	24

Table 18 Education Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	
Non efficient	
Over Standard	6
Under standard	

Predominantly urban

Performance	Number
Efficient	1
Non efficient	2
Over Standard	5
Under standard	4

Predominantly rural

Performance	Number
Efficient	3
Non efficient	8
Over Standard	7
Under standard	20

Resort

Performance	Number
Efficient	
Non efficient	2
Over Standard	2
Under standard	

The following table (***Table 19***) reports the complete list of the two opposite areas of the quadrants, i.e. efficient and non-efficient municipalities.

Table 19 Education Efficient and Non efficient performers (2018)

Efficient	Non efficient
Kupiškio raj.	Druskininkų m.
Pakruojo raj.	Neringos m.
Šalčininkų raj.	Anykščių raj.
Tauragės raj.	Joniškio raj.
	Plungės raj.
	Radviliškio raj.
	Raseinių raj.
	Šakių raj.
	Šilutės raj.
	Švenčionių raj.
	Trakų raj.
	Utenos raj.

Finally, through the following maps it can be displayed the geographical distribution of municipalities according to the level of performance attributed to each municipality. The predominance of azure areas confirms, as previously analysed, the prevalence of the under standard level of performance (***Figure 25***) which is concentrated in rural areas (***Figure 26***).

Figure 25 Education Performance analysis map (2018)

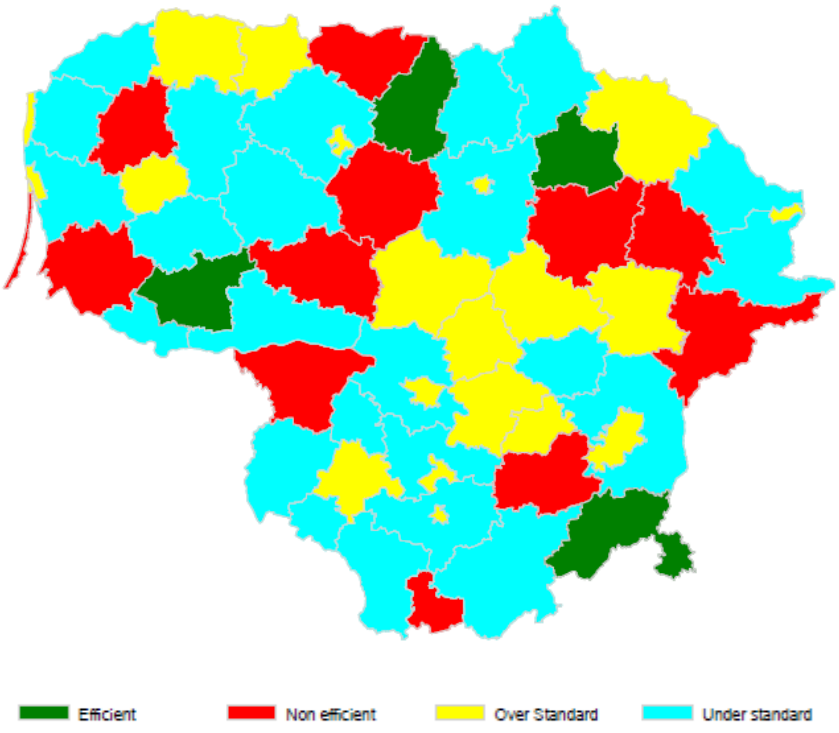
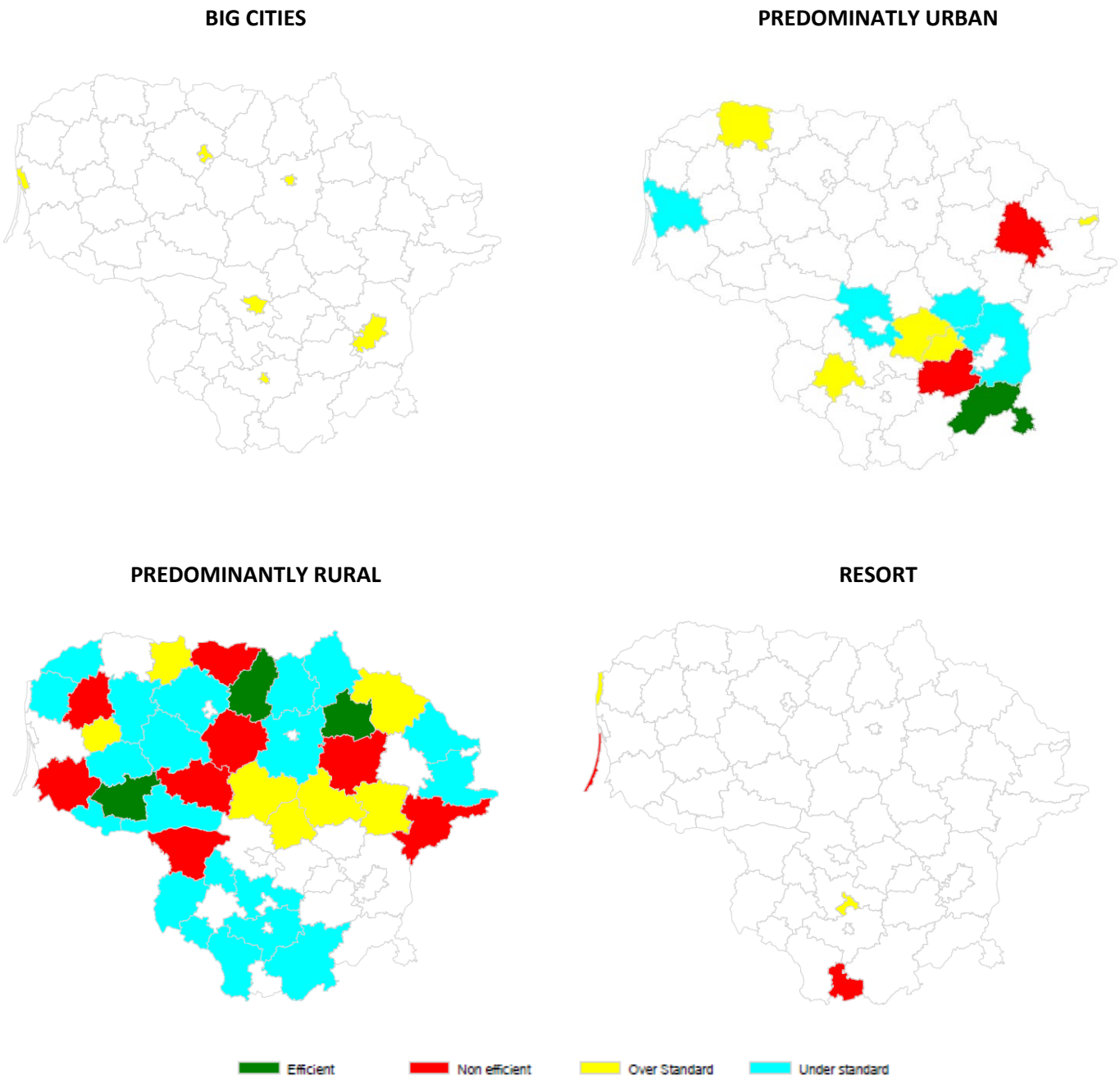


Figure 26 Education Performance analysis map by Cluster (2018)



Summarizing, the upward trend in expenses is contrasted by the downward trend in teaching hours, at least up to 2017. On the contrary, for 2018 teaching hours show an increasing trend according to the change registered for the number of pre-school pupils thus justifying the positive variation of the expenditures.

Considering that Education function covers approximately half of the total amount of municipalities expenditures this is an issue that should be addressed.

The high level of expenditures for all *Big cities* is justified by a high level of services provided due to an important demand of citizens. High density of population and concentration of activities require to enlarge the offer of the services.

On the opposite side, *Predominantly rural* municipalities should increase the supply of services (*under standard*) considering that, on average, expenditures values are aligned to the national ones.

3.1.2 Social security

Social security function plays a determinant role inside municipal activities, covering an important portion (14,5% for 2018) of total municipalities' expenditure as highlighted before (***Figure 9***).

In modern countries, it is the family that takes responsibility for the welfare of its members, and when the family itself is unable to provide for the care or protection of its members, the institutions, whether state or municipal, occur directly or indirectly. The main goal of the state is to ensure that public spending on welfare is sustainable and in line with the general budget of the state itself. State institutions and municipalities are the main actors behind the social welfare system and they design single social service strategies.

In the last years Lithuania has engaged a process of transformation towards the decentralization of social care services, and other important changes will happen in future years.

As Lithuania is undergoing a process of emigration of the working age population to foreign countries and at the same time an increase in the age of the population, as well as a shift towards urban areas, it is even more necessary to analyse and focus the attention on the different areas of intervention by municipalities.

The available information related to Social security function included in the dataset, as explained before, represent a consistent and complete set of information useful for the analysis of the sector. The additional information collected also through a specific questionnaire, directly submitted to municipalities, identifies an additional set of variables extremely useful for the measurability of the level of services provided.

Current expenditure computation for Social security function takes into account the following (***Table 20***) items of the municipal Balance sheet, which identify the main categories in which municipalities spend their resources to ensure the subsistence and well-being of citizens.

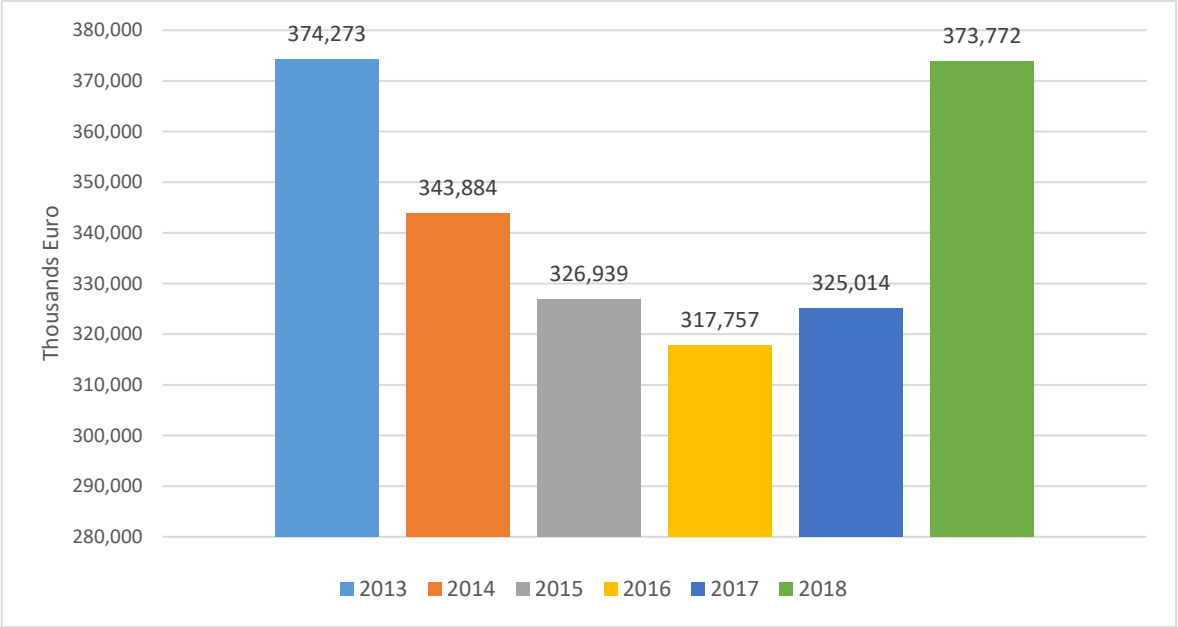
Table 20 Classification of the current expenditure for Social security

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
10. SOCIAL SECURITY	10.01. Ilness and Disability
10. SOCIAL SECURITY	10.02. Old age
10. SOCIAL SECURITY	10.03. Social assistance in case of close relative death
10. SOCIAL SECURITY	10.04. Family and children
10. SOCIAL SECURITY	10.05. Unemployment
10. SOCIAL SECURITY	10.06. Housing
10. SOCIAL SECURITY	10.07. Other vulnerable persons not included in the group

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
10. SOCIAL SECURITY	10.08. Research and development in the field of social security
10. SOCIAL SECURITY	10.09. Other social security matters not assigned to any group

The total amount of municipal current expenditure on Social security has constantly decreased[14] (***Figure 27***) from 2013 to 2016, while 2017 and 2018 show an inversion of the trend with a significant increase.

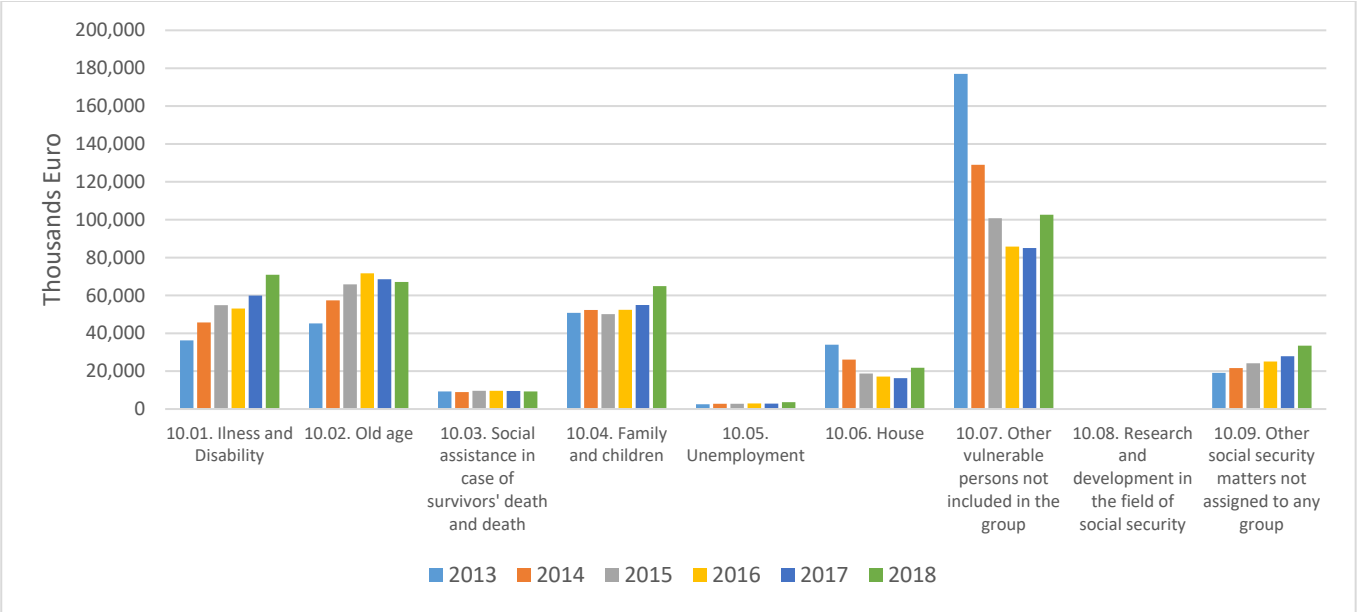
Figure 27 Social security current expenditure evolution



The dynamic of Social security expenditure can be furtherly analysed (***Figure 28***) considering the second level items of expenditure classification.

[14] Nominal values.

Figure 28 Social security current expenditure evolution and structure



The sub-group of expenditures related to *Other vulnerable persons* absorbs the main part of the current expenditure (***Table 21***) although with a decreasing impact on total expenditure between 2013-2018 (from 47,30% in 2013 to 27,46% in 2018).

The other categories of expenditure (***Table 21***) related to *Family and children*, *Old age* and *Illness and disability* which absorb another important portion of the total amount of current expenditure, move on the opposite direction. The percentage over the total expenditure basically increases between 2013-2018 (respectively from 13,57%, 12,07%, and 9,69% in 2013 to 17,37%, 17,95% and 18,97% in 2018).

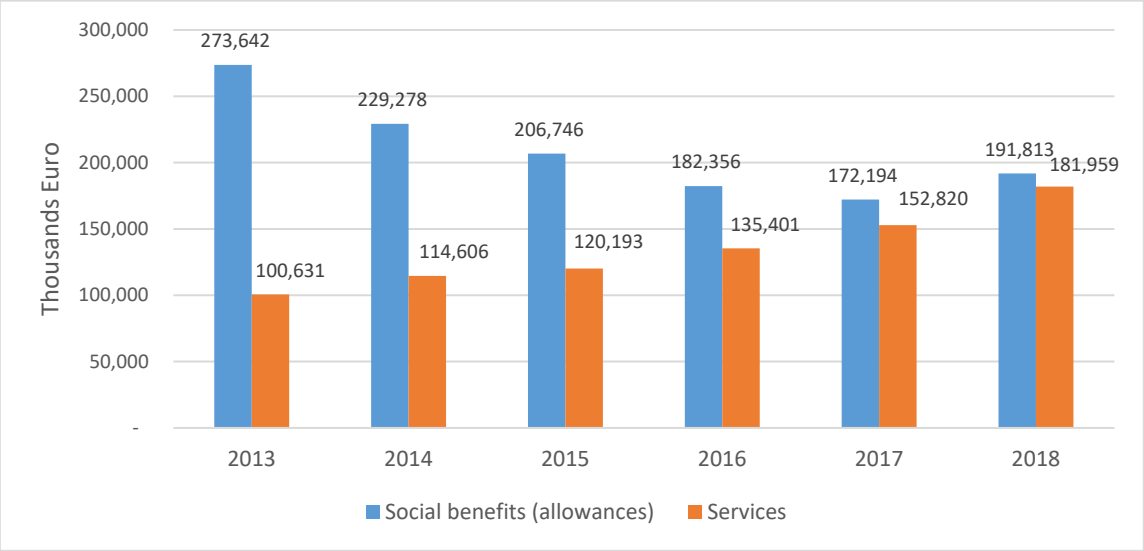
Table 21 Social security current expenditure decomposition

	10.01. Illness and Disability	10.02. Old age	10.03. Social assistance in case of close relative death	10.04. Family and children	10.05. Unemployment	10.06. Housing	10.07. Other vulnerable persons not included in the group	10.08. Research and development in the field of social security	10.09. Other social security matters not assigned to any group	Total Expenditure
2013	9,69%	12,07%	2,49%	13,57%	0,68%	9,09%	47,30%	0,00%	5,11%	100,00%
2014	13,30%	16,70%	2,61%	15,21%	0,80%	7,59%	37,50%	0,00%	6,30%	100,00%
2015	16,79%	20,13%	2,94%	15,34%	0,86%	5,73%	30,82%	0,00%	7,40%	100,00%
2016	16,70%	22,54%	3,04%	16,50%	0,93%	5,39%	26,99%	0,00%	7,90%	100,00%
2017	18,43%	21,08%	2,94%	16,90%	0,89%	5,01%	26,17%	0,00%	8,57%	100,00%
2018	18,97%	17,95%	2,49%	17,37%	0,97%	5,82%	27,46%	0,00%	8,96%	100,00%

The following graph (***Figure 29***) reports the decomposition of the total expenditure obtained by separating expenditure related to Social benefits (identified by the sub-item 2.7 of the municipal balance sheet) from the expenditures related to Services in kind.

The costs for allowances (social benefits) have progressively decreased between 2013 and 2018, on the contrary expenditures for social services have progressively increased. The opposite trend of the two components makes the distinction essential for the definition of reliable standard costs.

Figure 29 Social security current expenditure evolution by benefits and services



The completeness of the information available lies at the basis of the implementation of the cost function used for the estimation of the Standard expenditure needs (SEN), where the main output indicators[15] for expenditures are represented by:

1. Composite indicator of services provided by target users (per inhabitant);

2. Composite indicator of social benefits by target users (per inhabitant).

The following table (***Table 22***) reports the list of the variables included in the model of the cost function used for the estimation of the Standard expenditure needs, which can be considered as *cost-shifts* aimed at capturing the intensity with which the service is offered.

The first variable refers to the dependent variable of the Standard expenditure needs model, the others are the explanatory variables belonging to different explicative groups.

[15] The estimation of the cost function has been restricted within the range of time 2015-2018 due to the limited availability of information on the set of services provided.

Table 22 Social security Expenditure determinants

CATEGORY	Description
DEPENDENT VARIABLE	Actual cost per inhabitant (euro per inhabitant)
CONTEXT VARIABLES	Individuals living at risk of poverty or social exclusion (%)
CONTEXT VARIABLES	Life quality index
CONTEXT VARIABLES	Ratio of the unemployed to the working age population (%)
SERVICES OFFERED	Composite indicator of services provided by target users (per inhabitant)
SERVICES OFFERED	Composite indicator of social benefits by target users (per inhabitant)
CONTEXT VARIABLES	Cluster 1: Big cities
CONTEXT VARIABLES	Cluster 2: Predominantly urban
CONTEXT VARIABLES	Cluster 3: Predominantly rural
CONTEXT VARIABLES	Cluster 4: Resort

The level of services provided has been measured through two composite indicators that summarize both information related to the provision of services in kind and information related to social benefits (allowances):

1. *Composite indicator of services provided (weighted sum of service users);*
2. *Composite indicator of social benefits (weighted sum of allowances recipients).*

The identification of the two groups of outputs is directly related to the previously explained decomposition of the current expenditures.

The first composite indicator of services in kind takes into account target users distinct by macro area of intervention. Users receiving social services are divided into the following target groups:

- Elderly people;
- Adults (working age people);
- Children.

Information about users receiving social services is also available for the corresponding groups with disabilities.

Macro areas of intervention are distinguished into:

- Institutional (long term);
- Day care (short term);
- Home care (short term).

Information concerning users receiving social services by macro area of intervention has been collected through a new modality for Lithuanian system, i.e. questionnaires submitted to local authorities. Through the survey, which was prepared in collaboration with Lithuanian authorities, local municipalities were

requested to provide information relating to accounting and structural factors in the implementation of social services at municipal level according to the following matrix (***Table 23***):

Table 23 Municipal social services

TARGET	INSTITUTIONS (long term)	DAY CARE (short term)	HOME CARE (short term)
Elderly people	X	X	X
Elderly people with disabilities	X	X	X
Adults (Working age people)	X	X	X
Adults (Working age people) with disabilities	X	X	X
Children	X	X	X
Children with disabilities	X	X	X

All the information collected through the questionnaire has been summarized through the computation of the corresponding composite indicator:

$$Composite\ indicator\ of\ social\ services_{it} = \sum_{j} (Users_{ijt} * weight_{jt})$$

where *i* refers to municipality, *j* to social services and target groups (***Table 23***) and *t* identifies the year of analysis.

For each municipality and for each available year, the composite indicator synthesizes all the intersections of the matrix, i.e. information related to target users (Elderly, Adults and Children and corresponding target groups with disabilities) combined with information related to macro areas of intervention (institution, day care and home care).

Weights have been computed taking into account corresponding information related to expenditures needed for the provision of the services. The basic components of the system of weights are represented by simple indicators of the unit cost of the services:

$$Expenditure\ per\ User_{jt} = \frac{\sum_i Expenditure\ per\ user_{ijt}}{\sum_i User_{ijt}}$$

For each combination of target users (Elderly, Adults and Children and corresponding target groups with disabilities) and macro area of intervention (institution, day care and home care), weights are equal to:

$$Weight_{jt} = \frac{Expenditure\ per\ User_{jt}}{\sum_j Expenditure\ per\ User_{jt}}$$

For each year the sum of weights is equal to 1 and the following table (***Table 24***) reports the values of the weights for each combination of target group and macro area of intervention of the matrix collected through the questionnaire.

Table 24 Weights of Social services (2018)

Social services	Target group					
	Elderly people	Elderly people with disabilities	Adults (Working age)	Adults (Working age) with disabilities	Children	Children with disabilities
Institutional (long term)	0,0985	0,0720	0,0310	0,0726	0,1857	0,1796
Day care (Short term)	0,0240	0,0385	0,0119	0,0679	0,0088	0,1047
Home care (short term)	0,0260	0,0232	0,0120	0,0254	0,0082	0,0100

The same approach has been followed for the implementation of the second composite indicator related to Social benefits (allowances).

The composite indicator of social benefits considers users receiving social allowances divided into the following target groups:

- Number of recipients of compensation for the cost of heating the house and the cost of water;
- Students who have received free meals;
- Number of pupils who have received support for the acquisition of student needs;
- Number of recipients of funeral benefits.

All the information concerning recipients of social allowances has been summarized through the computation of the corresponding composite indicator:

$$Composite\ indicator\ of\ social\ benefits_{it} = \sum_{j} (Users_{ijt} * weight_{jt})$$

where *i* refers to municipality, *j* to social benefits and *t* identifies the year of analysis.

Weights have been calculated taking into account corresponding information related to expenditures needed for the provision of the benefits. The basic components of the system of weights are represented by simple indicators of the unit cost per user:

$$Expenditure\ per\ User_{jt} = \frac{\sum_i Benefit\ expenditure_{ijt}}{\sum_i User_{ijt}}$$

For each of the target user, weights are equal to:

$$Weight_{jt} = \frac{Expenditure\ per\ User_{jt}}{\sum_j Expenditure\ per\ User_{jt}}$$

For each year, the sum of weights is equal to 1 and the following table reports the values of the weights for each target group.

Table 25 Weights of Social benefits (2018)

Social benefits			
The number of recipients of compensation for the cost of heating the house and the cost of water	Students who have received free meals	The number of pupils who have received support for the acquisition of a student's needs	Number of recipients of funeral benefits
0,2330	0,2998	0,0737	0,3934

For each municipality and for each available year, the total actual composite indicator is calculated as the sum of the two actual composite indicators explained above and it identifies the total weighted sum of social services users and allowances recipients:

$$Composite\ indicator_{it} = Composite\ indicator\ of\ social\ services_{it} + Composite\ indicator\ of\ social\ benefits_{it}$$

For each composite indicator, the corresponding standard level has been calculated as the weighted sum of standard users according to the following generic (valid for both composite indicators) formula:

$$Standard\ Composite\ indicator_{it} = \sum_j Standard(Users_{ijt}) * weight_{jt}$$

For each composite indicator, the system of weights is the same explained before and the standard users take into account a fixed proportion, which is the median value by cluster of the users per target population. The product between the median value and the target population identifies the standard number of users as follows:

$$Standard\ (Users_{jt}) = Median_{Cluster}\left(\frac{Users_{jt}}{Target\ population_{jt}}\right) * Target\ population_{ijt}$$

The following table (***Table 26***) reports the list of target populations used for the computation of the standard level of social security outputs.

Table 26 Target population for users

	Social services institutional, day care and home care			Social benefits			
	Elderly people	Adults (Working age)	Children	The number of recipients of compensation for the cost of heating the house and the cost of water	Students who have received free meals	The number of pupils who have received support for the acquisition of students' needs	Number of recipients of funeral benefits
Target population	65 years and older	19 - 64 years	0 - 18 years	Resident population	0 - 19 years	0 - 19 years	Resident population

The total standard composite indicator of services and benefits by target users is the sum of the two standard composite indicators.

$$Standard\ Composite\ indicator_{it} =$$
$$Standard\ Composite\ indicator\ of\ social\ services_{it} + Standard\ Composite\ indicator\ of\ social\ benefits_{it}$$

The cost function allows for the estimation of the standard expenditure per inhabitant. Standard expenditure computation for Social security takes into account the results of the cost function model and it can be written as the product between the estimated expenditure per inhabitant and the number of inhabitants:

$$\text{Standard}(Expenditure) = \text{Standard}\left(\frac{Expenditure}{Resident\ Population}\right) * \text{Resident Population}$$

For the computation of the Standard expenditure needs, the following table (***Table 27***) reports the *default* values for policy determinants, i.e. variables that could be used by the policy maker to estimate different equalisation scenarios.

Table 27 Social security Policy determinants (default)

Policy determinant	Default value
Ratio of the unemployed to the working age population	Municipality actual value
Composite indicator of social services	Standard value
Composite indicator of social benefits	Standard value

The expected values of current expenditure of each local government are obtained by considering, as the default value, the standard composite indicator of social services and the standard composite indicator of social benefits.

Inside the framework of the cost function approach, exogenous outputs should be considered as a target to be achieved by the local authority.

Moreover, total standard expenditures have been split into two main components: one related to the standard expenditure of social services and the other one related to the standard expenditure for social benefits.

$$\text{Standard}(Expenditure) = \text{Standard}(Social\ services\ Expenditure) + \text{Standard}(Social\ benefits\ Expenditure)$$

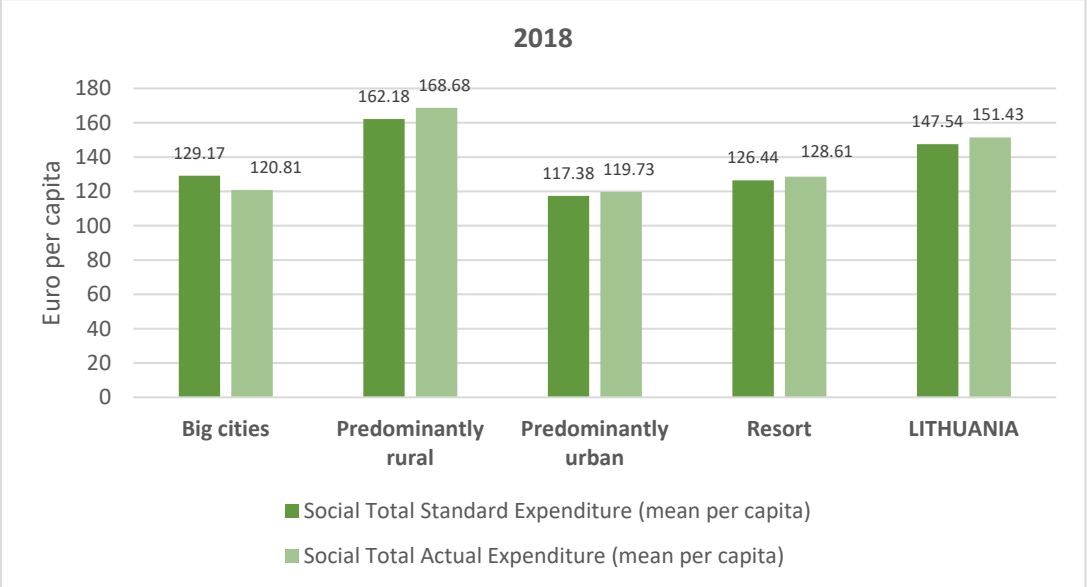
Standard expenditure for Social services depends on the determinant of the corresponding composite indicator (share of total standard expenditure explained by Social services) and on a redistribution of the basic uniform standard cost.

Standard expenditure for Social benefits depends on the determinant of the corresponding composite indicator (share of total standard expenditure explained by Social benefits) and on a redistribution of the basic uniform standard cost.

The results analysis related to the Standard expenditure needs can start from the comparison between the average of both actual and standard expenditure. The total per capita values displayed (***Figure 30***) show a level of actual expenditure slightly above the standard (+2,6%).

A deeper insight by cluster shows that *Predominantly rural* municipalities display values above national averages. In addition, the actual expenditure per inhabitant is higher than the standard (+4%). The actual value of the expenditure is higher than the standard also for *Predominantly urban* municipalities (+2%) and *Resorts* (around +2%), while the two dimensions are inverted for Big cities (-6,5%).

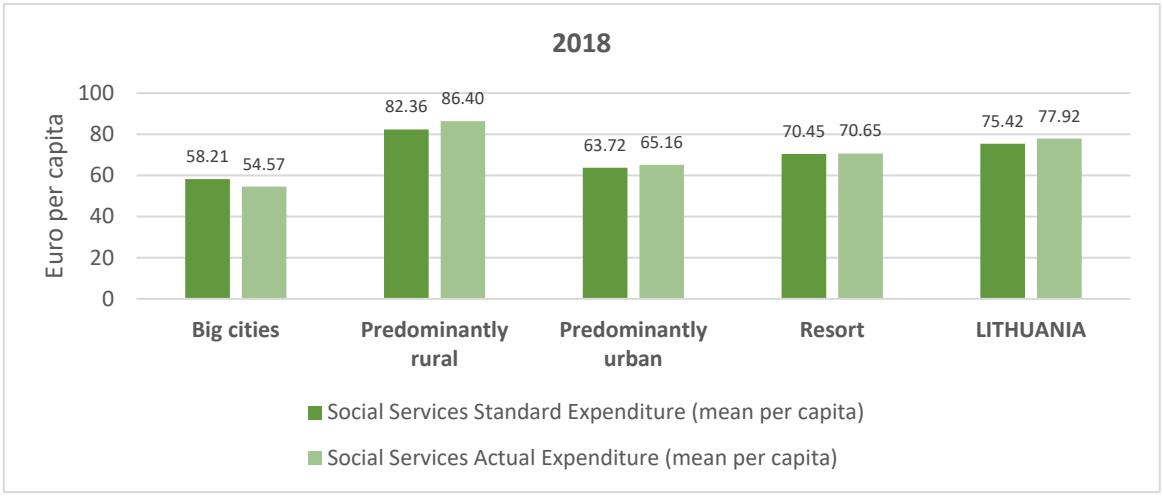
Figure 30 Social security Standard and Actual expenditure



Total actual and standard expenditures can be split, as explained before, into two main components: social services expenditure and social benefits expenditure.

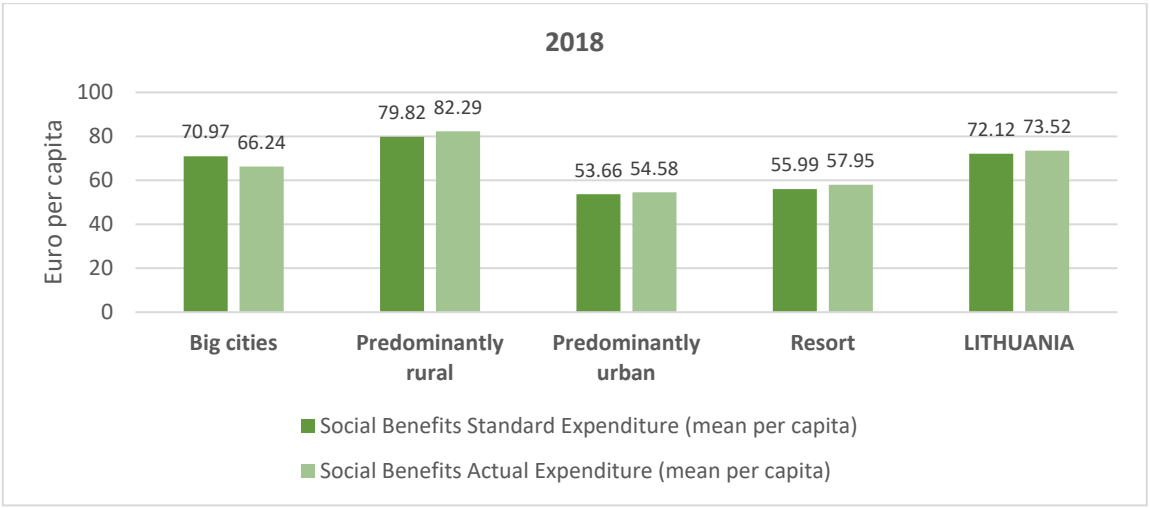
For Social services expenditure, the highest per capita expenditures are recorded among *Predominantly rural* municipalities (per capita Social services standard expenditure equal to 82,36 euro and actual value equal to 86,40 euro), while *Big cities* record the least substantial value (58,21 and 54,57 euro per capita respectively for standard and actual level of expenditure). The direction of the gaps confirms the trend registered for total expenditure, where actual values are on average higher than the standard ones for all the clusters except for *Big cities* for which a within cluster insight is needed.

Figure 31 Social services Standard and Actual expenditure



From Social allowances point of view *Big cities* record values very close to the national averages and the standard per capita values continue to remain above the actual ones. Lowest average per inhabitant values of both standard and actual expenditure can be attributed to *Predominantly urban* municipalities (53,66 euro per capita and 54,58 euro per capita respectively for standard and actual expenditure).

Figure 32 Social benefits Standard and Actual expenditure



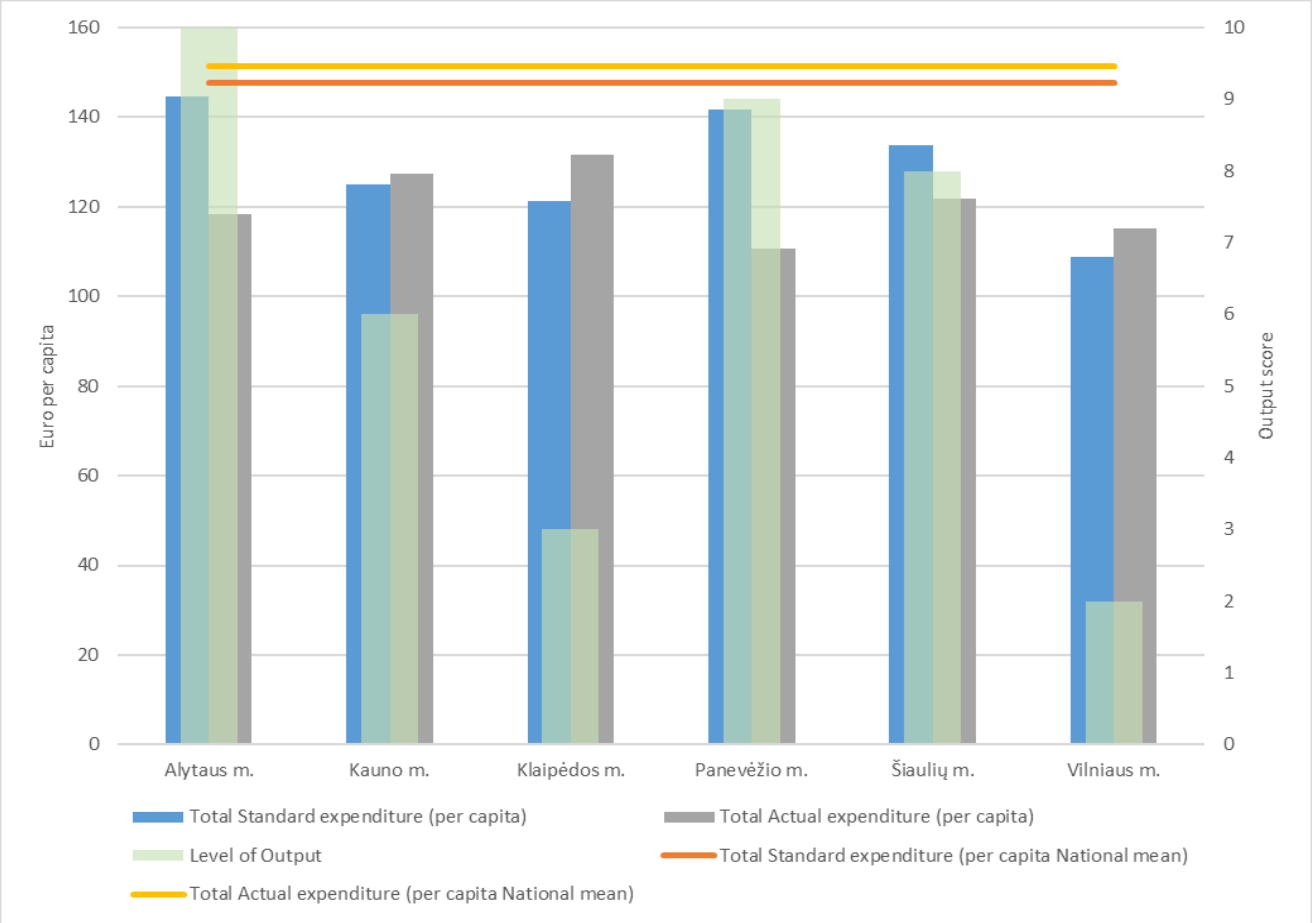
Considering the importance of the sector, the comparison between expenditures has been enriched with additional information related to the level of services provided with the aim to offer a full picture of the function. The level of services and benefits provided has been measured, as explained before, through the two composite indicators, one related to the social services and the other one related to social benefits.

Output gaps have been turned into normalized scores for which, the higher the score the greater the value of the actual level of services provided compared to the standard. The smaller the score the lower the historical level of services provided compared to the standard. Joining the results on expenditure and the provision of the services completes the set of information that is the basis of the performance analysis.

A within cluster analysis of *Big cities* (***Figure 33***) highlights that the standard expenditure is higher than the actual value for Alytaus m., Panevėžio m. and Šiaulių m. that are, at the same time, producing a high level of services and benefits, a combination that ensures a high level of efficiency according to the four quadrants methodology adopted for the scope of the analysis.

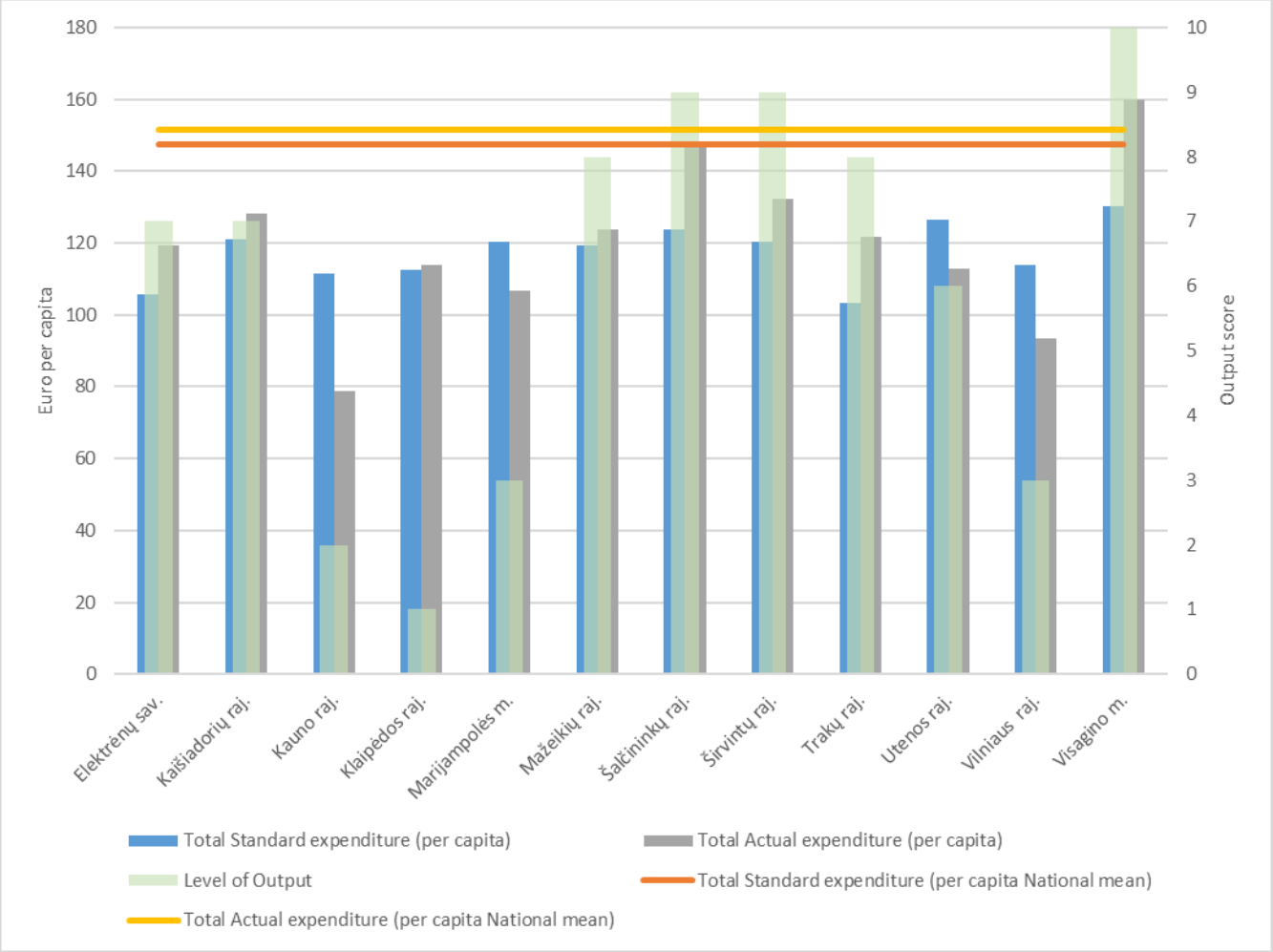
For the remaining municipalities the gaps go in the opposite direction, particularly for Vilniaus m. and Klaipėdos m. for which the low level of services and benefits provided implies an inefficient level of performance.

Figure 33 Social security standard and actual Expenditure – Big cities (2018)



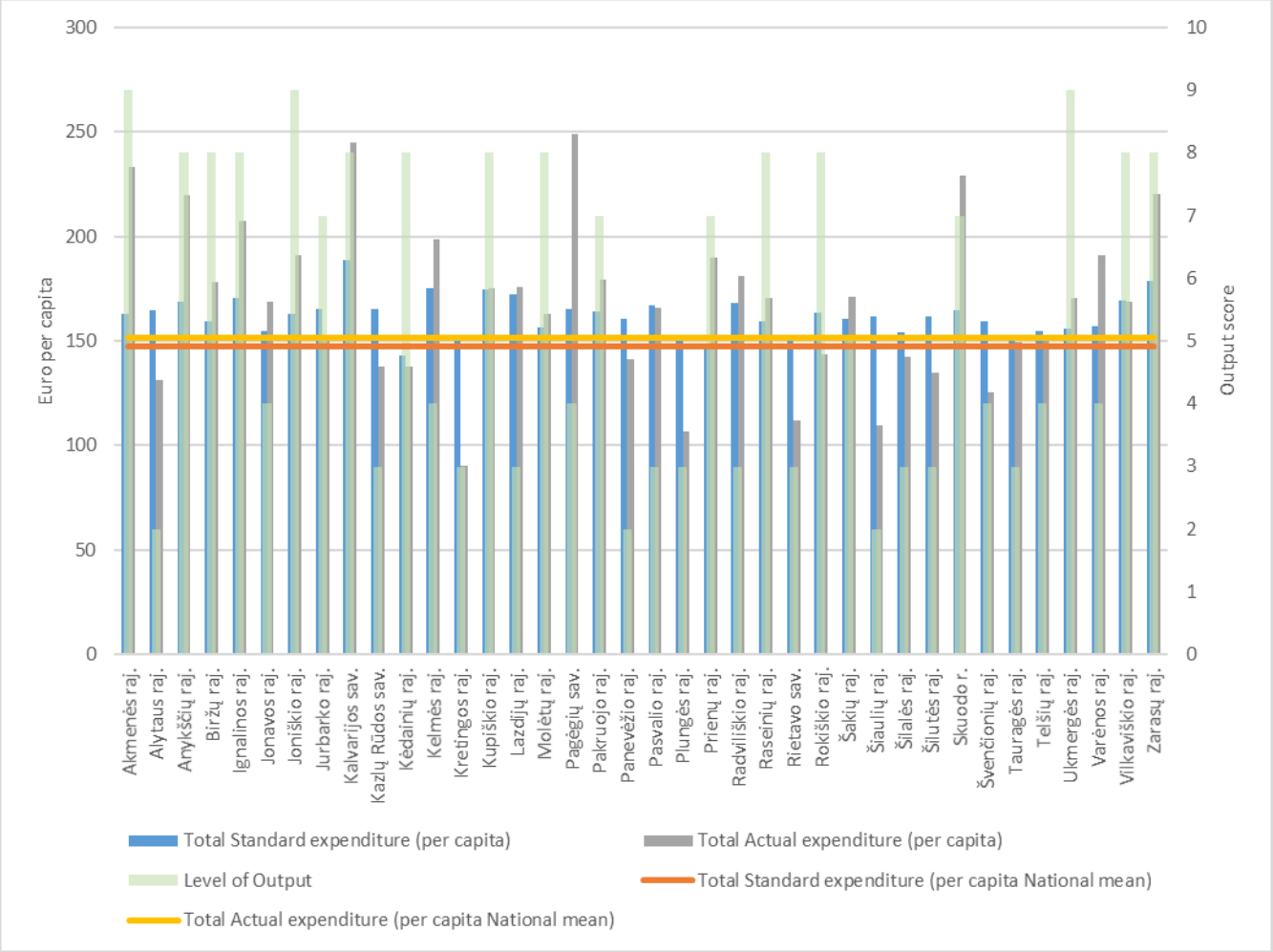
Predominantly urban municipalities (***Figure 34***) basically lie below the expenditure national average with the only exception of Visagino m. and most of the municipalities of this cluster display a positive gap between actual and standard expenditure, i.e. actual expenditure is higher than the standard. Kauno raj., Marijampolės m. and Vilniaus raj. show a standard value of the expenditure higher than the corresponding actual value but the level of services and benefits provided is quite low (under standard).

Figure 34 Social security standard and actual Expenditure – Predominantly urban (2018)



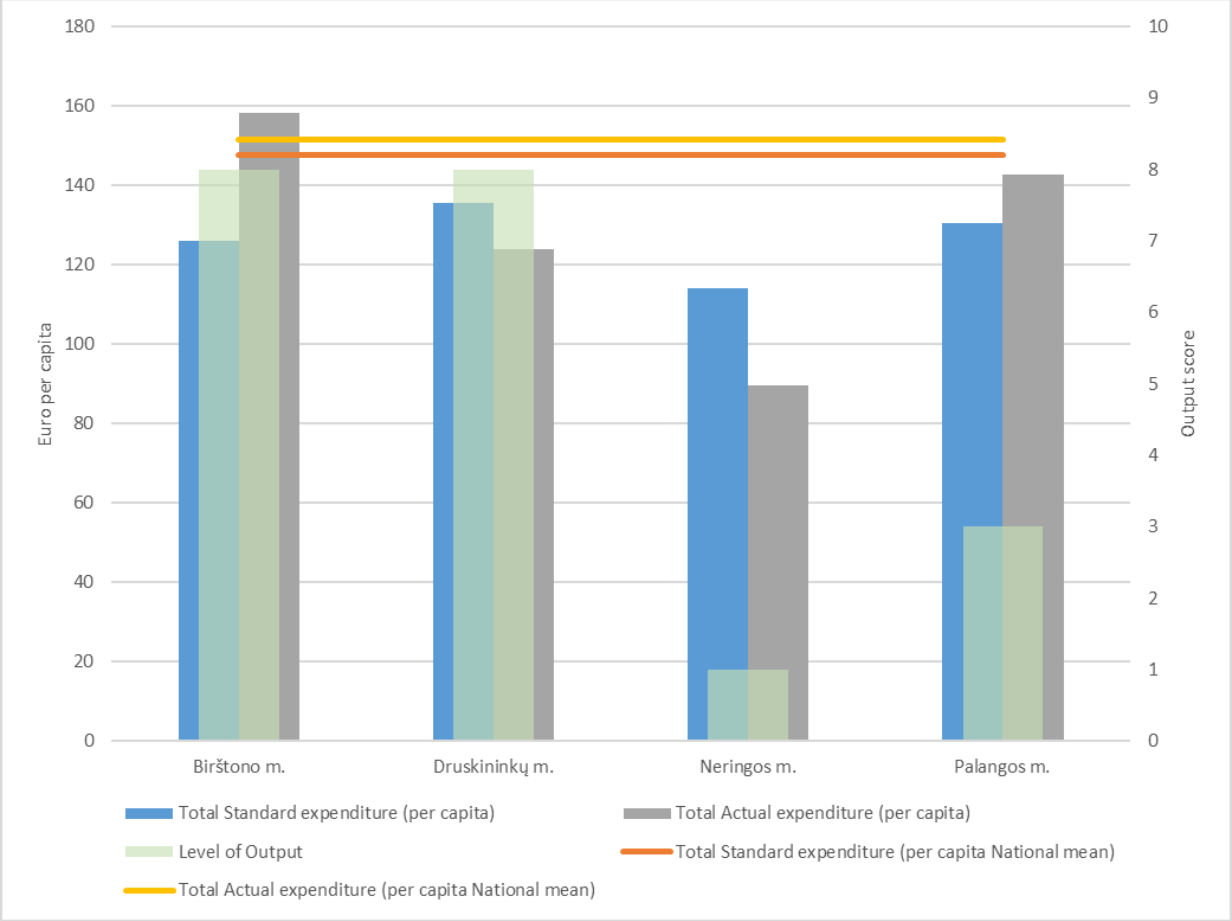
Predominantly rural municipalities (***Figure 35***) show total expenditure values above the national averages in most cases. Akmenės raj., Kalvarijos sav., Pagėgių sav. and Skuodo r. are the municipalities with the highest gap between actual and standard expenditure. Most municipalities are under standard or over standard, while Jurbarko raj., Kėdainių raj., Rokiškio raj. and Vilkaviškio raj. have negative gaps on the expenditure and positive gaps on the outputs (efficient).

Figure 35 Social security standard and actual Expenditure – Predominantly rural (2018)



Finally, for *Resort* municipalities (***Figure 36***) Birštono m. and Palangos m. show values of the actual expenditures higher than the standard, with only the first two municipalities displayed in the graph providing a high level of services and benefits. Both Druskininkų m. and Neringos m. report values of the actual expenditures lower than the standard ones but with different levels of services and benefits provided, over the standard for the former and below the standard for the latter.

Figure 36 Social security standard and actual Expenditure – Resort (2018)



Overall results related to the combination of the comparison between actual and standard values of both expenditure and level of services can be summarized through the distribution of normalized scores, with values ranging between 1 and 10 (***Table 28*** and ***Table 29***). For Social security function most of Lithuanian municipalities are *over standard*, spending more than the standard and providing a level of services higher than the standard.

Table 28 Social security Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10			1						1		2
9		1						4		1	6
8			3	1	1	1	2	4	4		16
7				1			1	2	2		6
6			1				1				2
5							1				1
4			1	1				3		1	6
3	1	2	4	2	1		1	3			14
2	1	1	2				1				5
1		1				1					2
Total	2	5	12	5	2	2	7	16	7	2	60

Table 29 Social security Performance (2018)

Performance	Number
Efficient	9
Non efficient	11
Over Standard	23
Under standard	17

The overall results can be subdivided within clusters in order to analyse in detail the individual behaviours of municipalities. The analysis shows that the most efficient municipalities are distributed among *Big cities* and *Predominantly rural* groups. Moreover, this last group gathers most of *over standard* and *under standard* municipalities.

Table 30 Social security Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	3
Non efficient	2
Over Standard	1
Under standard	

Predominantly urban

Performance	Number
Efficient	1
Non efficient	1
Over Standard	7
Under standard	3

Predominantly rural

Performance	Number
Efficient	4
Non efficient	7
Over Standard	14
Under standard	13

Resort

Performance	Number
Efficient	1
Non efficient	1
Over Standard	1
Under standard	1

The following table (***Table 31***) reports the complete list of the two opposite areas of the quadrants, i.e. efficient and non-efficient municipalities.

Table 31 Social security Efficient and Non efficient performers (2018)

Efficient	Non efficient
Alytaus m.	Vilniaus m.
Druskininkų m.	Klaipėdos m.
Panevėžio m.	Palangos m.
Šiaulių m.	Jonavos raj.
Jurbarko raj.	Kelmės raj.

Efficient	Non efficient
Kėdainių raj.	Klaipėdos raj.
Rokiškio raj.	Lazdijų raj.
Utenos raj.	Radviliškio raj.
Vilkaviškio raj.	Šakių raj.
	Varėnos raj.
	Pagėgių sav.

Finally, through the following maps, the municipalities' geographical distribution can be displayed, according to the level of performance attributed to each municipality. The predominance of yellow areas confirms, as previously analysed, the prevalence of over standard levels of performance (***Figure 37***) which are mainly concentrated in rural areas (***Figure 38***).

Figure 37 Social security Performance analysis map (2018)

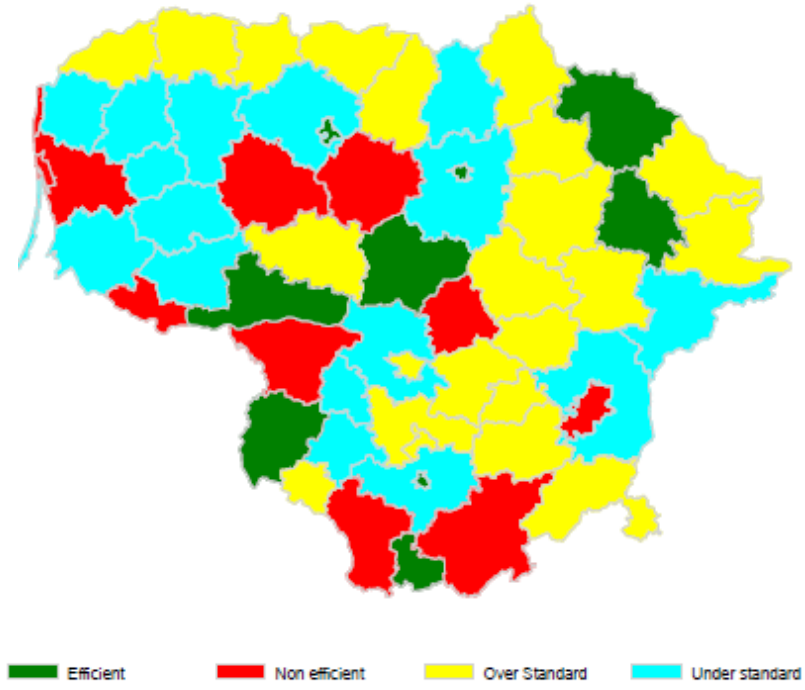
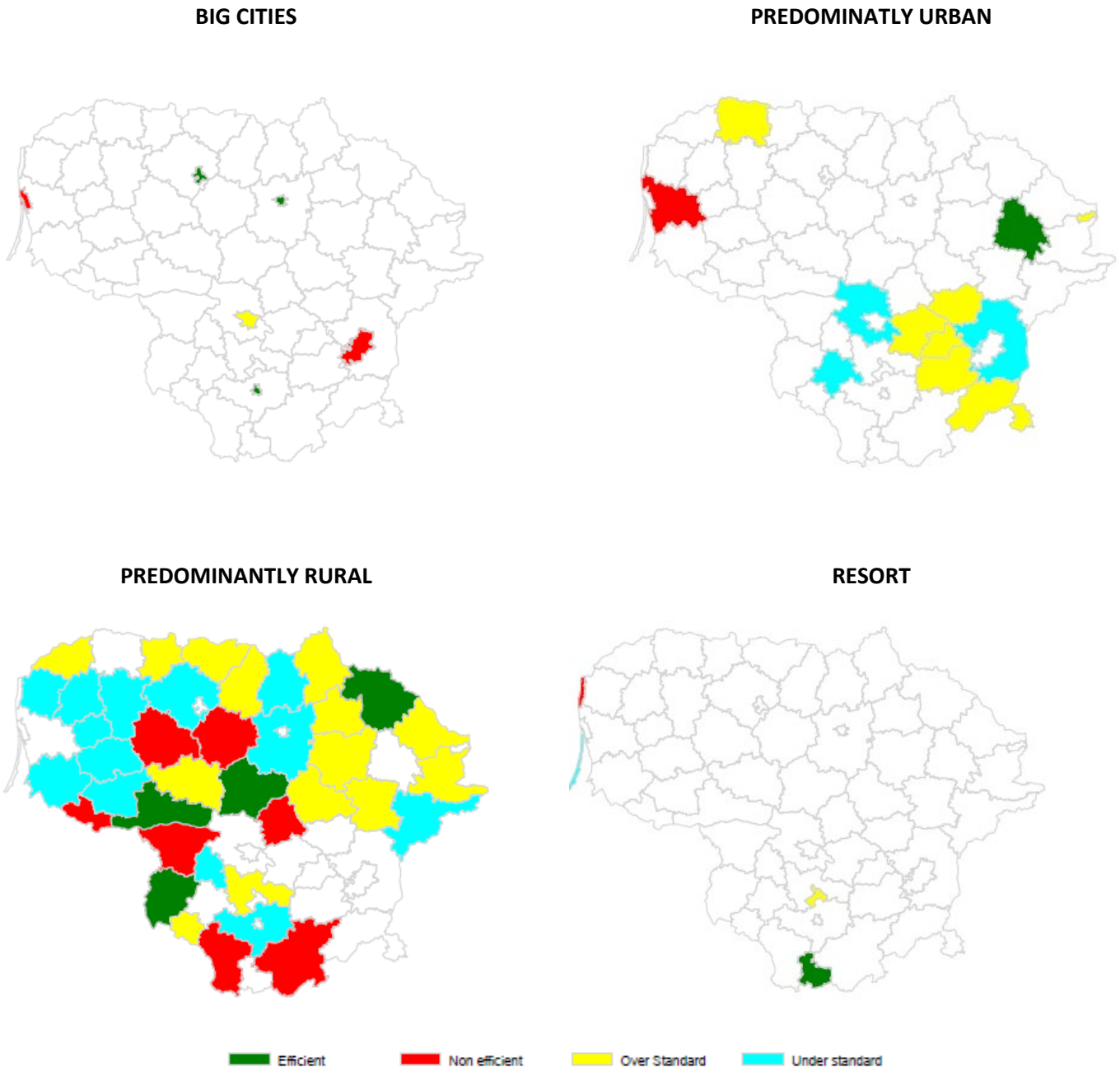


Figure 38 Social security Performance analysis map by Cluster (2018)



Summarizing, for Social security function it should be underlined the substantial incidence of local authorities identifiable as high service provision administrations. These are municipalities spending more than the standard and, at the same time, producing more services than the standard which can be seen as "normal" under the principle that local governments should be left free to exercise their autonomy in order to satisfy the local demand for public services.

On the contrary, the national government should analyse the level of services provided by under standard municipalities mainly grouped in *Predominantly rural* cluster. This could lead to the identification of essential (minimum) levels of services that should be guaranteed throughout the national territory.

The dynamic of the evolution of Social security current expenditure (*Figure 29*) is showing that social services are increasing their weights in the composition of the total amount of expenditures, while the weight on social benefits follows an opposite path. To define service objectives and/or essential levels of services in accordance with target populations becomes a fundamental task.

The task of the policy maker is to decide what percentage of the target users should be served especially with reference to the most widespread services that have a direct impact on the health/wellbeing of the population. This is required also by the process of transformation towards decentralization of social care services that has been engaged recently in Lithuania.

The increase in the age of population, as well as the growing urbanization, implies a deeper analysis and focus on the different areas of intervention by municipalities especially for some categories of expenditures, family and children, old age and illness and disability.

3.1.3 Recreation, culture and religion

The set of available data related to **Recreation, culture and religion** function represent a consistent and complete basket of information useful for the analysis of the sector. The availability and measurability of the level of services provided enables the use of the cost function for the identification of the efficient level of expenditures (SEN).

The total amount of expenditure used for Recreation, culture and religion accounts for a small share of total municipality expenditures (7,1% for 2018).

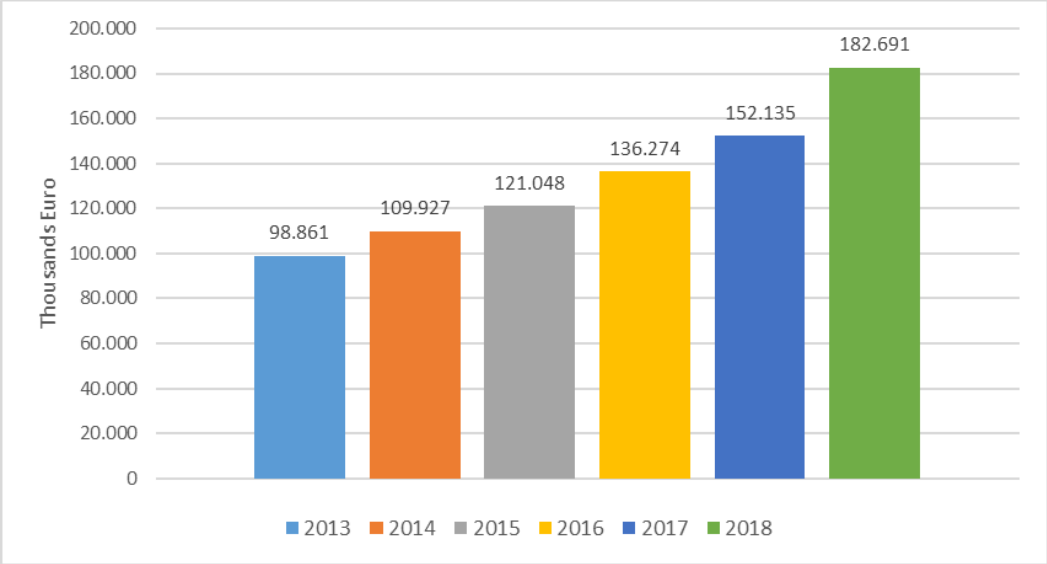
Current expenditure computation for Recreation, culture and religion function takes into account the following (***Table 32***) items of the municipal Balance sheet.

Table 32 Classification of the current expenditure for Recreation, culture and religion

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
08. RECREATION, CULTURE AND RELIGION	08.01. Recreational and sporting services
08. RECREATION, CULTURE AND RELIGION	08.02. Cultural services
08. RECREATION, CULTURE AND RELIGION	08.03. Public Information Services
08. RECREATION, CULTURE AND RELIGION	08.04. Religious communities and non-governmental organizations
08. RECREATION, CULTURE AND RELIGION	08.05. Research and development in the fields of recreation, culture and religion
08. RECREATION, CULTURE AND RELIGION	08.06. Other recreational, cultural and religious affairs not included in any group

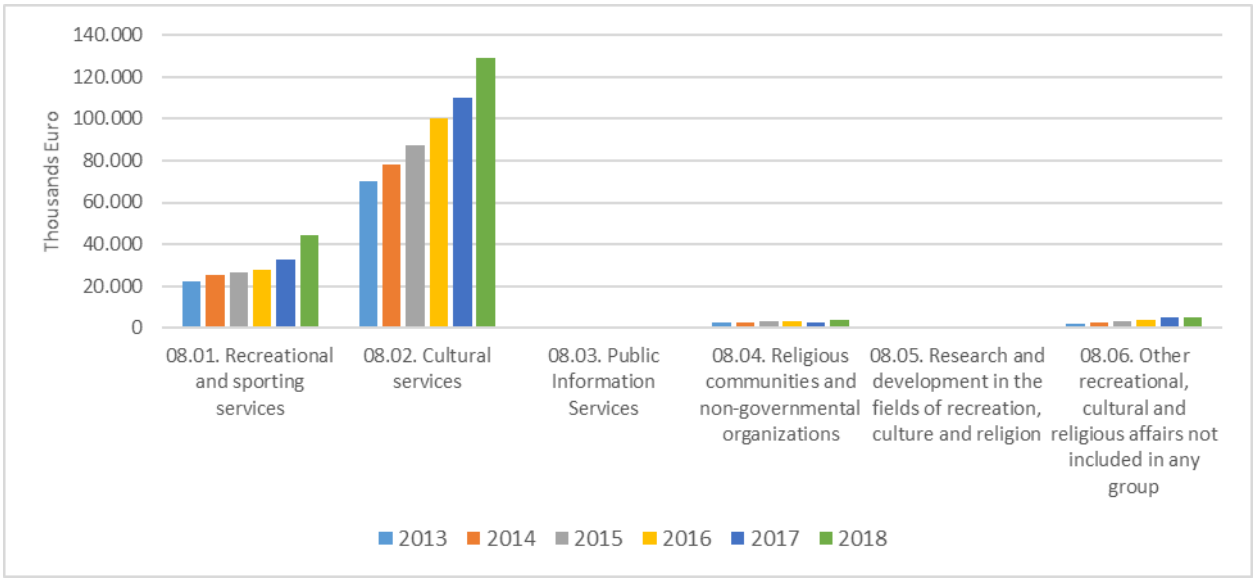
The total amount of municipal current expenditure[16] on Recreation, culture and religion has constantly increased (***Figure 39***) from 2013 to 2018.

Figure 39 Recreation, culture and religion current expenditure evolution



The dynamic of expenditures can be furtherly analysed (***Figure 40***) considering the second level items of expenditure classification. The disaggregation of the total amount of expenditure highlights that Cultural services and Recreational and sporting services gather the most important portion of the total for this function (70,49% and 24,16% respectively for 2018). Such components also identify the measurable outputs of the function thus specifying the basis of the model implemented for the standardization of the current expenditure.

Figure 40 Recreation, culture and religion current expenditure evolution and structure



[16] Nominal values.

For the evaluation of the standard expenditure of Recreation, culture and religion services, a cost function model has been implemented and the main output indicators included are:

- Number of participants by cultural centre;
- Number of visits by museums;
- Number of visits by library;
- Number of participants in sports competitions by sport facility.

The following table (***Table 33***) reports the list of the variables included in the model of the cost function used for the estimation of the Standard expenditure needs, which can be considered as *cost-shifts* aimed at capturing the intensity with which the service is offered.

Table 33 Recreation, culture and religion Expenditure determinants

CATEGORY	Description
DEPENDENT VARIABLE	Actual cost per inhabitant (euro per inhabitant)
EXOGENOUS LOAD FACTORS	Cultural centres, branches and other cultural institutions per inhabitant
EXOGENOUS LOAD FACTORS	Number of museum buildings per inhabitant
EXOGENOUS LOAD FACTORS	Number of branches of public libraries per inhabitant
EXOGENOUS LOAD FACTORS	Stadiums, swimming pools, other sport infrastructure per inhabitant
SERVICES OFFERED	Number of participants by cultural centre
SERVICES OFFERED	Number of visits by museums
SERVICES OFFERED	Number of visits by library
SERVICES OFFERED	Number of participants in sports competitions by sport facility
CONTEXT VARIABLES	Cluster 1: Big cities
CONTEXT VARIABLES	Cluster 2: Predominantly urban
CONTEXT VARIABLES	Cluster 3: Predominantly rural
CONTEXT VARIABLES	Cluster 4: Resort

For the estimation of the Standard expenditure needs the *default* values are here summarized (***Table 34***) for all policy determinants included in the calculation.

Table 34 Recreation, culture and religion Policy determinants (default)

Policy determinant	Default value
Cultural centers, branches and other cultural institutions	Municipality actual value
Number of museum buildings	Municipality actual value
Number of branches of public libraries	Municipality actual value
Stadiums, swimming pools, other sport infrastructure	Municipality actual value
Number of participants by cultural center	Standard value
Number of visits by museums	Standard value
Number of visits by library	Standard value
Number of participants in sports competitions by sport facility	Standard value

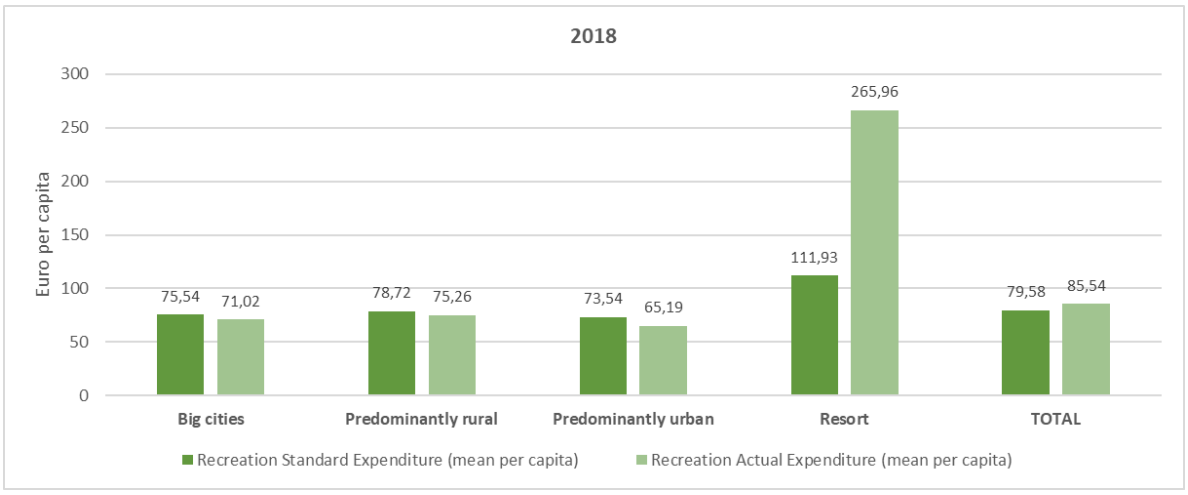
For the following list of variables, which identify the proxies of the outputs provided, the final computation of Standard expenditure needs takes into account the corresponding target values, i.e. the median value of the cluster the municipality refers to:

- Number of participants by cultural centre;
- Number of visits by museums;
- Number of visits by library;
- Number of participants in sports competitions by sport facility;

These variables have been recognized on the basis of a target value that can be prefigured as an objective to be achieved by the local authority; the correspondent determinant of the Standard expenditure needs is given by the product between the target values and the estimated standard costs.

A general overview of the results (***Figure 41***) shows that per capita standard expenditure is on average slightly higher than the actual value for all clusters with the exception of *Resorts*. Recreational, sporting and cultural activities heavily depend on the flow of tourism that characterises the economy of these municipalities and this could justify the amount of expenditure significantly above the standard.

Figure 41 Recreation, culture and religion Standard and Actual expenditure



However, the analysis of the expenditure only may provide incomplete information about the activity of municipalities, consequently the joint analysis of both expenditure and level of services provided should be addressed.

The level of services provided for **Recreation, culture and religion** function has been measured through the computation of a composite indicator, identifiable as *Number of equivalent users per facility*, that considers two blocks of information, one related to the number of users and the second one is related to the number of facilities.

The first block can be summarized with the following list:

- Number of participants in cultural centers;
- Number of visits to the museum;
- Number of users in public libraries;
- Number of participants in sports competitions.

The number of users is evaluated in correspondence to the number of facilities:

- Cultural centers;
- Museums;
- Public libraries;
- Sport facilities.

The final synthetic indicator identifies an intensity measure of the level of services provided, which could be considered as a *proxy* of "facility occupancy" rate and it has been calculated as follows:

$$Number\ of\ equivalent\ users\ per\ facility_{it} = \sum_{j} \left(\frac{Users_{ijt}}{Facility_{ijt}} * weight_j\right)$$

The system of weights used for the computation of the composite indicator is illustrated in the following table (***Table 35***).

Table 35 Recreation, culture and religion system of weights

Component of composite indicator$_j$	Weight$_j$
Number of participants by cultural center	0,3003
Number of visits by museums	0,1234
Number of visits by library	0,0212

Number of participants in sports competitions by sport facility	1,0000

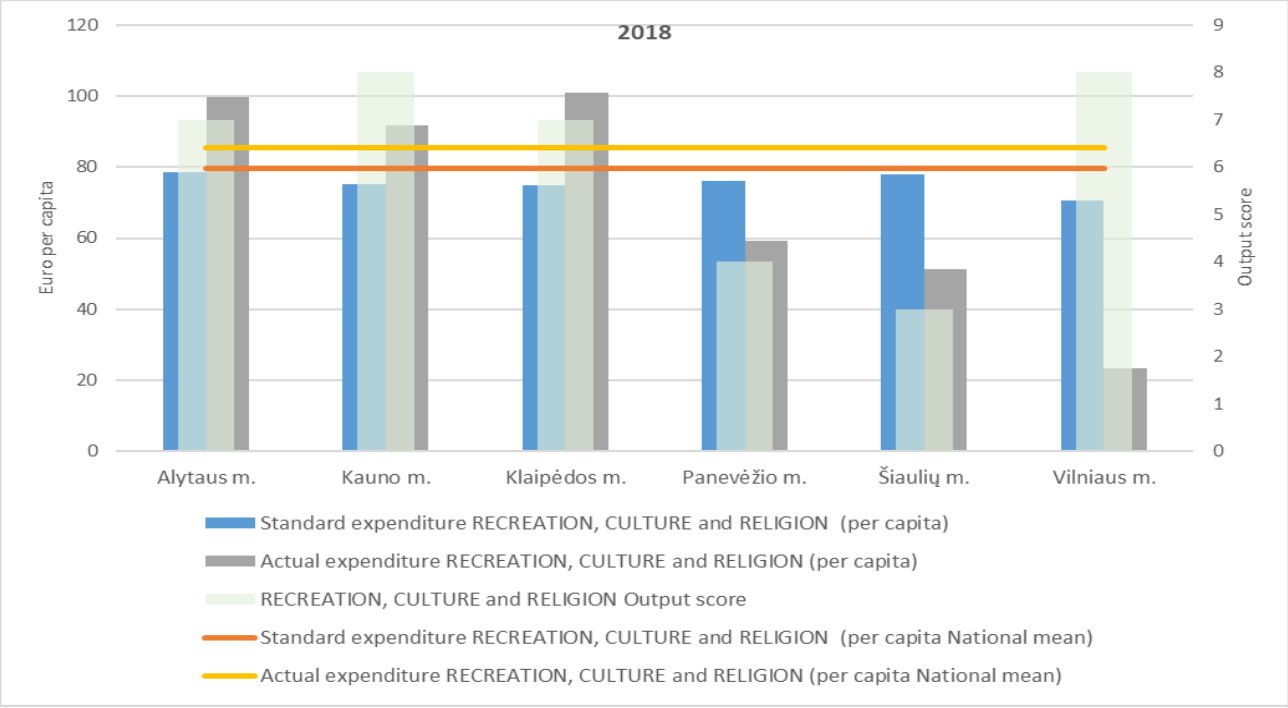
Weights have been computed from the results of the cost function. For every single component the correspondent standard cost has been divided by the standard cost related to the number of participants in sports competitions by sport facility, chosen as baseline index.

In order to enable comparisons between actual and standard value, the standard level of services for this indicator has been calculated as the weighted sum of standard users per facility, where standard users per facility is equal to the median value by cluster of each facility capacity index.

$$Standard\ Number\ of\ equivalent\ users\ per\ facility_{it} = \sum_{j}(Standard(\frac{Users_{jt}}{Facility_{jt}}) * weight_j)$$

Results on both expenditure and output standardization show that for Alytaus m., Kauno m. and Klaipėdos m. (***Figure 42***) the actual value of per capita expenditure is higher than the standard; this discrepancy is justified by the significantly high output scores, considering the level of services provided. As to Vilniaus m. the condition of efficiency is guaranteed by a level of actual expenditure lower than the standard combined with a high score on the output, while Šiaulių m. seems to underfinance the provision of services related to this function (under standard).

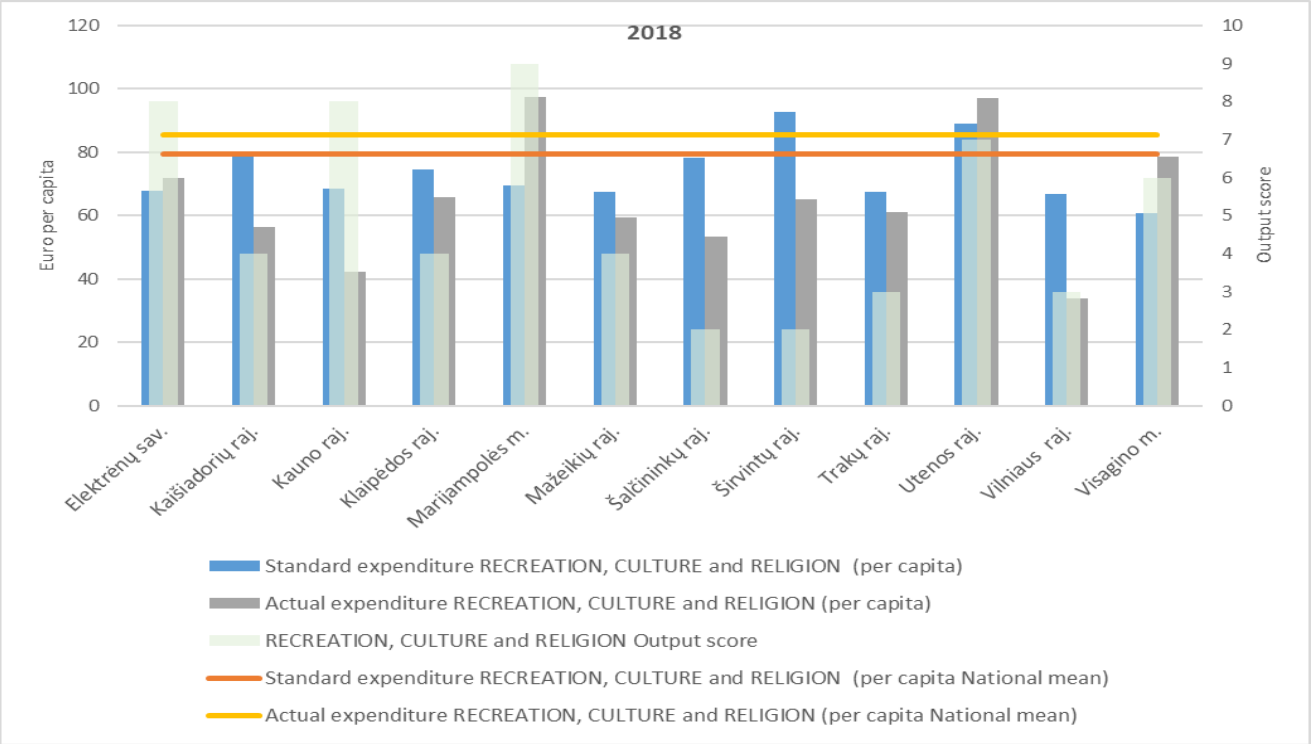
Figure 42 Recreation, culture and religion standard and actual Expenditure – Big cities



Among *Predominantly urban* municipalities (***Figure 43***) Marijampolės m., Visagino m., Utenos raj. and Elektrėnų sav. have positive expenditure gaps, i.e. actual expenditures greater than the standard value; the high level of expenditures is supported by an equally high level of outputs produced.

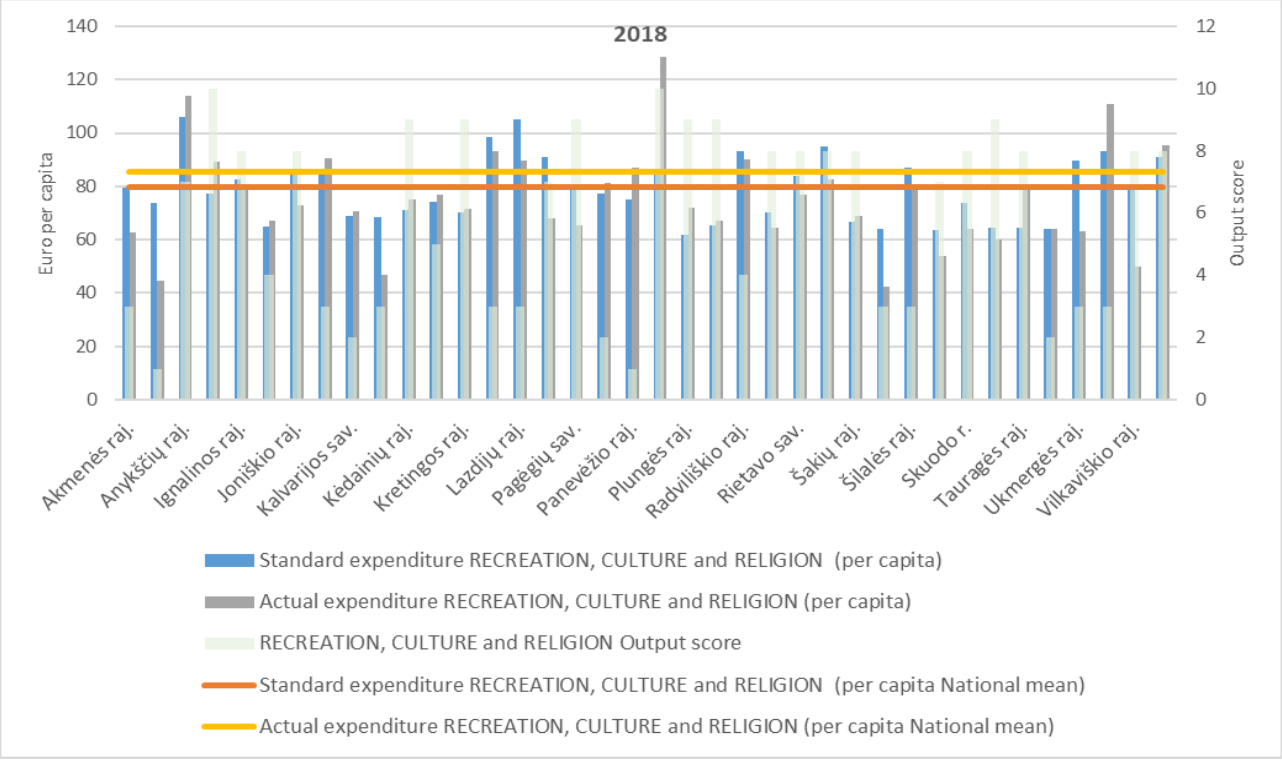
Kauno raj. displays an efficient behaviour, while the remaining *Predominantly urban* municipalities despite showing a level of expenditures below the standard do not provide enough services to satisfy the demand.

Figure 43 Recreation, culture and religion standard and actual Expenditure – Predominantly urban



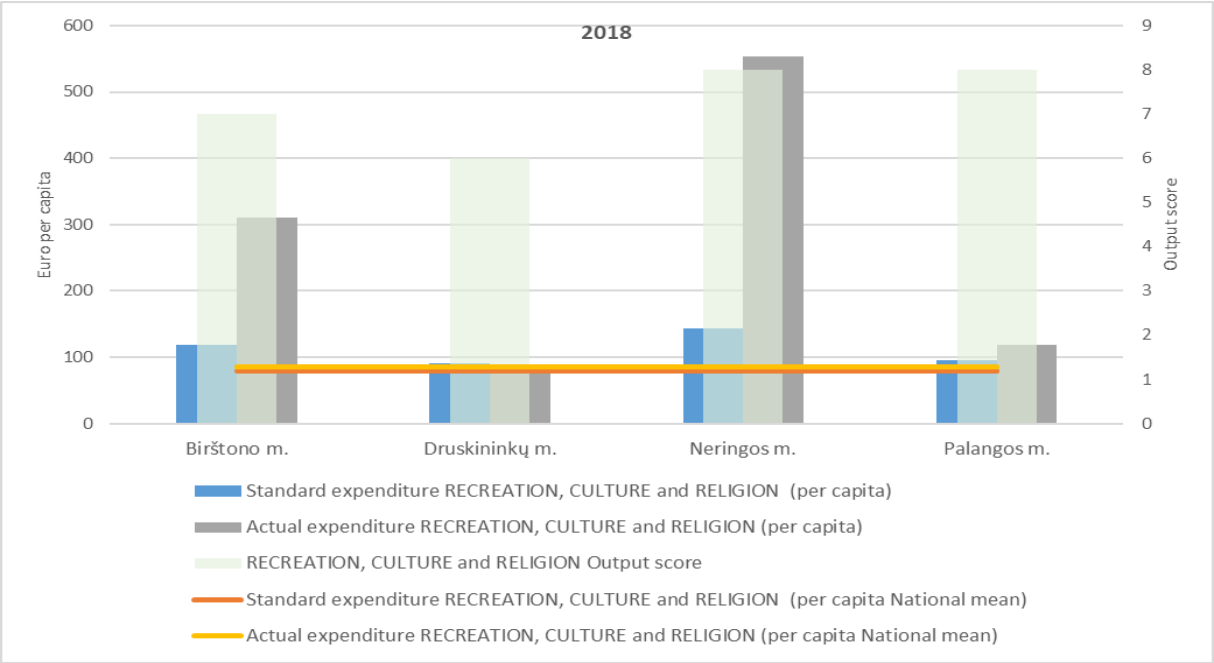
Predominantly rural administrations show (***Figure 44***) an average actual expenditure very close to national average that is equally distributed among the different groups of performance.

Figure 44 Recreation, culture and religion standard and actual Expenditure – Predominantly rural



Finally, all *Resort* municipalities show as expected a significantly high level of outputs with standard expenditures largely outweighed by the historical value (only for Druskininkų m. standard expenditures are over the actual value).

Figure 45 Recreation, culture and religion standard and actual Expenditure – Resort



Results related to the comparison between actual and standard values of both expenditure and level of services can also be summarized through the distribution of normalized scores. Expenditure and output gap can be turned into scores with values ranging between 1 and 10 (***Table 36*** and ***Table 37***).

For Recreation, culture and religion function an important share of Lithuanian municipalities are *over standard*, i.e. spending more than the standard and providing a level of services higher than the standard.

Equally considerable is the number of *under standard* municipalities distributed mainly between *Predominantly urban* and *rural* areas.

Table 36 Recreation, culture and religion Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10								1	1		2
9			1	1		2		2	1		7
8	1	2	3	2	1		2	4		1	16
7			2					2	2	1	7
6			1						1		2
5							1				1
4			4	1			1				6
3	1	3	4	2				2			12
2		1	1		1		1	1			5
1		1						1			2
Total	2	7	16	6	2	2	5	13	5	2	60

Table 37 Recreation, culture and religion Performance (2018)

Performance	Number
Efficient	14
Non efficient	7
Over Standard	20
Under standard	19

The following table (***Table 38***) reports a within cluster analysis and the distribution of municipalities according to different level of performance.

Table 38 Recreation, culture and religion Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	1
Non efficient	
Over Standard	3
Under standard	2

Predominantly urban

Performance	Number
Efficient	1
Non efficient	
Over Standard	4
Under standard	7

Predominantly rural

Performance	Number
Efficient	11
Non efficient	7
Over Standard	10
Under standard	10

Resort

Performance	Number
Efficient	1
Non efficient	
Over Standard	3
Under standard	

The following table (***Table 39***) shows the full list of efficient and non-efficient municipalities for Recreation, culture and religion function.

Table 39 Recreation, culture and religion Efficient and Non efficient performers (2018)

Efficient	Non efficient
Vilniaus m.	Jonavos raj.
Druskininkų m.	Jurbarko raj.
Ignalinos raj.	Kelmės raj.
Joniškio raj.	Pakruojo raj.
Kauno raj.	Panevėžio raj.

Efficient	Non efficient
Molėtų raj.	Varėnos raj.
Raseinių raj.	Kalvarijos sav.
Rokiškio raj.	
Skuodo r.	
Šilutės raj.	
Švenčionių raj.	
Vilkaviškio raj.	
Pagėgių sav.	
Rietavo sav.	

Summarizing, even if expenditures on Recreation, culture and religion cover just a small portion of the total municipal expenditures, the constantly increasing trend has almost doubled the expenses for this function. This means that recreational activities are becoming more important inside municipal services and a more targeted distribution of resources should be addressed among *under standard* municipalities that are mainly located in *Predominantly urban* and *Predominantly rural* areas.

Recreational, sporting and cultural activities depend heavily on the flow of tourism that characterises the economy of many municipalities and this could justify the amount of expenditure significantly above the standard.

3.1.4 General administration

For the standardization of **General administration** expenditure, the analysis has not been restricted just to General state services (function 01 of the expenditure classification) as it also includes other residual functions. Preliminary results have highlighted the possibility of channelling the current expenditure of several satellite functions into a single general administration function thus determining an innovative feature of the project.

In accordance with Lithuanian authorities, the complete set of municipal functions that converge to General administration is shown with the following list:

- 01. GENERAL STATE SERVICES
- 02. DEFENCE
- 03. PUBLIC PROCEDURE and PUBLIC PROTECTION
- 04. ECONOMY
- 05. ENVIRONMENTAL PROTECTION
- 06. HOUSING AND UTILITIES
- 07. HEALTH PROTECTION
- 08. RECREATION, CULTURE AND RELIGION
- 09. EDUCATION
- 10. SOCIAL SECURITY

For some of the functions listed above the contribution to the definition of the final General administration current expenditure is restricted to sub-items of expenditure classification of the municipal balance sheet. For simplicity the structure of General administration current expenditure could be divided into two main blocks:

1. General state services and institutional management costs;
2. Other municipal functions.

The following table (***Table 40***) shows the detail of the items and sub-items included in the first block of the structure considered for the computation of the current expenditures for municipal General administration function.

Table 40 General administration expenditure (first block)

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
01. GENERAL STATE SERVICES	01.01. Public authorities, financial and fiscal affairs, foreign affairs
	01.02. Economic aid to foreign countries
	01.03. General services
	01.04. Basic research
	01.05. Research and development in the field of public services
	01.06. Other public services not assigned to any group
	01.07. Interest
	Institutional management costs
02. DEFENCE	Institutional management costs
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	Institutional management costs
04. ECONOMY	Institutional management costs
05. ENVIRONMENTAL PROTECTION	Institutional management costs
06. HOUSING AND UTILITIES	Institutional management costs
07. HEALTH PROTECTION	Institutional management costs
08. RECREATION, CULTURE AND RELIGION	Institutional management costs
09. EDUCATION	Institutional management costs
10. SOCIAL SECURITY	Institutional management costs

The following table (***Table 41***) shows the detail of items and sub-items of the municipal balance sheet included in the second block of the structure considered for the computation of the current expenditures for General administration function.

Table 41 General administration expenditure (second block)

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
02. DEFENCE	EXP 02.01. Military defence
	EXP 02.02. Civil safety
	EXP 02.03. Military assistance abroad and participation in international operations
	EXP 02.04. Research and development in the field of defence
	EXP 02.05. Another defence matters not included in any groups
03. PUBLIC PROCEDURE and PUBLIC PROTECTION	EXP 03.01. Police
	EXP 03.02. Fire-security
	EXP 03.03. Courts
	EXP 03.04. Offenders
	EXP 03.05. Research and development in the fields of public order and public security
	EXP 03.06. Other issues of public order and public security not attributed to any group
04. ECONOMY[17]	Exp 04.01. General economic, trade and labour affairs
	EXP 04.02. Agriculture, forestry, fishing and hunting
	EXP 04.04. Mining and manufacturing industry and construction
	EXP 04.06. Communications
	EXP 04.07. Other economic activities
	EXP 04.08. Economic research and development
	EXP 04.09. Other economic matters not belonging to any group
05. ENVIRONMENTAL PROTECTION[18]	EXP 05.03. Reducing environmental pollution
	05.04. Biodiversity and nature protection
	05.05. Research and development in the field of environmental protection
	05.06. Other environmental issues not assigned to any group
06. HOUSING AND UTILITIES	Wages and social security - 06.01. Housing development
	Wages and social security - 06.02. Development of municipal economy

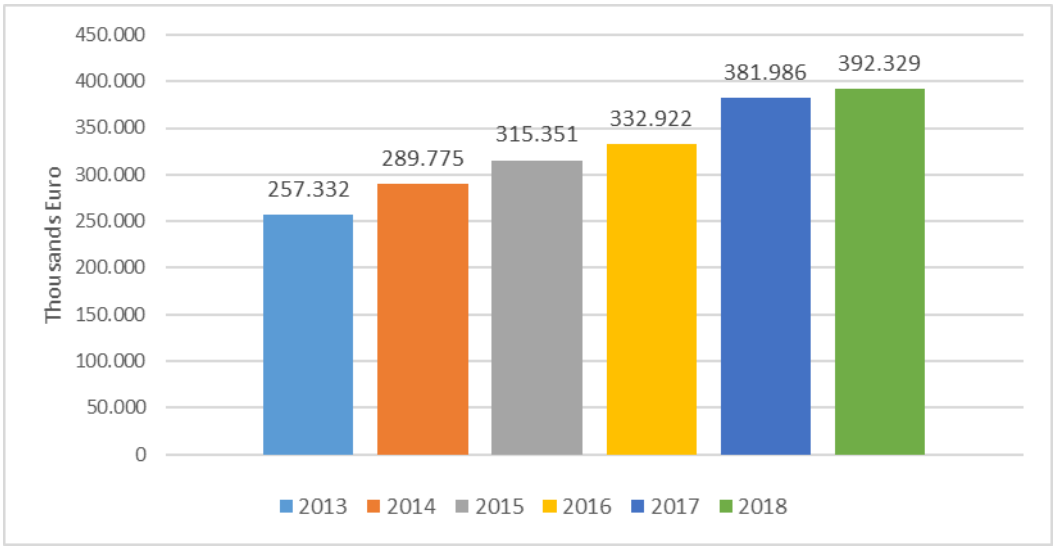
[17] Expenditures related to "04.03 Fuel and energy" and "04.05 Transportation" are not included except for institutional management costs that converge to the first block of General administration expenditures.

[18] Expenditures related to "05.01 Waste management" and "05.02 Sewage treatment" are not included except for institutional management costs that converge to the first block of General administration expenditures.

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
	Wages and social security - 06.03. Water supply
	Wages and social security - 06.04. Street lighting
	Wages and social security - 06.05. Research and development in the field of housing and utilities
	Wages and social security - 06.06. Other housing and communal affairs not included in any group

The overall dynamic of General administration costs displayed in the graph[19] (***Figure 46***) shows a constant increasing trend for all years considered.

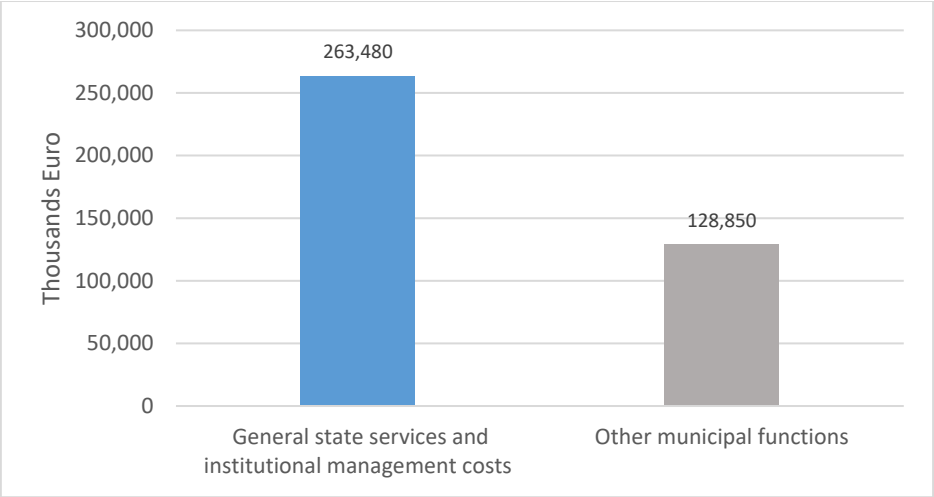
Figure 46 General administration current expenditure evolution



For 2018, the following graph (***Figure 47***) reports the total amount of current expenditure split up by single block of classification, where General state services and institutional management costs (first block) absorb the main part of the total current expenditure.

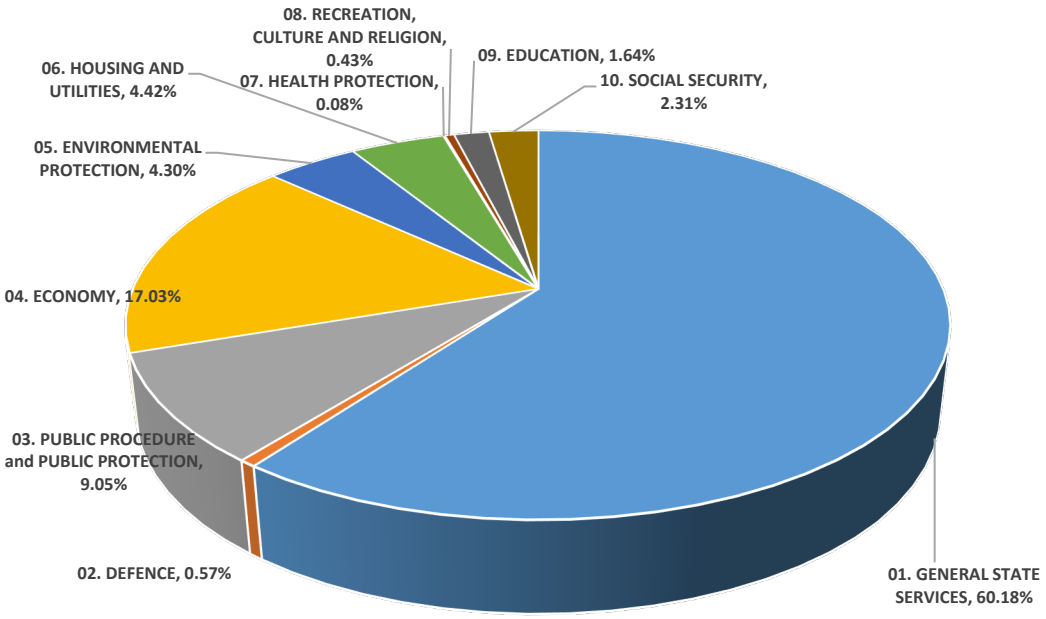
[19] Nominal values.

Figure 47 General administration expenditure structure by block (2018)



Even from a distinct function perspective, the most important contribution to the total composition of General administration current expenditures comes from the function "01 - General state service" of municipal expenditure classification (more than 60%). The remaining part is mainly absorbed by function "04 - Economy" with an average weight around 17%.

Figure 48 General administration expenditure structure by function (2018)



The main determinants of the current expenditure can be firstly identified in the input costs necessary for the implementation the activity.

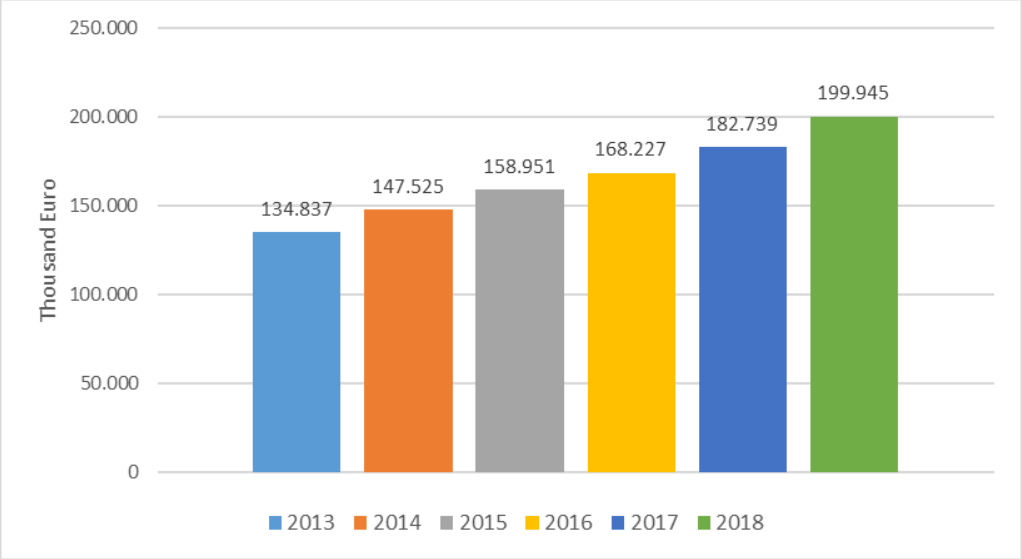
Labor cost plays in fact the main role among the input variables, i.e. part of the total expenditure used for acquisition of inputs necessary to the provision of services.

Labor cost has been calculated as the sum of wages and social security of the following functions included in the structure of General administration services:

- 01. GENERAL STATE SERVICES
- 02. DEFENCE
- 03. PUBLIC PROCEDURE and PUBLIC PROTECTION
- 04. ECONOMY
- 05. ENVIRONMENTAL PROTECTION
- 06. HOUSING AND UTILITIES

The overall evolution of labour cost reflects the increasing trend of total current expenditure[20] (***Figure 49***).

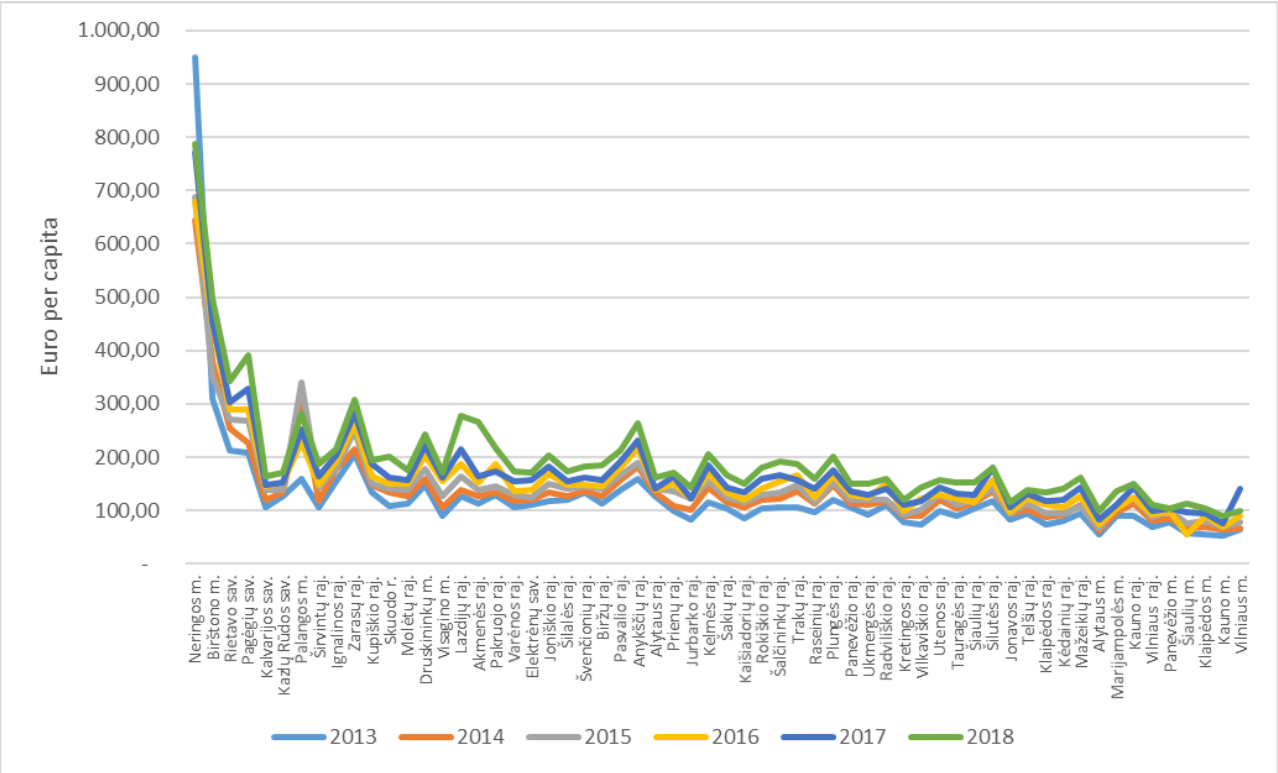
Figure 49 General administration labor cost evolution



The other main explanatory determinant of General administration expenditures is represented by diseconomies of scale (***Figure 50***). The costs for the provision of General administration (per capita expenditure) decreases as the population increases and the diseconomies are mainly concentrated on a few municipalities, which arguably are too small. In the perspective of such obvious diseconomies of scale, the Lithuanian authorities should therefore consider the possibility of identifying an efficient structure of administrative borders such as the amalgamation of small neighbouring municipalities.

[20] Nominal values.

Figure 50 General administration diseconomies of scale



The estimation of the Standard expenditure needs has been implemented through an expenditure function model, where resident population identifies the main proxy of the level of the services.

The following table (***Table 42***) reports the list of the variables included in the model of the expenditure function used for the estimation of the Standard expenditure needs, which can be interpreted as *expenditure-shifts* aimed at capturing the intensity with which the service is offered.

Table 42 General administration Expenditure determinants

CATEGORY	Description
DEPENDENT VARIABLE	Actual expenditure per capita (euro per inhabitant)
CONTEXT VARIABLES	Diseconomies of scale
INPUT PRICES	Labour cost
CONTEXT VARIABLES	Cluster 1: Big cities
CONTEXT VARIABLES	Cluster 2: Predominantly urban
CONTEXT VARIABLES	Cluster 3: Predominantly rural
CONTEXT VARIABLES	Cluster 4: Resort

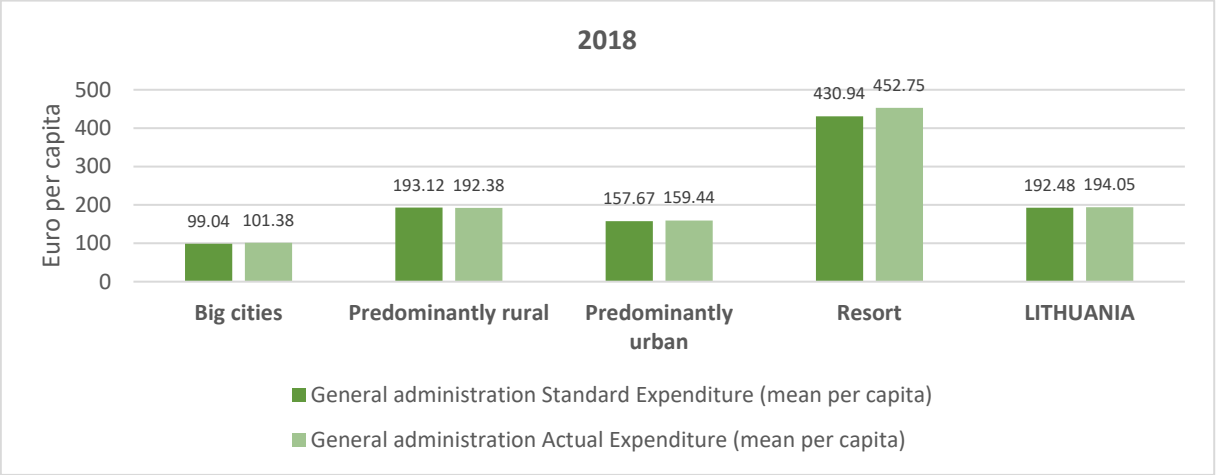
Standard expenditure needs results reported below have been calculated setting the municipal actual value as *default* value for the policy determinant related to the cost of labour.

An overall analysis of standardization results (***Figure 51***) shows that, on average, actual costs per capita are marginally higher than the standard ones. A between cluster analysis remarks this trend for all clusters with

the exception of *Resort*, where the distance between the two measures is more evident probably due to the fact that these municipalities provide general administration services not only to the resident population but also to tourists, and *Predominantly rural* municipalities with an average actual value of expenditure below the standard.

The density of population is also reflected through Clusters that distinguish Lithuanian municipalities according to increasing concentration of inhabitants respectively for *Resorts*, *Predominantly rural*, *Predominantly urban* and *Big cities*. The presence of diseconomies of scale for General administration function is thus confirmed by the increasing trend of both standard and actual values of per capita expenditure to the decrease of density of population.

Figure 51 General administration Standard and Actual expenditure



For **General administration** it is difficult to measure a direct level of services provided, in addition it can be considered as support activity for the implementation of other municipal functions. According to this assumption the standard level of services calculated for General administration has been measured merging together all indicators of other functions.

The final output gap is measured as the weighted average of other functions' output gaps:

$$Output\ gap_{it} = \frac{\left(\sum_j Output\ gap_{itj} * weight_{jt}\right)}{\sum_j weight_{jt}}$$

Weights are generated, for each available year, from the ratio between the total amount of standard expenditures of each function on the total amount of standard expenditures of all functions (***Table 43***).

Table 43 General administration system of weights

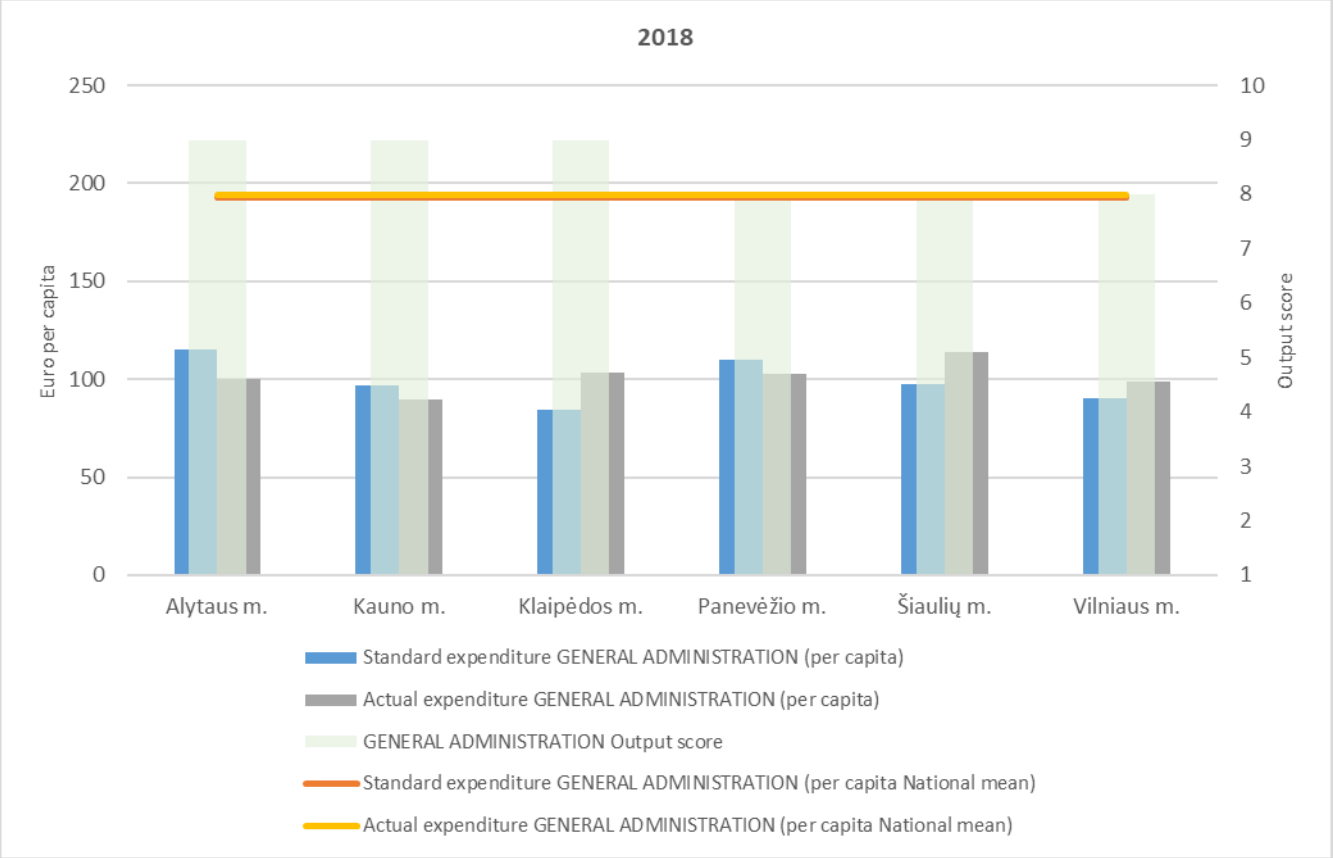
Function	$Weight_j$
EDUCATION	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Education}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$

Function	$Weight_j$
HOUSING	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Housing}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
RECREATION, CULTURE and RELIGION	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Recration}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
SOCIAL SECURITY	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Social}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$

The following figures (***Figure 52***, ***Figure 53***, ***Figure 54*** and ***Figure 55***) show a more detailed insight within the clusters taking into account results related to the standardization of the expenditure and the level of services.

Considering the high density of population and the presence of diseconomy of scales, *Big cities* show, on average, the lowest expenditure value per inhabitant if compared to the other municipalities. Klaipėdos m., Šiaulių m. and Vilniaus m. display an actual per capita value of the expenditure greater than the standard. For the remaining *Big cities* (Alytaus m., Kauno m. and Panevėžio m.) actual expenditures are below the standard. Interestingly all *Big cities* provide a very high level of services.

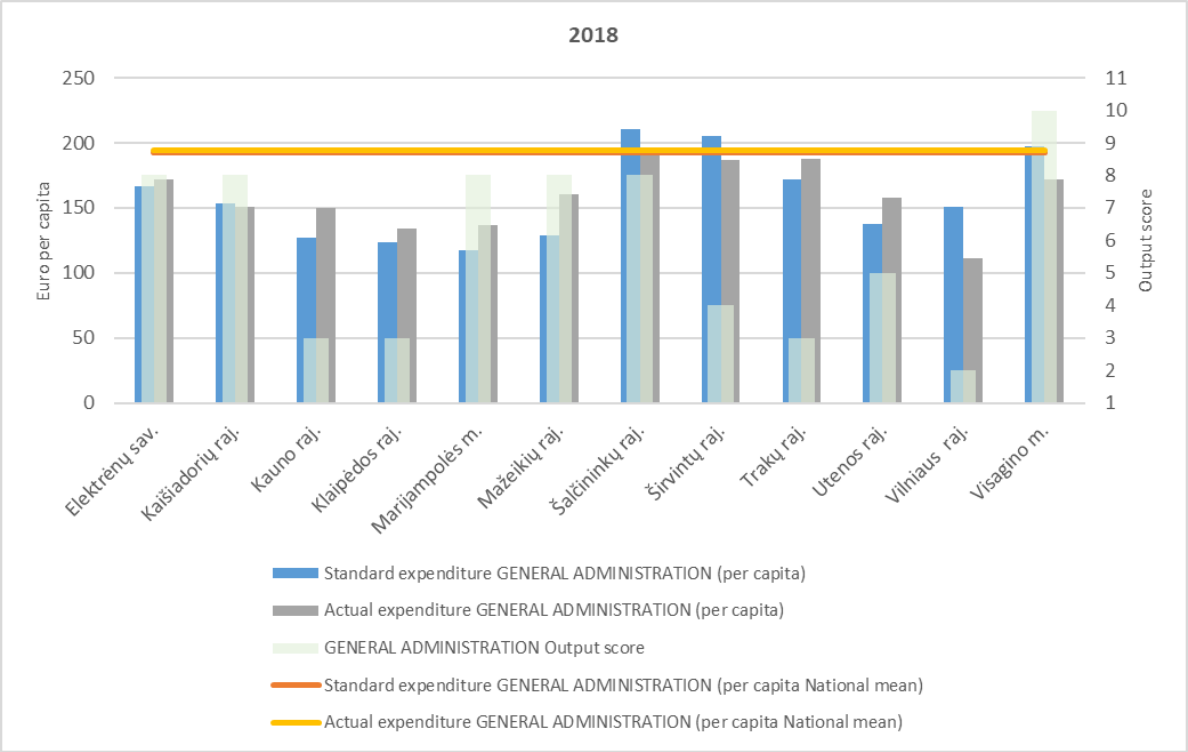
Figure 52 General administration standard and actual Expenditure – Big cities



Actual expenditure for *Predominantly urban* municipalities generally exceeds the standard estimation and the gap is around 3% on average. The highest positive gap (+24,4%) belongs to Mažeikių raj. which displays

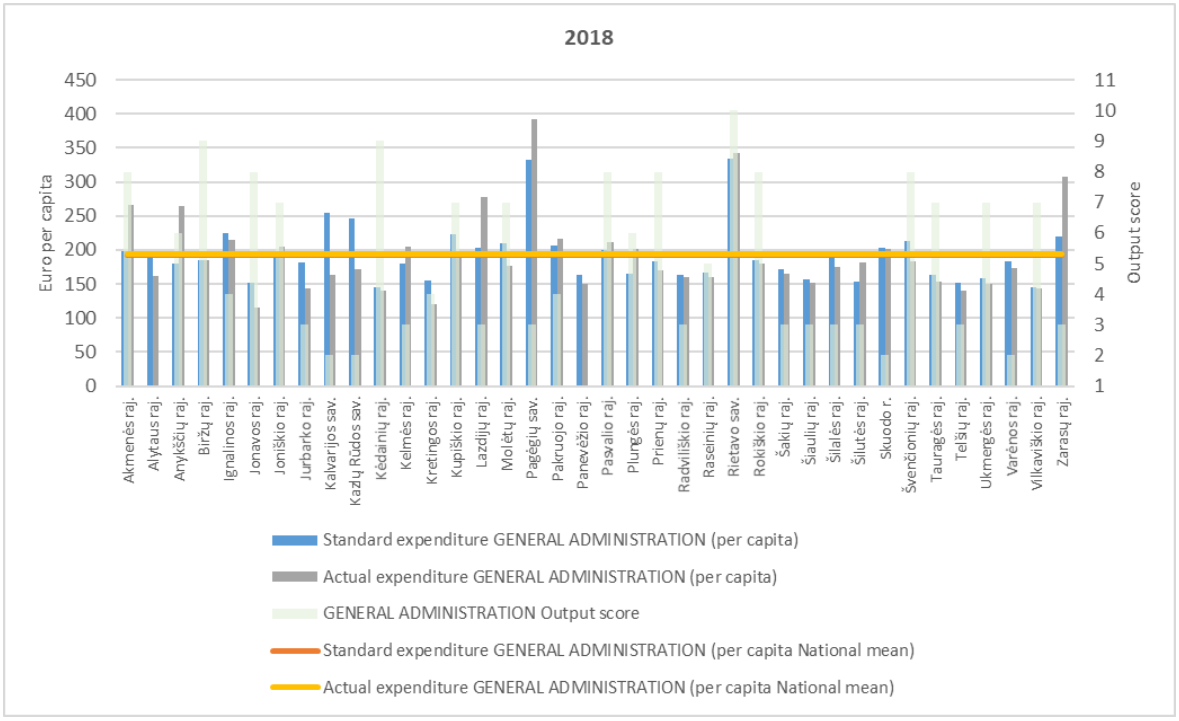
an actual level of expenditure significantly higher than the standard, while the highest negative gap is attributed to Vilniaus raj. (-25,8%) which shows an actual level of expenditure below the standard and this could reflect the fact that Vilnius City is providing services to inhabitants of suburban municipalities. The combination with output scores identifies a quite heterogeneous distribution for the levels of performance.

Figure 53 General administration standard and actual Expenditure – Predominantly urban



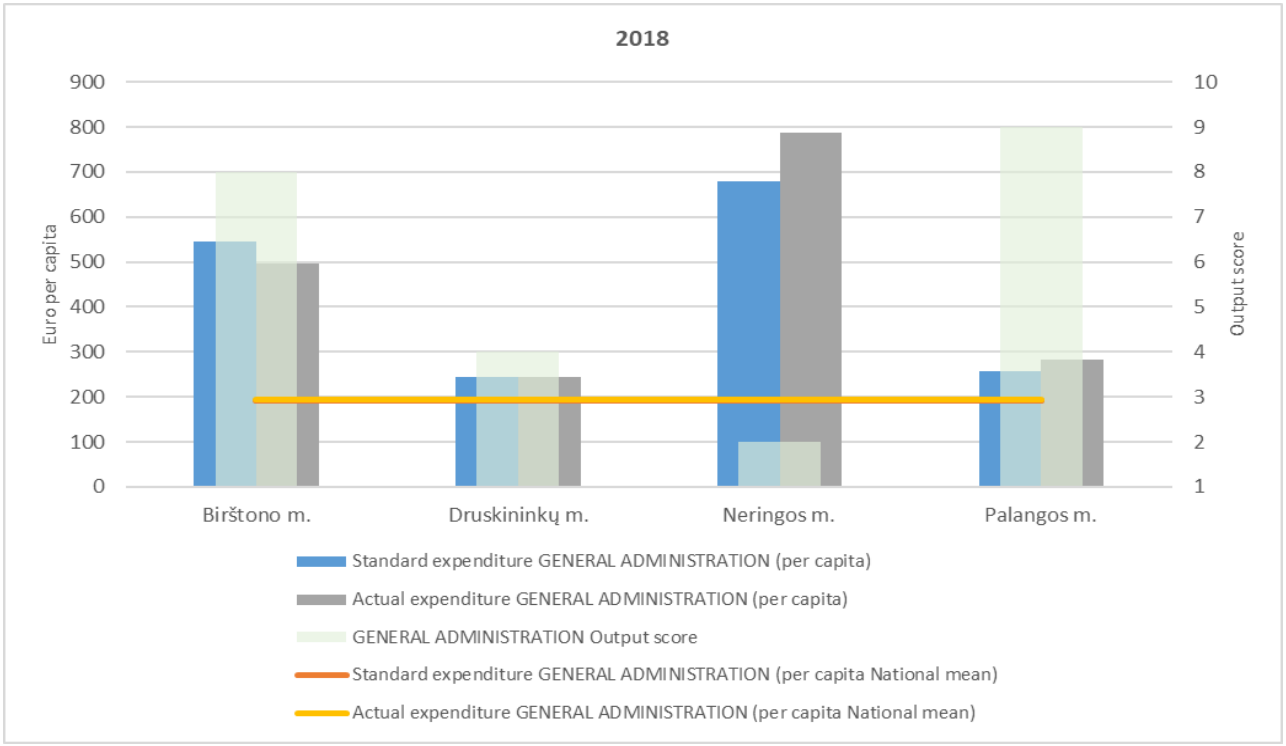
Predominantly rural municipalities are basically aligned to national targets of expenditure, with only few municipalities (Rietavo sav., Pagėgių sav. and Zarasų raj.) displaying expenditure significantly above the average. The alignment of the expenditures combined with the level of services provided places most of Lithuanian municipalities on the left side of the quadrant areas of performance, classifying local authorities mainly as *efficient* or in the *under standard* group.

Figure 54 General administration standard and actual Expenditure – Predominantly rural



Even for *Resorts* the actual values of General administration expenditures are very close to the standard, with only Neringos m. showing a rather large gap (15,9%) and simultaneously a low level of services provided (*non-efficient*).

Figure 55 General administration standard and actual Expenditure – Resort



As done for the other functions, General administration expenditure and output gaps have been turned into normalized scores. High scores identify an actual level of expenditure or provided services greater than the estimated standard with the intensity of the gap measured by the score itself.

The complete distribution of municipalities for the different combinations of scores are reported in the table below (***Table 44***). The four quadrants are equally distributed (***Table 45***) among the different categories of performance with a prevalence of *efficient* and *under standard* performances.

Table 44 General administration Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10			1			1					2
9			2	1		1		2			6
8		2	4	2			2	3	2		15
7		1	3		1		1				6
6									1	1	2
5			1					1			2
4		1	2		1		1				5
3		1	2	3			1	5	1	1	14
2	2	1	1	1				1			6
1		1	1								2
Total	2	7	17	7	2	2	5	12	4	2	60

Table 45 General administration Performance (2018)

Performance	Number
Efficient	17
Non efficient	11
Over Standard	14
Under standard	18

An insight of the performance analysis within clusters points out an almost perfect balance for *Predominantly urban* municipalities and for *Resorts*. No *under standard* and *inefficient* municipalities are included in *Big cities*, while most of *under standard* municipalities are placed in *Predominantly rural* areas.

Table 46 General administration Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	3
Non efficient	
Over Standard	3
Under standard	

Predominantly urban

Performance	Number
Efficient	3
Non efficient	4
Over Standard	3
Under standard	2

Predominantly rural

Performance	Number
Efficient	10

Resort

Performance	Number
Efficient	1

Non efficient	6
Over Standard	7
Under standard	15

Non efficient	1
Over Standard	1
Under standard	1

The full list of efficient and inefficient municipalities for General administration is displayed in the following table (***Table 47***).

Table 47 General administration Efficient and Non efficient performers (2018)

Efficient	Non efficient
Alytaus m.	Neringos m.
Birštono m.	Kauno raj.
Kauno m.	Kelmės raj.
Panevėžio m.	Klaipėdos raj.
Visagino m.	Lazdijų raj.
Jonavos raj.	Pakruojo raj.
Kaišiadorių raj.	Šilutės raj.
Kėdainių raj.	Trakų raj.
Kupiškio raj.	Utenos raj.
Molėtų raj.	Zarasų raj.
Prienų raj.	Pagėgių sav.
Rokiškio raj.	
Šalčininkų raj.	
Švenčionių raj.	
Tauragės raj.	
Ukmergės raj.	
Vilkaviškio raj.	

Summarizing, diseconomies of scale play a determinant role for the identification of General administration Standard expenditure needs. Municipalities seem to be uniformly distributed among the different performance groups and expenditure actual values are very close to the standard. Lithuanian authorities should consider the possible amalgamation of municipalities with a reform of local authorities borders in order to reduce the number of inefficient municipalities.

3.1.5 Housing and utilities

For the analysis of **Housing and utilities** function the set of available data represents a complete set of information.

The total amount of expenditure allocated for Housing and utilities accounts for a smaller share of the total municipal expenditures (4,6% for 2018).

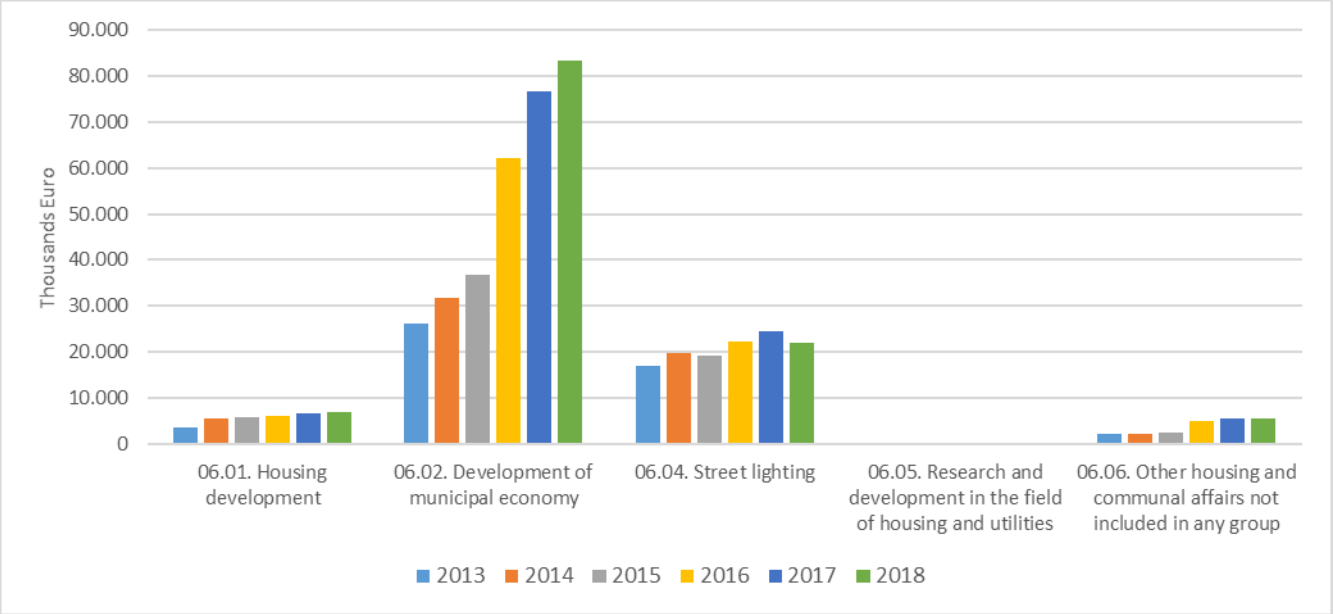
The following table (***Table 48***) shows the detailed sub-items of current expenditures classification that have been included in the computation of the expenditures.[21]

Table 48 Classification of the current expenditure for Housing and utilities

CLASSIFICATION OF MUNICIPAL FUNCTION COSTS	
06. HOUSING AND UTILITIES	06.01. Housing development
06. HOUSING AND UTILITIES	06.02. Development of municipal economy
06. HOUSING AND UTILITIES	06.04 Street lighting
06. HOUSING AND UTILITIES	06.05. Research and development in the field of housing and utilities
06. HOUSING AND UTILITIES	06.06. Other housing and communal affairs not included in any group

The dynamic of Housing and utilities expenditure[22] can be directly analysed (***Figure 56***) considering the evolution of the second level items of expenditure classification.

Figure 56 Housing and utilities current expenditure evolution and structure



The decomposition of the total expenditure suggests the identification of two distinct sub-groups. Therefore, the estimation of the Standard expenditure needs for Housing and utilities function has been implemented through two separate expenditure function models divided as follows:

1. Housing development;
2. Street lighting.

The first model takes into account expenditures on housing development, development of municipal economy, research and development in the field of housing and utilities and other housing and communal affairs not included in any group, while the second model is mainly focused on street lighting expenditures.

[21] The sub-item "06.03 Water supply" has not been included in the computation of the current expenditure. Expenditures used for wages and social security converge to General administration.
[22] Nominal values.

The identification and estimation of these two distinct models and the subsequent aggregation of both results gives a full picture of the Housing and utilities function.

The availability of two separate estimated models provides a big advantage for the analysis. This means that it is possible to rely on robust estimates simply joining both information.

On the basis of this assumption, it was possible to estimate the indirect standard cost associated to Housing and utilities services just merging the two models. The final standardization of Housing and utilities function is in fact calculated as the sum of the indirect standard costs of each function.

The following table (***Table 49***) reports the full list of the variables included in both models of the expenditure functions used for the estimation of the Standard expenditure needs, which can be interpreted as *expenditure-shifts* aimed at capturing the intensity with which the service is offered.

Table 49 Housing and utilities Expenditure determinants

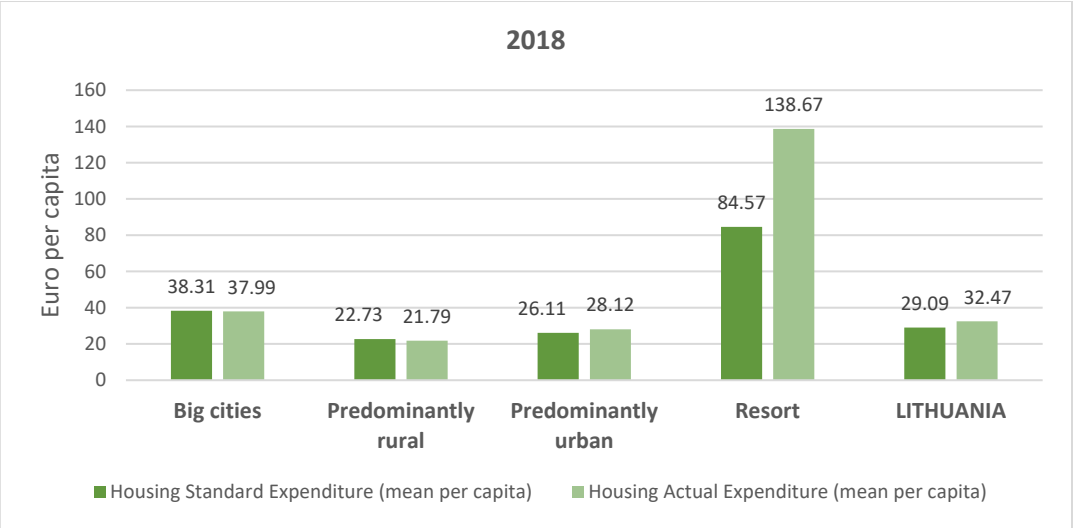
CATEGORY	Description
DEPENDENT VARIABLE	Actual expenditure per capita (euro per inhabitant)
INPUT PRICES	Residential apartments real estate average sale price (Eur/m²)
CONTEXT VARIABLES	Ratio of the unemployed to the working age population (%)
CONTEXT VARIABLES	Cluster 1: Big cities
CONTEXT VARIABLES	Cluster 2: Predominantly urban
CONTEXT VARIABLES	Cluster 3: Predominantly rural
CONTEXT VARIABLES	Cluster 4: Resort

The analysis of results related to the Standard expenditure needs can start from the comparison between the average of actual and standard expenditure, both for the entire Lithuania country and for cluster disaggregation.

Standard expenditure needs results reported below have been calculated setting the municipal actual value as the *default* value for the policy determinants related to the Ratio of unemployed to the working age population and Residential apartments real estate average sale price.

Total actual per inhabitant expenditure (***Figure 57***) exceeds the standard estimation (+11,6%) and the gap can be explained through a between cluster analysis. *Big cities* and *Predominantly rural* municipalities report negative gaps (-0,8% and -4,1% respectively), while *Resorts* show a significant positive discrepancy that could arguably been explained by the use of resident population as main driver, which is not taking into account tourists benefitting from the services.

Figure 57 Housing and utilities Standard and Actual expenditure



The full picture of the performance is however identified by the joint analysis of expenditure and level of services provided.

For **Housing and utilities** function the level of services provided has been measured through two different indicators:

1. *Residential housing fund (m² per inhabitant)* which is a proxy of the level of services for Housing development;

2. *Length of the asphalted streets (km per inhabitant)* which is a proxy of the level of services for Street lighting.

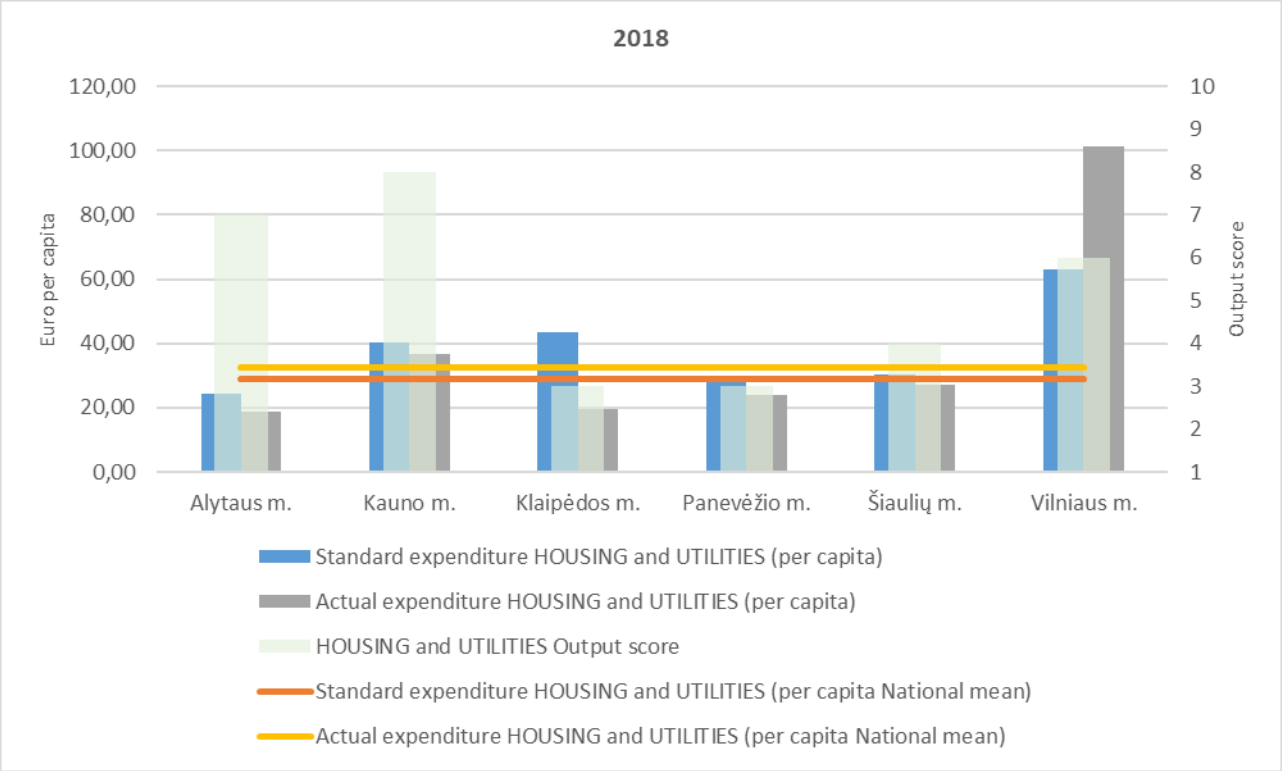
For both indicator the standard level of services has been calculated as the median by cluster, in order to allow comparison between actual and standard value.

$$\text{Standard}(Residential\ housing\ fund\ m^2\ per\ inhabitant\ ) = Median_{\text{Cluster and Year}} \left(\frac{Sqm\ of\ Residential\ housing\ fund}{Resident\ Population}\right)$$

$$\text{Standard}(Length\ of\ the\ asphalted\ streets\ km\ per\ inhabitant) = Median_{\text{Cluster and Year}} \left(\frac{Km\ of\ the\ asphalted\ streets}{Resident\ Population}\right)$$

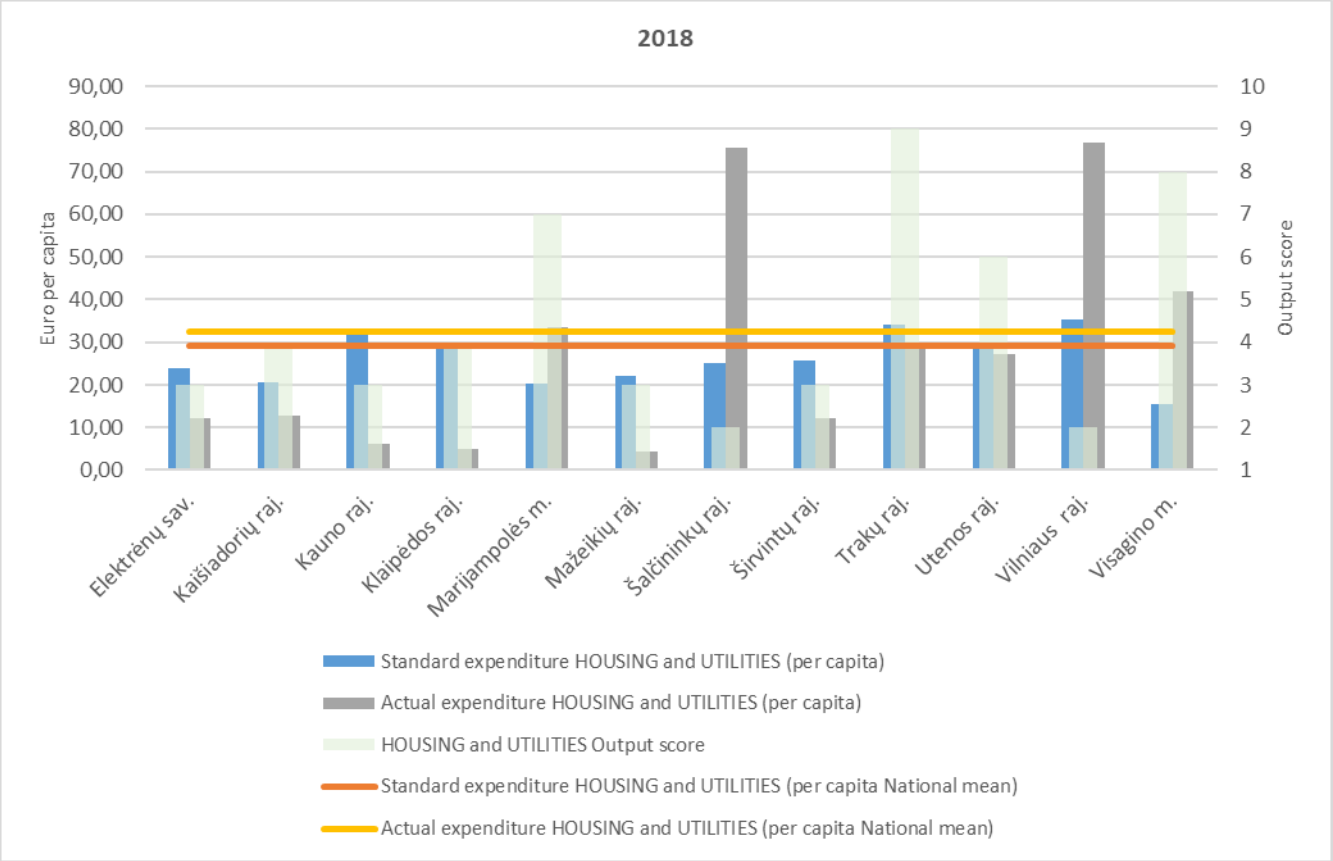
Vilniaus m. is the only *Big city* with actual per capita expenditure significantly higher than the standard (***Figure 58***) partially compensated by the level of services provided. Alytaus m. and Kauno m. are the other two municipalities with an intense level of services produced and negative gaps for the expenditure (actual level of the expenditure lower than the standard). The combination of the two information corresponds to an efficient behaviour.

Figure 58 Housing and utilities standard and actual Expenditure – Big cities



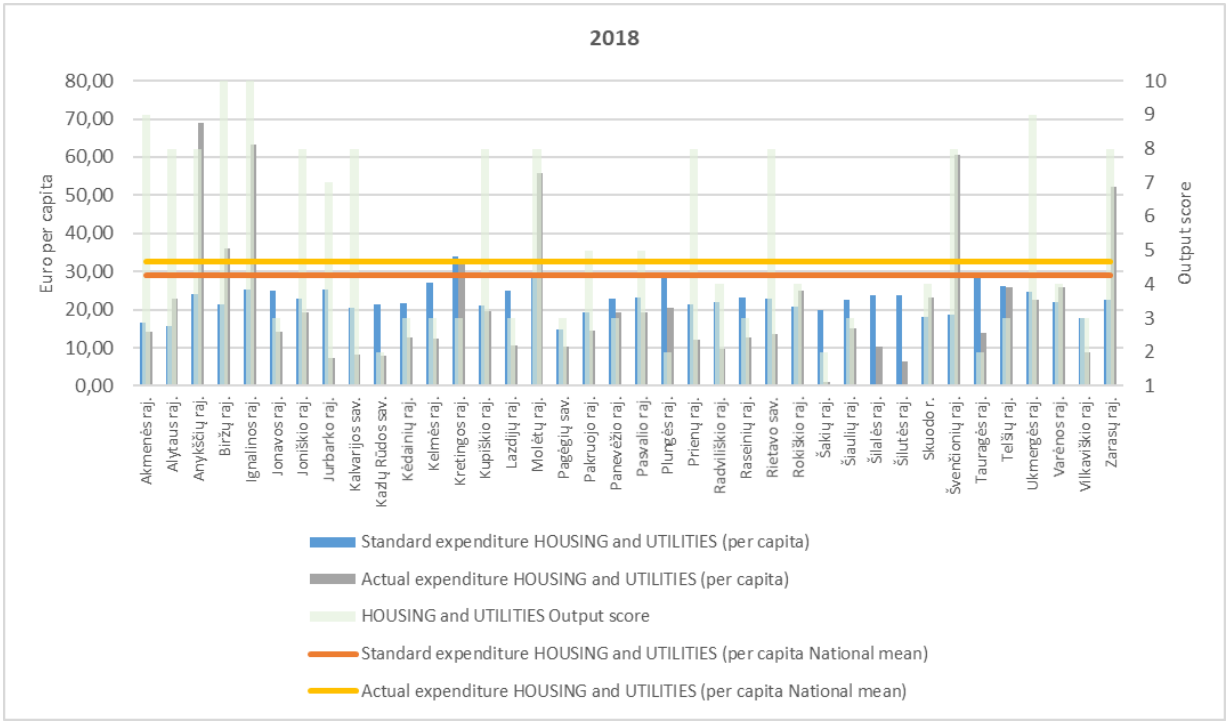
Among *Predominantly urban* municipalities (***Figure 59***), Šalčininkų raj. and Vilniaus raj. display actual per capita expenditure far above the standard and the national averages and, at the same time, low level of services (non-efficient). On the other side Visagino m. and Marijampolės m. compensate the high level of expenditure with an equally high level of services produced. All remaining municipalities, with the exclusion of Trakų raj. and Utenos raj. which perform quite efficiently, should increase the supply of services (under standard).

Figure 59 Housing and utilities standard and actual Expenditure – Predominantly urban



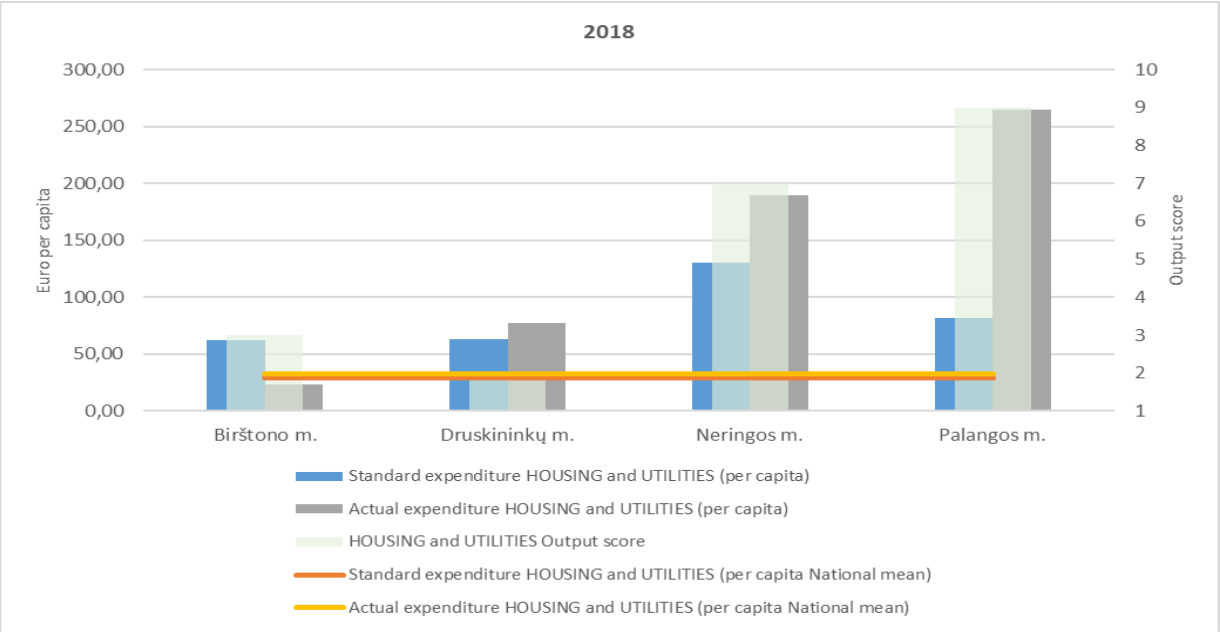
Among *Predominantly rural* (***Figure 60***) most of the municipalities are *under standard* which means that despite the level of expenditure is below the standard, the correspondent level of services is still low.

Figure 60 Housing and utilities standard and actual Expenditure – Predominantly rural



All *Resorts* except Birštono m., have positive expenditure gaps, with actual expenditures exceeding the correspondent standard estimation. Neringos m. and Palangos m. supply adequate level of services, while Birštono m. and Druskininkų m. do not support the demand efficiently.

Figure 61 Housing and utilities standard and actual Expenditure – Resort



The combination of results concerning expenditure and output analysis is summarized through the following two tables (***Table 50*** and ***Table 51***). For Housing and utilities function most of municipalities seem to be *under standard*, spending less than the standard but also providing less services than the standard.

Table 50 Housing and utilities Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10								2			2
9				3					1		4
8		1	2	3				3	2	1	12
7		1	1				1	1			4
6					1			1			2
5			2								2
4	1		2	1		1	2				7
3	1	3	11	1	2						18
2	1	1	2				1	1	1		7
1		2									2
Total	3	8	20	8	3	1	4	8	4	1	60

Table 51 Housing and utilities Performance (2018)

Performance	Number
Efficient	12
Non efficient	6
Over Standard	12

Under standard	30

Cluster partitioning highlights the absence of *inefficient* municipalities among *Big cities* and *Resort*, while the most important proportion of *under standard* municipalities is localized in the *Predominantly rural* areas.

Table 52 Housing and utilities Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	2
Non efficient	
Over Standard	1
Under standard	3

Predominantly urban

Performance	Number
Efficient	2
Non efficient	2
Over Standard	2
Under standard	6

Predominantly rural

Performance	Number
Efficient	8
Non efficient	3
Over Standard	7
Under standard	20

Resort

Performance	Number
Efficient	1
Non efficient	
Over Standard	2
Under standard	1

The list of best performing municipalities (*efficient*) as well as *inefficient* ones is reported in the table below (***Table 53***).

Table 53 Housing and utilities Efficient and Non efficient performers (2018)

Efficient	Non efficient
Alytaus m.	Druskininkų m.
Kauno m.	Rokiškio raj.
Akmenės raj.	Skuodo r.
Joniškio raj.	Šalčininkų raj.
Jurbarko raj.	Varėnos raj.
Kupiškio raj.	Vilniaus raj.
Prienų raj.	
Trakų raj.	
Ukmergės raj.	
Utenos raj.	
Kalvarijos sav.	
Rietavo sav.	

Summarizing, for Housing and utilities function it is necessary, for the policy maker, to focus on *under standard* municipalities that represent the biggest portion of the performance distribution.

Furthermore, special emphasis should be placed on those few municipalities that are spending much more than the standard, with mixed results (some inefficient, other over standard) and pushing, at national level, total actual expenditure for Housing and utilities significantly above the standard.

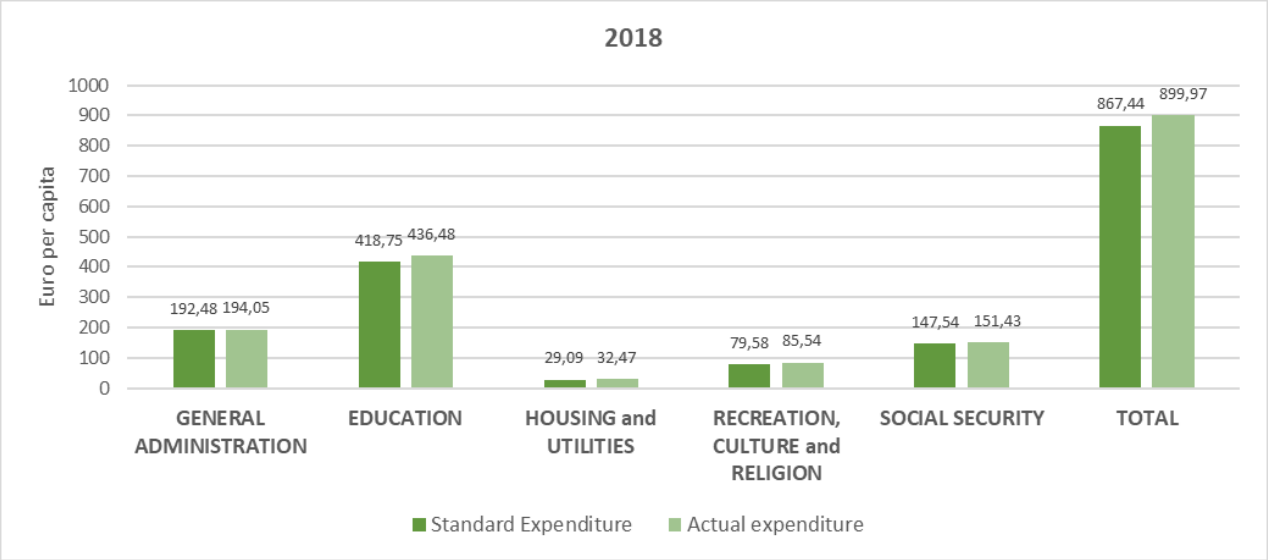
3.1.6 Total standard Expenditure

Total standard expenditure has been calculated as the sum of the expenditures related to the following standardized functions:

- Education;
- Social security;
- Recreation, culture and religion;
- General administration;
- Housing and utilities.

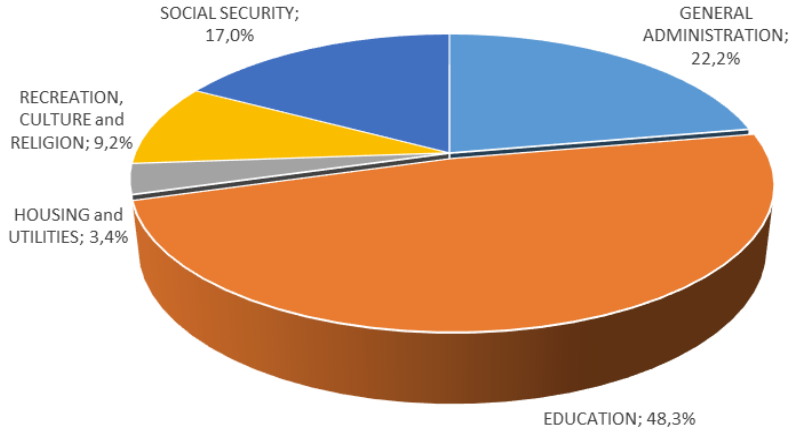
The comparison between standard expenditures and actual expenditures per inhabitant is summarized in the following figure (***Figure 62***), for each function included in the standardization list. The total actual expenditures average per inhabitant slightly exceeds the corresponding standard value (+3,75%). The actual expenditures average exceeds the standard value for all the functions considered: General administration (+0,82%), Education (+4,23%), Housing and utilities (+11,63%), Recreation, culture and religion (+7,48%) and finally Social security (+2,64%).

Figure 62 Components of Total Standard and Actual expenditure



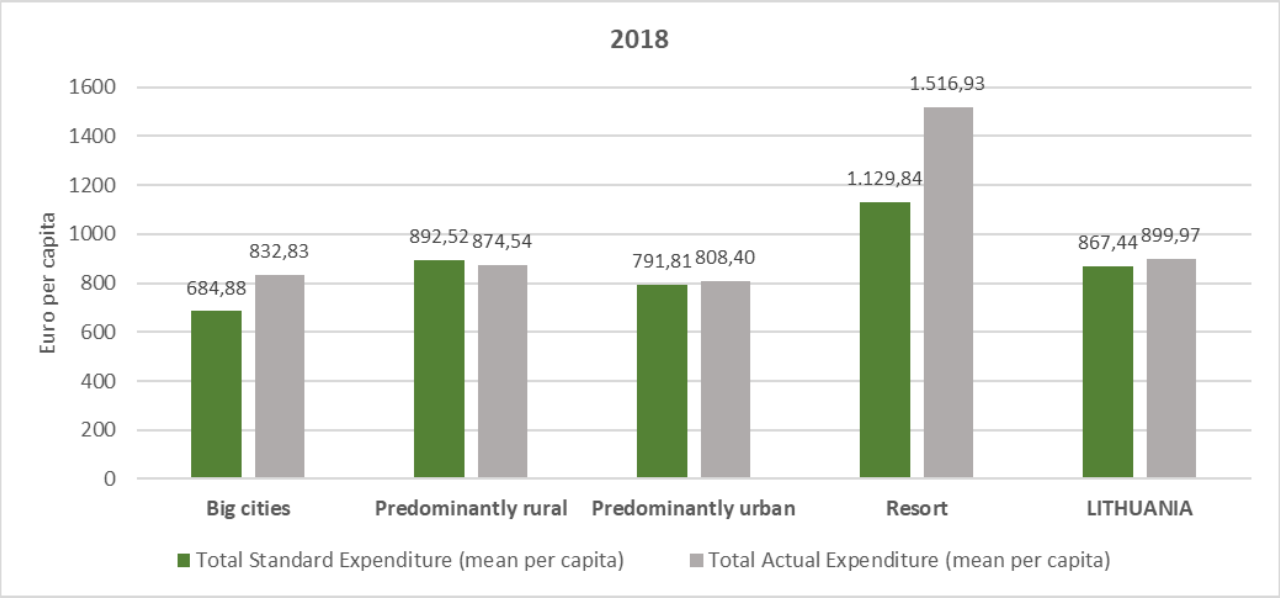
The main contribution (***Figure 63***) to the total standard expenditure is attributed to the Education function (48,3%), while Housing and utilities represent the smallest part (3,4%).

Figure 63 Components of Total Standard expenditure (2018)



Focusing on results between clusters, the standard and actual level of expenditures are clearly aligned for *Predominantly urban* (+2,09%) and *Predominantly rural* (-2,01%) municipalities. The distance seems to be more accentuated for *Big cities* (+21,60%) and for *Resort* (+34,26%). The extremely high population density for the first group of municipalities and the intense tourist flow for the second group could explain the significant discrepancy of the two dimensions.

Figure 64 Total Standard and Actual expenditure by Cluster



The overall level of services supplied has been measured considering the output gaps of each function included in the standardization process. The final score related to the total level of services provided is equal to the weighted sum of the output gaps of all the standardized functions:

$$Output\ gap_{it} = \frac{\left(\sum_j Output\ gap_{ijt} * weight_{jt}\right)}{\sum_j weight_{jt}}$$

For each available year of analysis, weights are given by the ratio between the total amount of standard expenditures of each function and the total amount of standard expenditures of all the functions (***Table 54***).

Table 54 Weights of Standardized functions

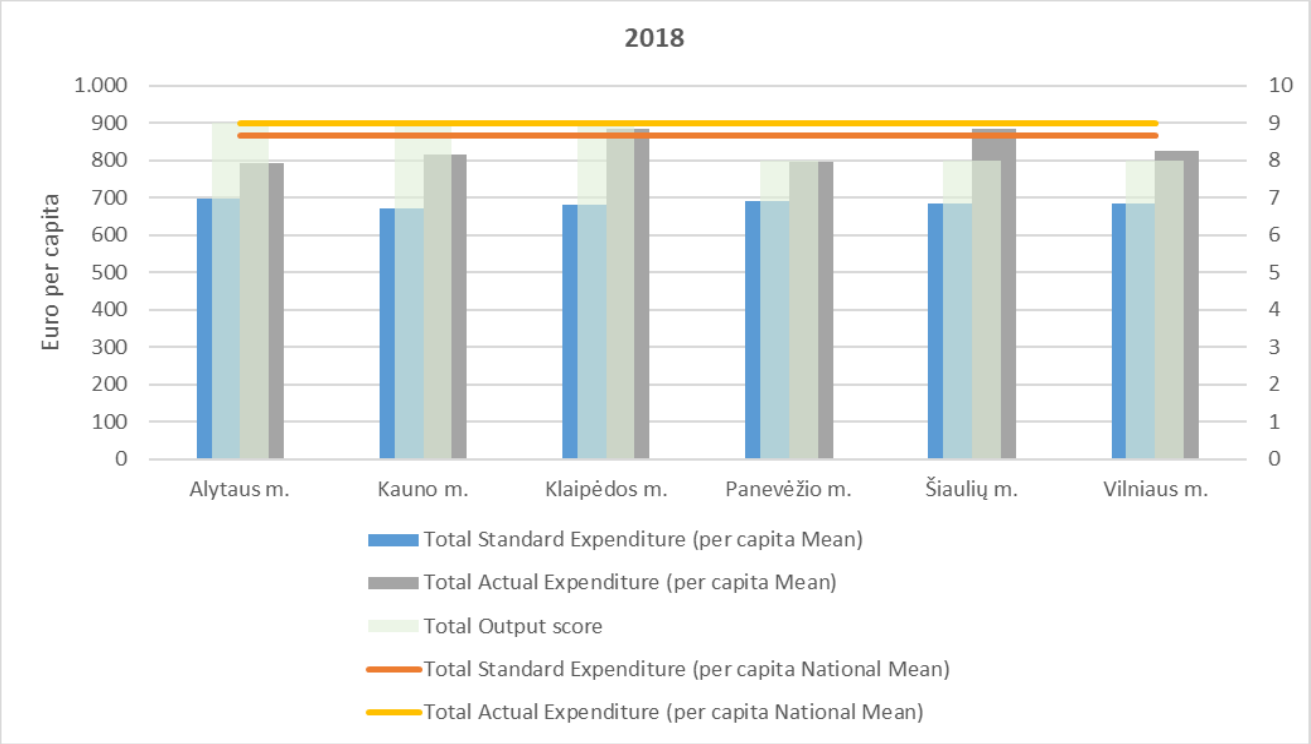
FUNTION	$WEIGHT_j$
EDUCATION	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Education}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
SOCIAL SECURITY	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Social\ security}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
RECREATION, CULTURE and RELIGION	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Recration, culture\ and\ religion}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
GENERAL ADMINISTRATION	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{General\ administration}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$
HOUSING and UTILITIES	$\frac{Total\ Standard\ Expenditure\ \boldsymbol{Housing\ and\ utilities}}{\sum_j Total\ Standard\ Expenditure\ Function_j}$

Merging results related to the standardization of the expenditure and to the standardization of the level of the services, it is possible to have a full picture of the performance associated to each municipality; furthermore, a more detailed analysis within cluster adds significant insights.

Standard expenditures for *Big cities* (***Figure 65***) are homogeneous and vary within a strict range of values (from 670,48 to 698,91 euro per inhabitant). On the other side actual expenditures are more heterogeneous and constantly higher than the standard, with Klaipėdos m. and Šiaulių m. displaying the highest positive gaps. The discrepancy is justified by a substantial production of services that attributes to all municipalities of the cluster a performance *over standard*.

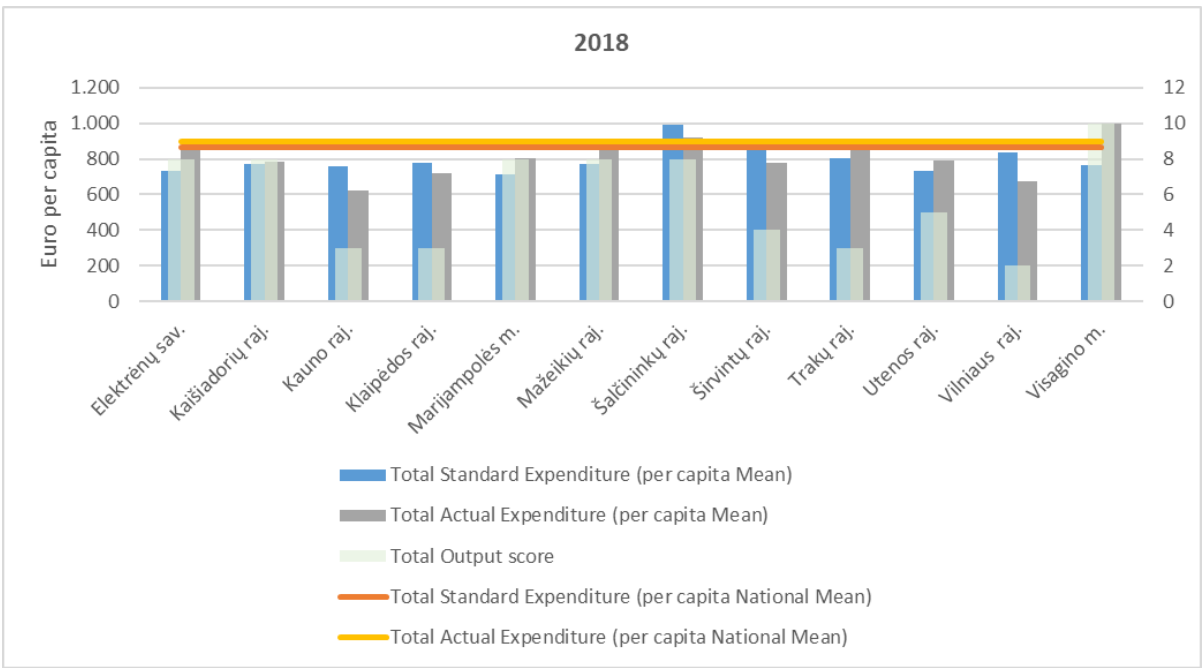
Municipalities providing high service, representing administrations spending more than the standard and, at the same time, producing more services than the standard, can be seen as "*normal*" under the principle that local governments should be left free to exercise their autonomy in order to satisfy the local demand for public services.

Figure 65 Total Expenditure and Output score – Big cities



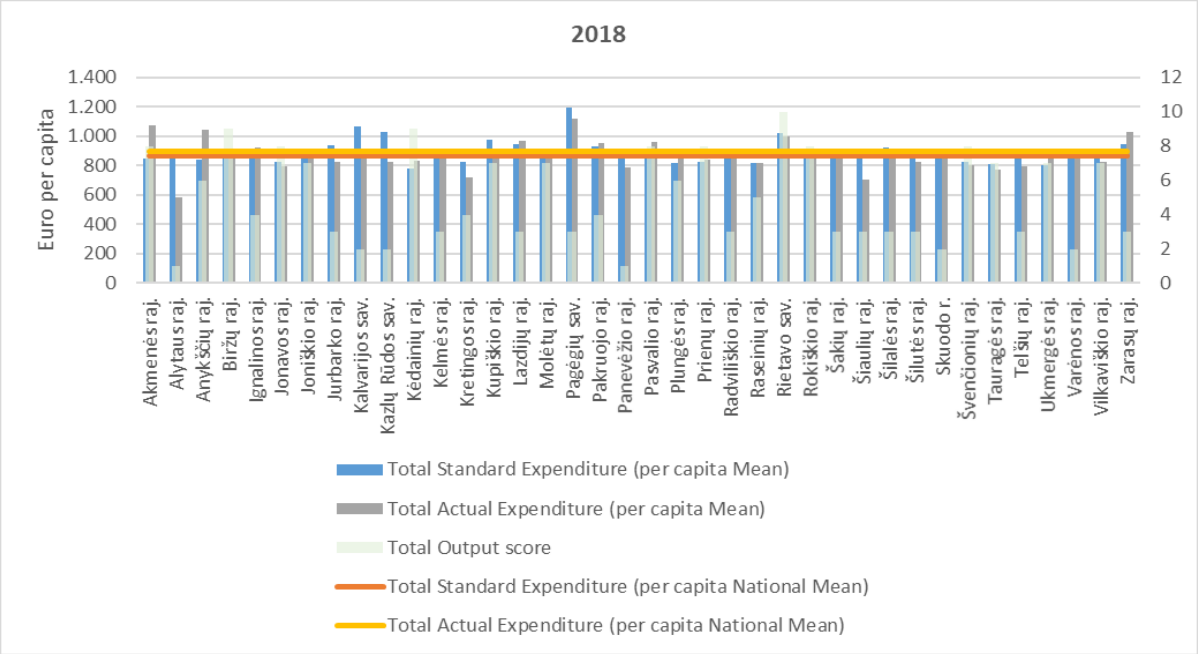
Predominantly urban municipalities do not show a significant expenditure imbalance, which is basically positive. Only few municipalities of this cluster (Kauno raj., Klaipėdos raj., Širvintų raj. and Vilniaus raj.) report a negative gap, i.e. the standard expenditure is higher than the actual expenditure, combined with a low level of services provision (*under standard* municipalities). Šalčininkų raj. is the only efficient municipality of the cluster.

Figure 66 Total Expenditure and Output score – Predominantly urban



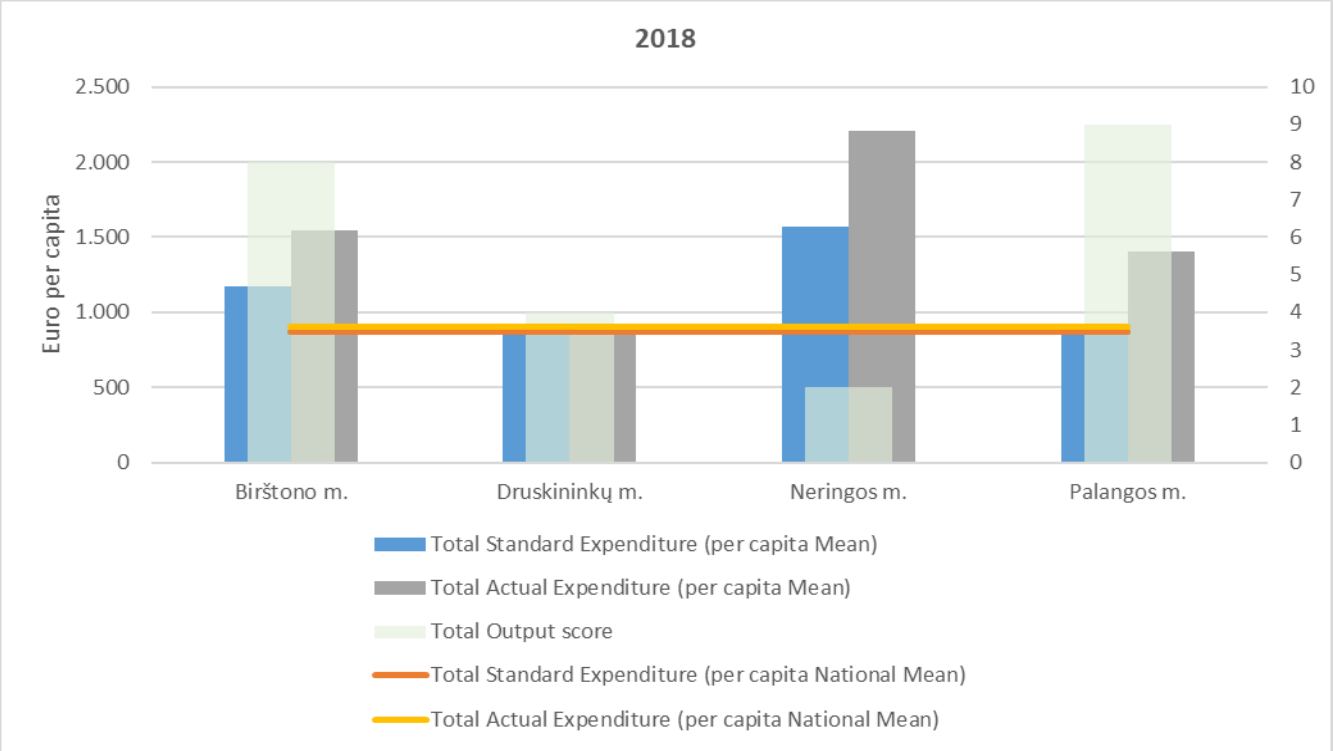
Predominantly rural municipalities are equally distributed around the national average and the gap between the standard and the actual value of the expenditure is extremely reduced for most municipalities of the cluster. Even from the provision of services point of view municipalities are uniformly distributed.

Figure 67 Total Expenditure and Output score – Predominantly rural



Among *Resort* municipalities Druskininkų m. standard expenditure seems to be aligned with the actual value, while Neringos m. reports a significant distance from the actual expenditure combined with a low level of services provision. The remaining municipalities display a value of the actual expenditures much higher than the standard, but also the level of services is consistent (*over standard*).

Figure 68 Total Expenditure and Output score – Resort



The overall picture of Lithuanian municipalities distribution in the four quadrants of performance is displayed in the following table (***Table 55***). Most municipalities are simultaneously spending and producing services more than the standard (see also ***Table 56***). Efficient municipalities are located mainly in *Predominantly rural* areas (***Table 57***).

Table 55 Total Expenditure and Output scores distribution (2018)

Output score	Expenditure score										Total
	1	2	3	4	5	6	7	8	9	10	
10				1					1		2
9						1		2	2	1	6
8			1	2			2	7	3		15
7			3		1			2			6
6								1	1		2
5					1			1			2
4			2				2	1			5
3	1	1	5	1		1	2	3			14
2		3					1	1		1	6
1	1		1								2
Total	2	4	12	4	2	2	7	18	7	2	60

Table 56 Total Performance (2018)

Performance	Number
Efficient	8
Non efficient	13
Over Standard	23
Under standard	16

Table 57 Total Performance by Cluster (2018)

Big cities

Performance	Number
Efficient	
Non efficient	
Over Standard	6
Under standard	

Predominantly urban

Performance	Number
Efficient	1
Non efficient	2
Over Standard	5
Under standard	4

Predominantly rural

Performance	Number
Efficient	7
Non efficient	9
Over Standard	10
Under standard	12

Resort

Performance	Number
Efficient	
Non efficient	2
Over Standard	2
Under standard	

The list of best performing municipalities (*efficient*) as well as *inefficient* ones is reported in the table below (***Table 58***).

Table 58 Total Efficient and Non efficient performers (2018)

Efficient	Non efficient
Jonavos raj.	Druskininkų m.
Kupiškio raj.	Neringos m.
Molėtų raj.	Ignalinos raj.
Šalčininkų raj.	Kelmės raj.
Švenčionių raj.	Lazdijų raj.
Tauragės raj.	Pakruojo raj.
Vilkaviškio raj.	Radviliškio raj.
Rietavo sav.	Skuodo r.
	Šakių raj.
	Trakų raj.
	Utenos raj.
	Varėnos raj.
	Zarasų raj.

The geographical distribution of expenditure normalized scores, ranging from 1 to 10, are reported in the following figures that show the distribution across the whole territory (***Figure 69***) and then by cluster (***Figure 70***). Green areas identify municipalities with low expenditure scores, i.e. local administrations with a level of actual expenditure lower than the standard one. On the contrary, red or dark red areas identify municipalities with actual values of the expenditure greater than the standard.

Figure 69 Total Expenditure score map (2018)

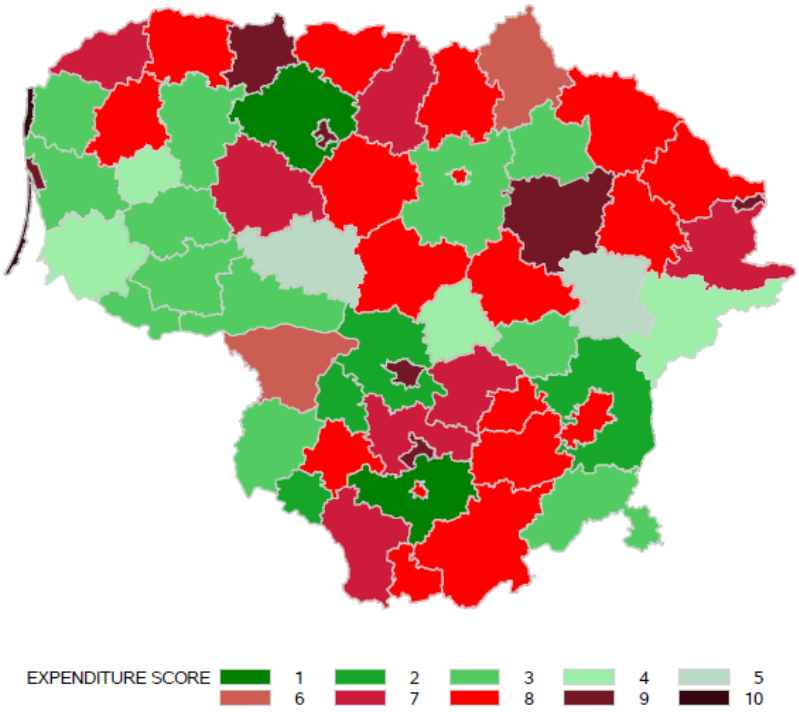
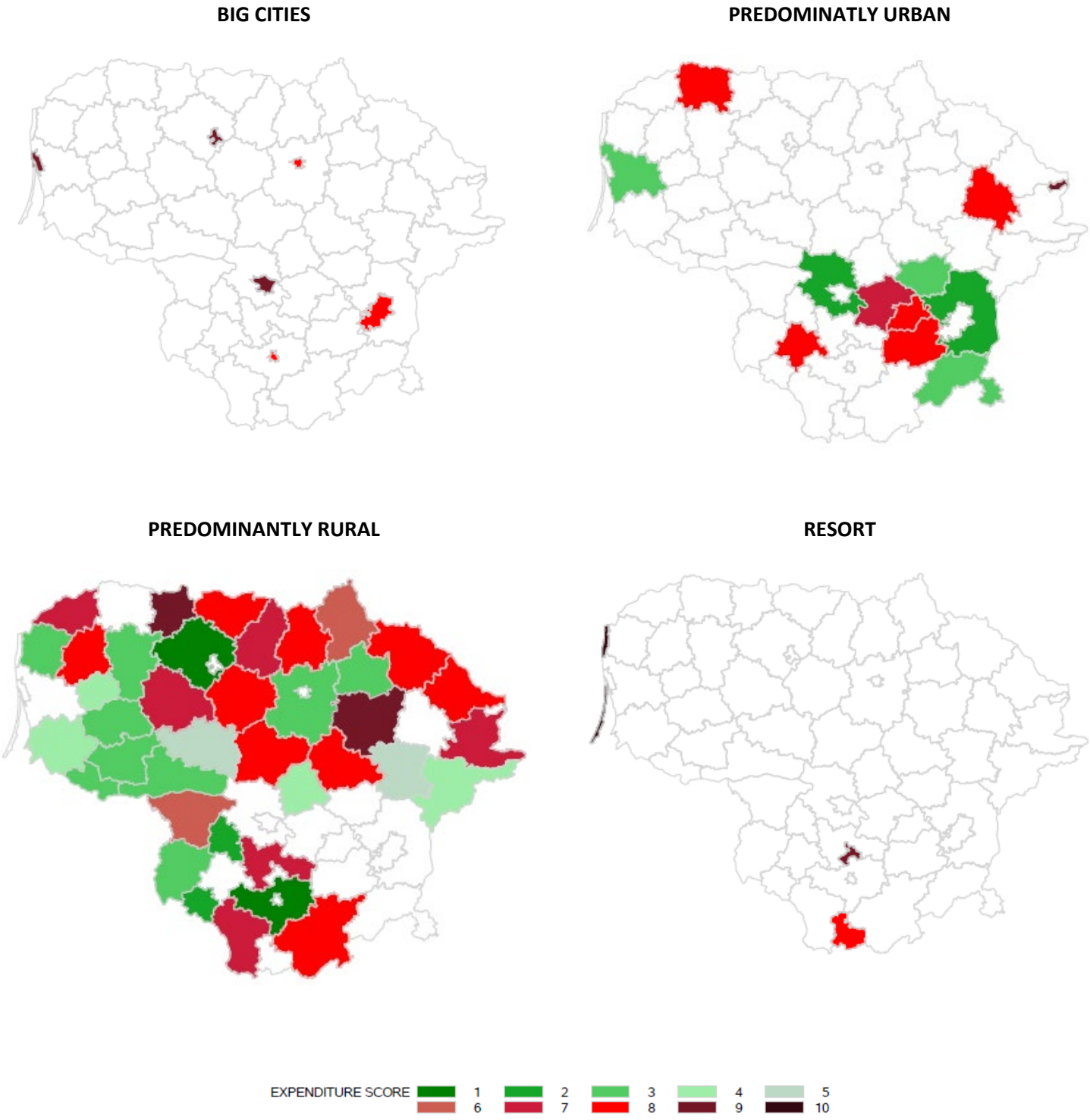
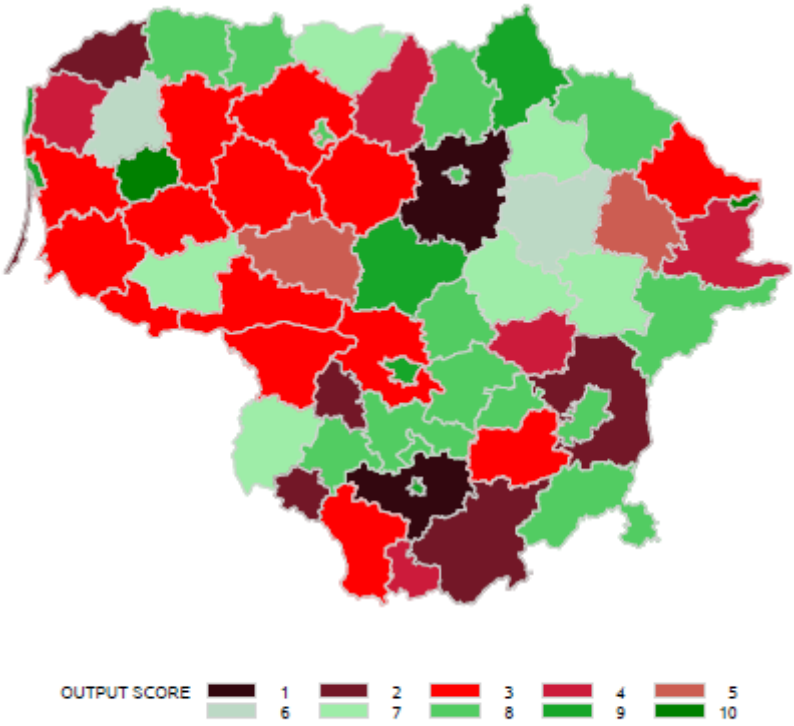


Figure 70 Total Expenditure score map by cluster (2018)



With the same approach a snapshot of the level of services provided is given by the following map (***Figure 71***) that displays the scores of the outputs produced. The higher the output score, the higher the level of provided services than the standard. From the performance point of view (four quadrants theory) a high level of services produced can classify local authorities as *over standard* or *efficient*, thus justifying the choice of green colour for high output scores.

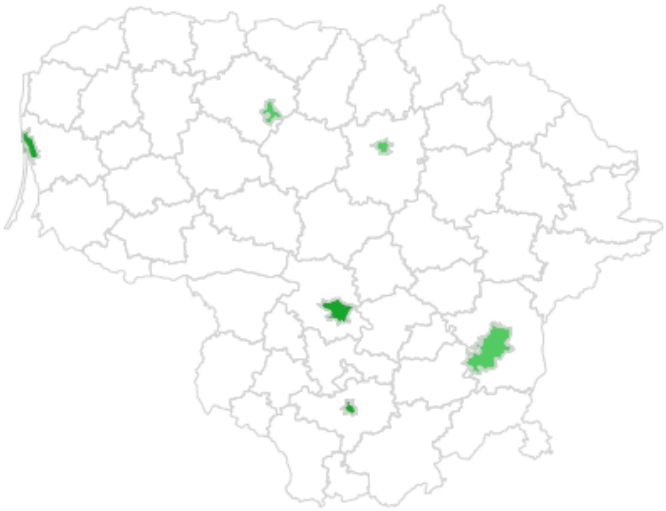
Figure 71 Total Output score map (2018)



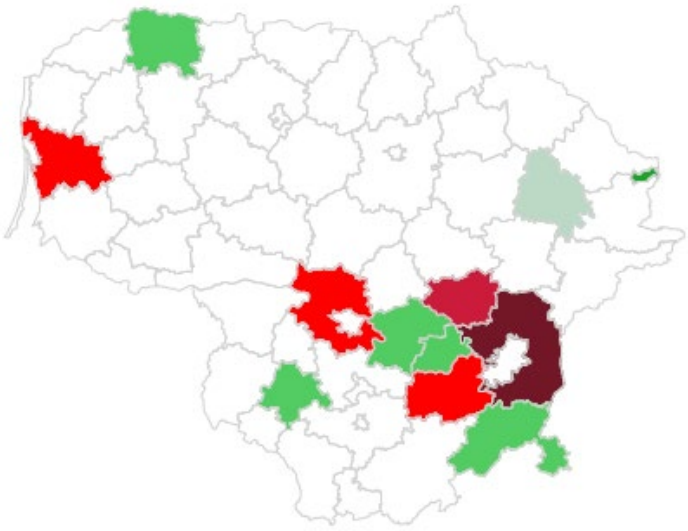
A distinct focus by cluster is provided below (***Figure 72***) where municipalities with the same socio-demographic background are compared within each group.

Figure 72 Total Output score map by cluster (2018)

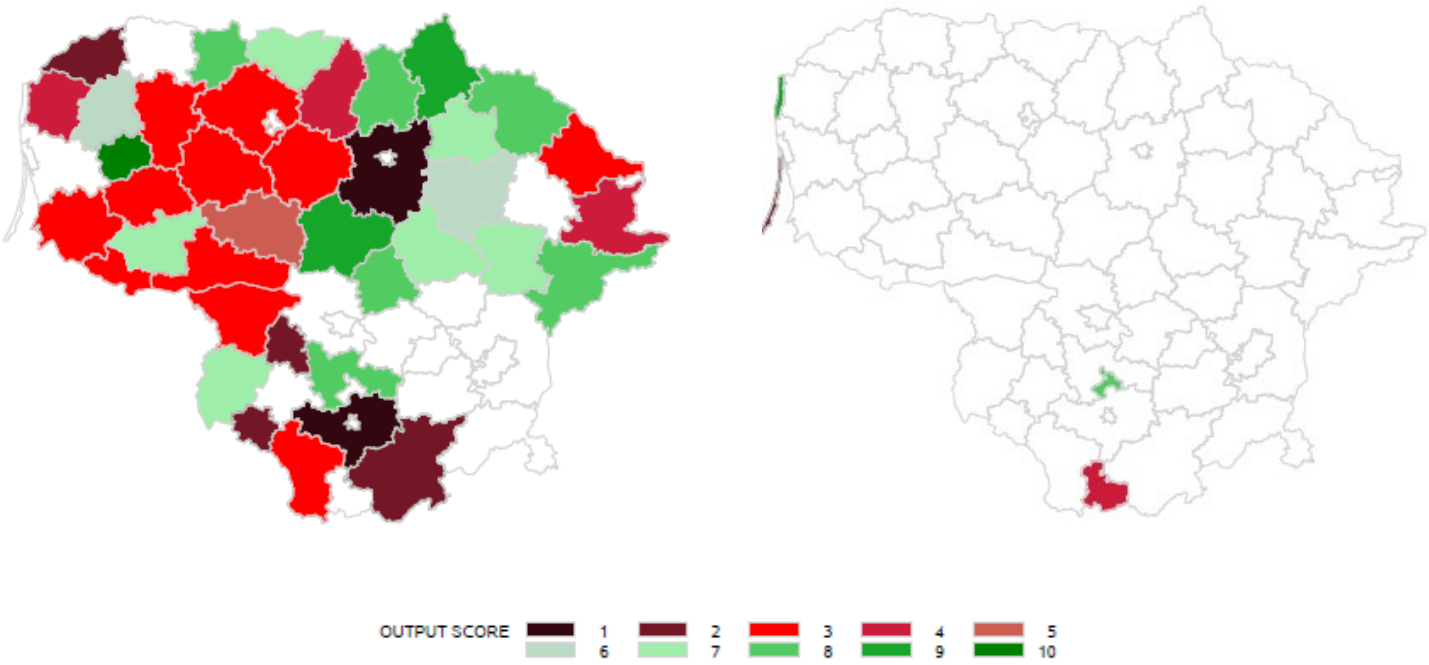
BIG CITIES



PREDOMINATLY URBAN



PREDOMINANTLY RURAL **RESORT**



As presented above, the simultaneous results concerning the level of expenditures and the level of services supplied provide the basis for identifying a specific expected rate of performance. The numeric distribution of municipalities previously showed (***Table 56*** and ***Table 57***) is now presented through a geographical map for the whole Lithuanian territory (***Figure 73***) and for each cluster (***Figure 74***).

Figure 73 Total Performance analysis map (2018)

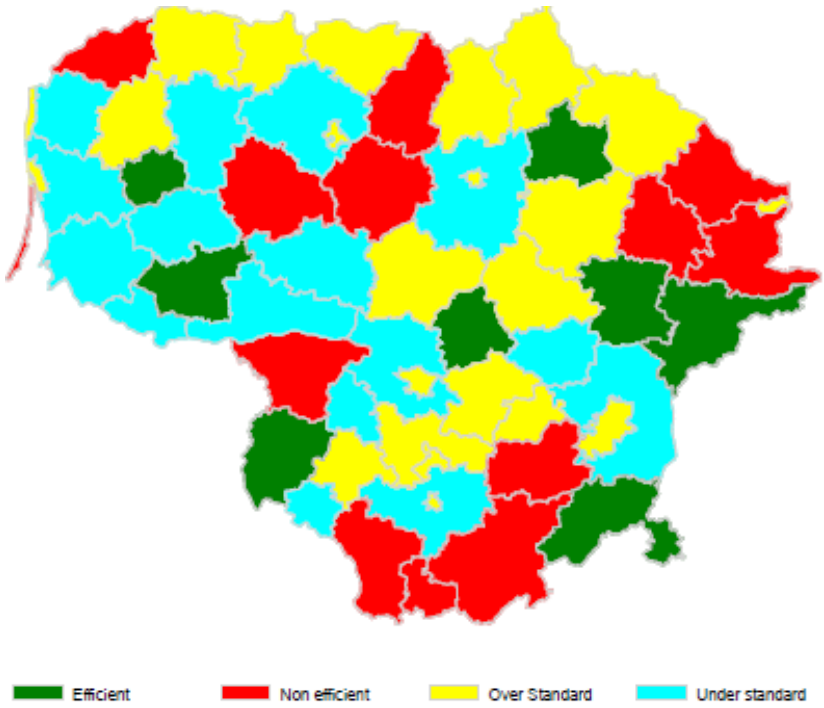
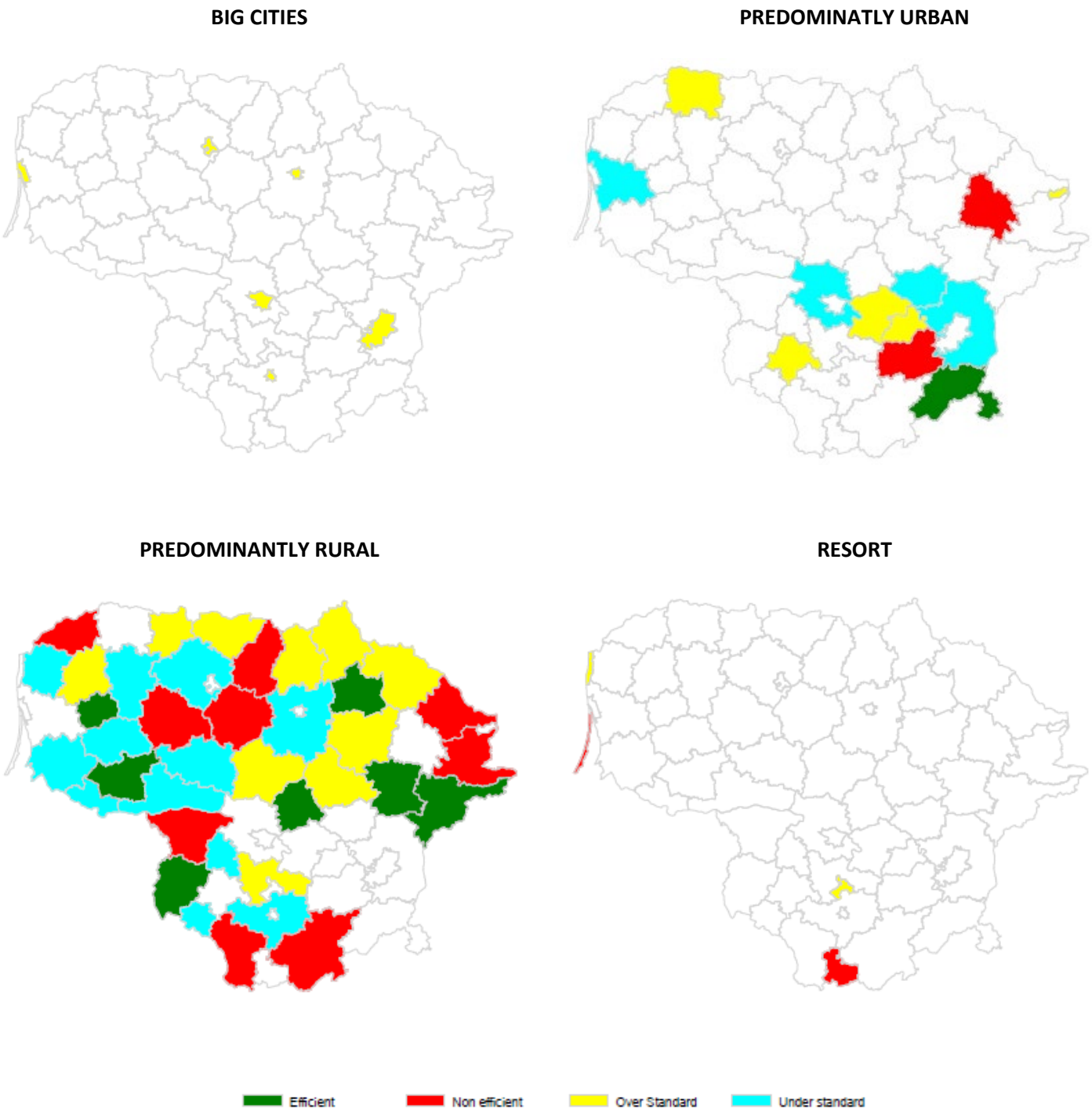


Figure 74 Total Performance analysis map by Cluster (2018)



An alternative approach to the theory of the four quadrants relies on a numeric combination of the expenditure and output scores in order to identify a final synthetic performance score:

$$Synthetic\ performnce\ score = (11 - Expenditure\ score) * 0{,}40 + Output\ score * 0{,}60$$

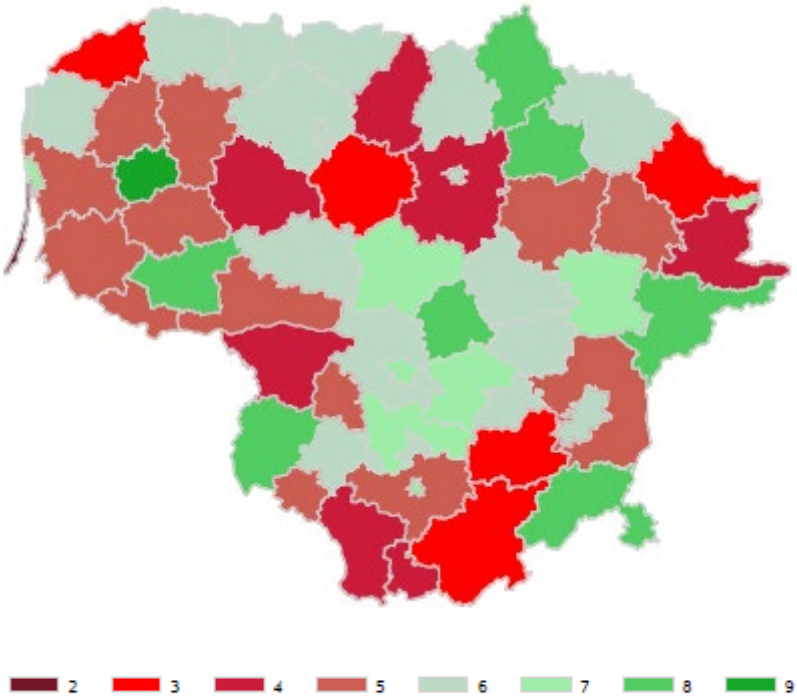
The base assumption to justify the asymmetric system of weights of the synthetic performance score is that an efficient provision of local public services plays a predominant role in the sustainability of the financial structure of municipalities. The following table (***Table 59***) reports the average values of the synthetic performance score by cluster. The level of urbanization is the key determinant to explain the distribution of the synthetic performance score; *Big cities* are in fact the municipalities with highest scores followed by *Predominantly urban*, *Predominantly rural* and finally *Resort* municipalities.

Table 59 Overall score by Cluster (2018)

Cluster	Overall score (Mean)
Big Cities	6,10
Other (predominantly rural)	5,26
Other (predominantly urban)	5,60
Resort	4,15
Total	**5,34**

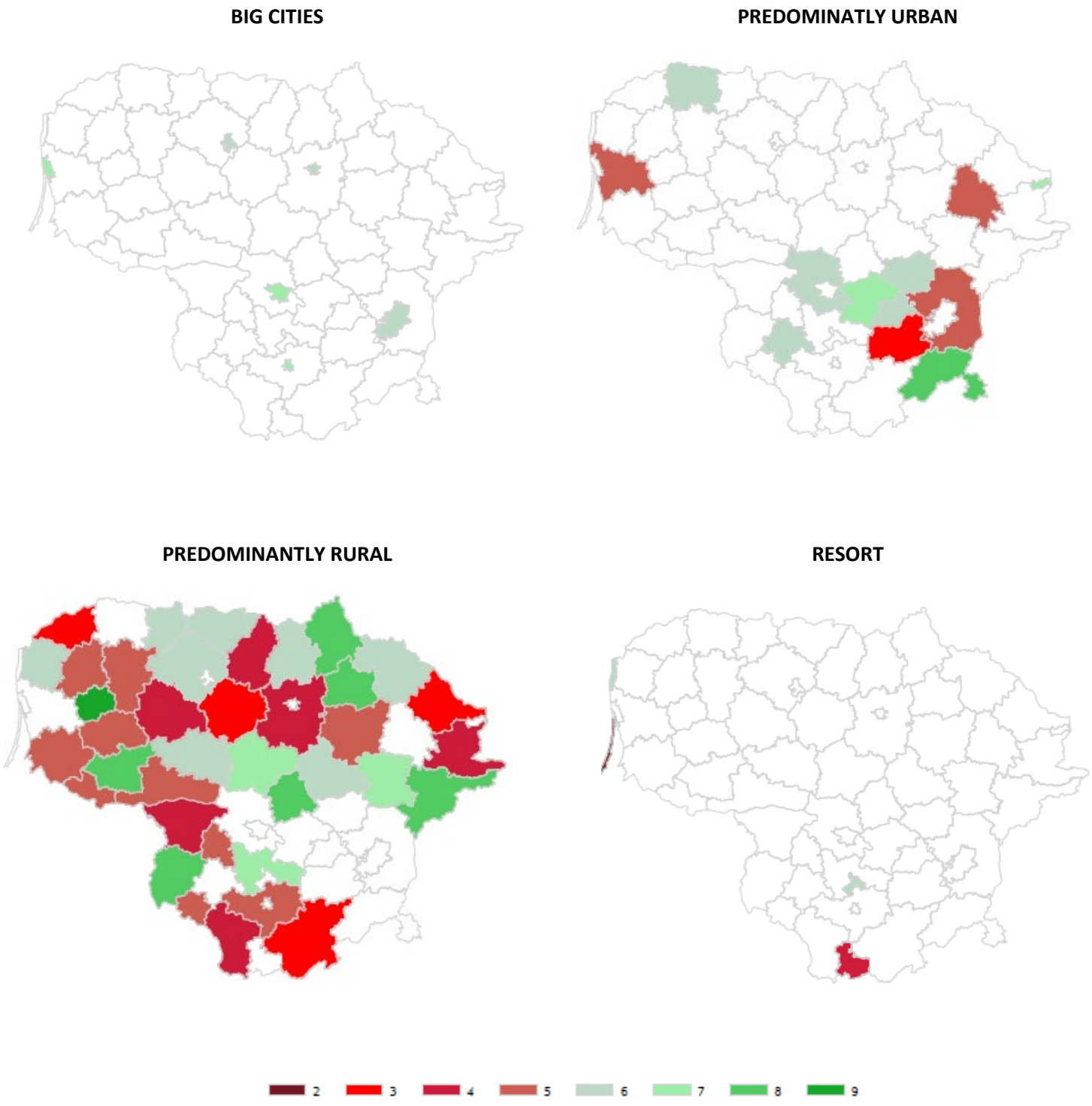
A geographical perspective of the synthetic performance score is displayed in the following map (***Figure 75***) where light green and dark green areas represent the best performing municipalities.

Figure 75 Overall score map (2018)



The detail by cluster is showed in the following figure (***Figure 76***).

Figure 76 Overall score map by Cluster (2018)



Combining Life quality index information with performance results, it clearly appears that *over standard* municipalities are the areas with a higher quality of life. Spending more than the standard and, at the same time, producing more services than the standard turns out to improve the quality of life.

Table 60 Total Performance analysis and LQI (2018)

Performance	LIFE QUALITY INDEX (Mean)
Efficient	43,1%
Non efficient	44,7%
Over standard	53,0%
Under standard	44,3%
Total	**47,5%**

In the following table (***Table 61***) Life quality index has been furtherly split by groups of performance and clusters. The remarkably high level of quality of life for *over standard* municipalities mainly depends on the presence of *Big cities* and *Resorts* in the group.

On the contrary, the low value of the Life quality index among *efficient* municipalities is due to the presence of *Predominantly rural* municipalities, which on average correspond to lower values of the Life quality index itself.

Table 61 Total Performance analysis by Cluster and LQI (2018)

Performance by Cluster	LIFE QUALITY INDEX (Mean)	Number
Efficient	**43,1%**	**8**
Predominantly rural	43,7%	7
Predominantly urban	39,0%	1
Non efficient	**44,7%**	**13**
Predominantly rural	38,7%	9
Predominantly urban	54,4%	2
Resort	62,1%	2
Over standard	**53,0%**	**23**
Big Cities	65,3%	6
Predominantly rural	44,2%	10
Predominantly urban	50,8%	5
Resort	65,4%	2
Under standard	**44,3%**	**16**
Predominantly rural	41,5%	12
Predominantly urban	52,7%	4
Total	**47,5%**	**60**

The same results are reproduced through maps for the entire national territory (***Figure 77***) and for each cluster (***Figure 78***). The maps combine simultaneously territorial information, level of performance and intensity of the Life quality index that is represented by bubbles.

Figure 77 Total Performance analysis and LQI map (2018)

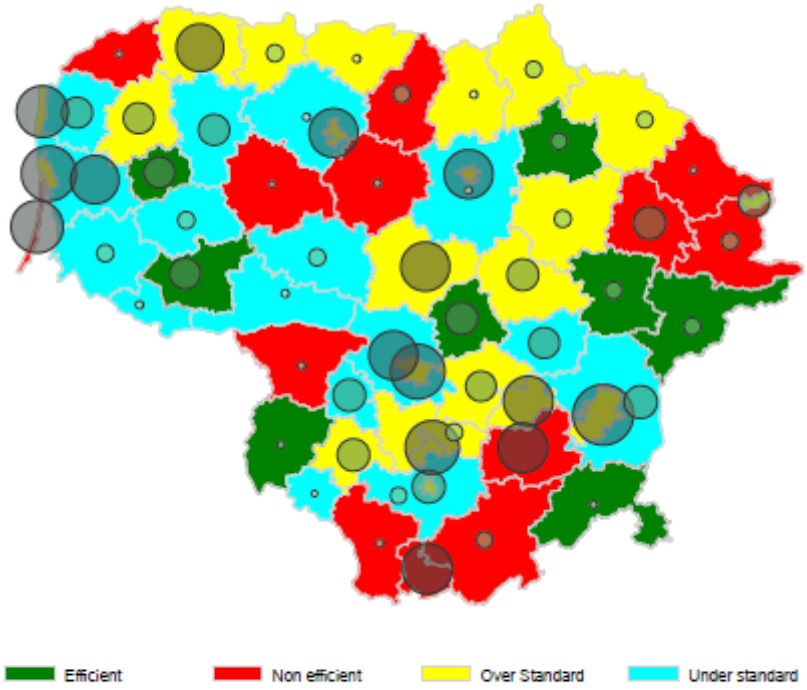
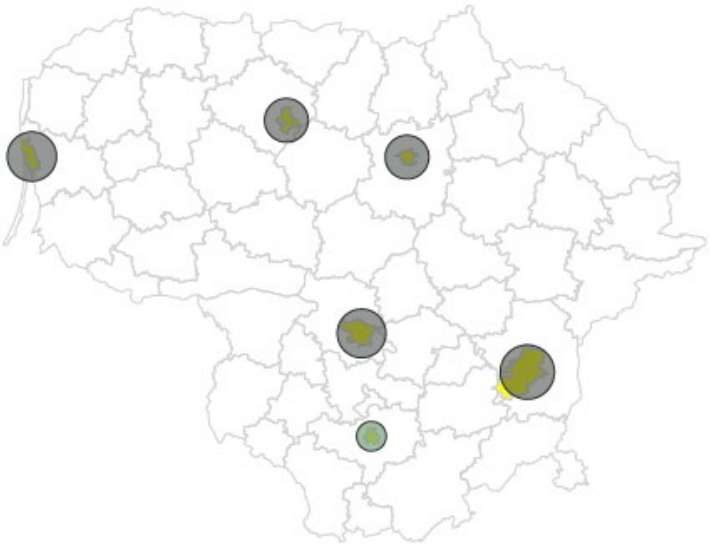
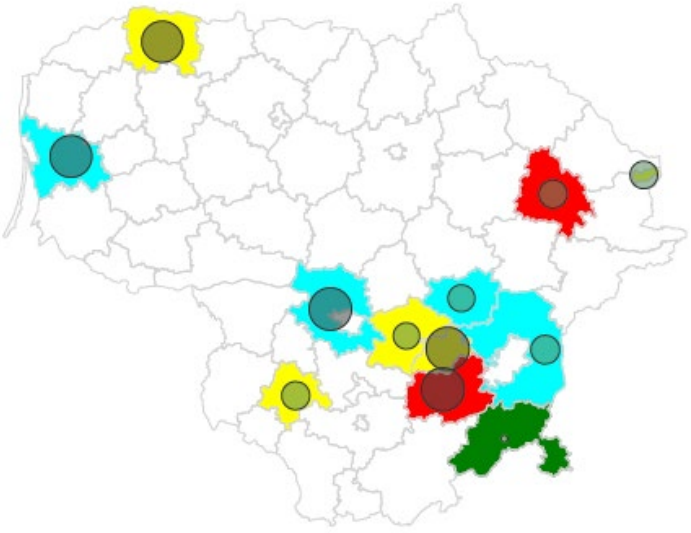


Figure 78 Total Performance analysis and LQI map by Cluster (2018)

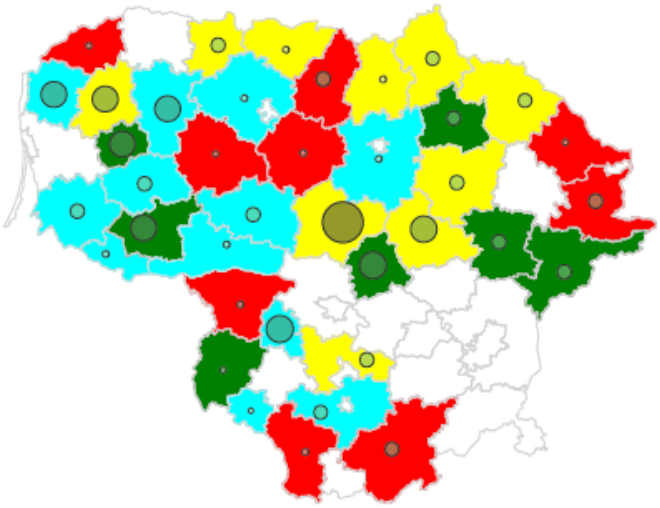
BIG CITIES



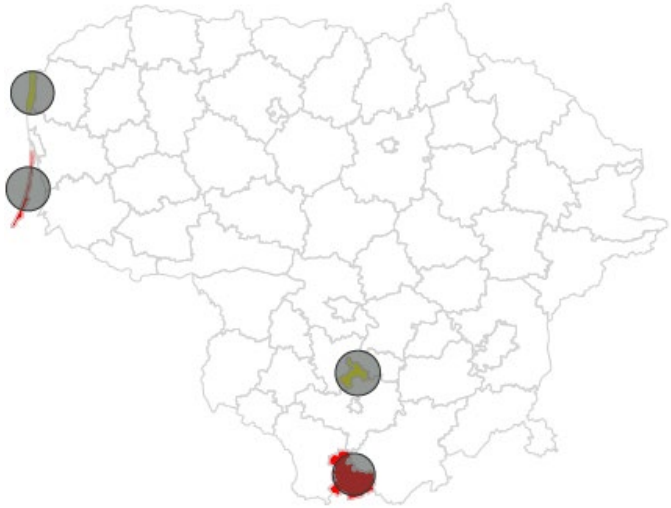
PREDOMINATLY URBAN



PREDOMINANTLY RURAL



RESORT



Summarizing, the total performance analysis, which simultaneously combines results related both to Standard expenditure needs and standard level of services, shows the prevalence of *over standard* municipalities. The high level of expenditure is counterbalanced by an adequate production of services, especially among *Big cities* increasingly subject to urbanization phenomena. High service provision, i.e. spending more than the standard and producing more services than the standard, turns out to improve the quality of life.

What deserves special attention are *under standard* municipalities. Although low service provision could be seen as "normal", under the principle that local governments should be left free to exercise their autonomy in order to satisfy the local demand for public services, it does not guarantee an adequate standard of living. Life quality index is the lowest for *under standard* municipalities and particularly among *Predominantly rural* areas.

Finally, similar conclusions could be deduced for *Predominantly rural* municipalities included in the *inefficient* group, with a quality of life index even lower than other groups under overspending conditions.

3.2 Analysis of Revenues

The second building block of the project concerns the analysis of the fiscal capacity at municipal level, which can be defined as municipalities' own revenue raising capacity, i.e. the potential ability of a Municipality to raise revenues.

The standardization process of municipal tax revenues has been implemented for the revenues raised through the following taxes (***Table 62***) according to the models reported.

Table 62 Revenues Standardization methodology

REVENUES	MODEL
Tax on immovable property	Representative Tax System (**RTS**)
Tax on land	Representative Tax System (**RTS**)
Fees	Regression-based Fiscal Capacity Approach (**RFCA**)

For the analysis of Lithuanian municipalities' fiscal capacity, a very detailed and complete data set has been built up for the period under observation. The database includes information on the entire set of municipal revenues over six years ranging from 2013 to 2018.

The components of fiscal capacity included in the database can be divided into three main blocks:

1. Revenues from Personal income tax (PIT);
2. Local government own incomes;
3. Special targeted grants from the state budget.

The first block of Personal income tax can be furtherly split into the following items:

- Personal income tax (PIT) received from State Tax Inspectorate;
- Equalization component to 90% of PIT average;
- Equalization component according to expenditure needs.

Local government own incomes include:

- Tax on immovable property;
- Tax on land;
- Lease tax on state owned land and water bodies;
- Inheritance tax, estate;
- Out of fiscal capacity:
    - revenue from dividends;
    - revenue from interests and deposits;
    - revenue from sales of long-term tangible and intangible assets;

- Fees:
    - State fee;
    - Revenue from fines and forfeiture;
    - Revenue from goods and services;
    - Local fee;

- Other revenue not elsewhere classified;
- Pollution taxes;
- Tax on State-owned natural resources.

The last group of Special targeted grants includes:

- State delegated functions;
- Student basket;
- Grants for investment projects;
- Other grants.

The table below (***Table 63***) shows the financial indicators (thousands of Euros[23]) of Lithuanian Municipal budgets from 2013 to 2018. Data have been provided by Lithuanian Ministry of Finance.

Table 63 Revenues and Grants

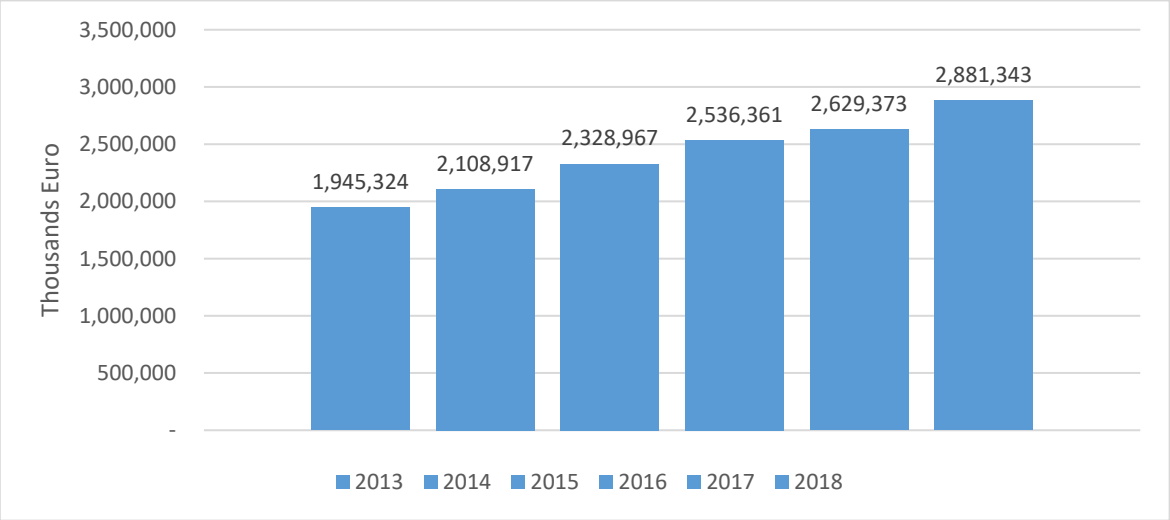
(Values in thousands of Euros)	2013	2014	2015	2016	2017	2018
Revenue for independent functions:	**976.046,60**	**1.202.049,30**	**1.378.872,34**	**1.525.812,60**	**1.597.832,44**	**1.877.855,70**
1.1 Personal income tax (PIT)	713.495,10	908.598,70	1.051.677,30	1.171.758,40	1.216.045,00	1.465.237,00
2.1 Tax on immovable property	75.963,20	82.513,40	97.018,30	96.502,70	95.863,80	96.590,10
2.2 Tax on land	18.193,60	22.768,60	26.664,74	29.703,90	31.421,34	39.582,20
2.3 Lease tax on state owned land and water bodies	20.437,50	20.348,30	20.651,70	21.455,70	21.531,90	22.298,90
2.4 Inheritance tax, estate	1.282,10	1.330,90	1.429,50	1.468,70	1.669,50	1.801,70
2.5 Dividends	5.611,7	5.510,5	6.179,5	10.308,3	17.648,5	18.396,8
2.6 State fee	3.367,1	3.175,2	3.461,3	3.598,3	3.709,6	3.074,4
2.7 Interest for deposit	332,6	186	191,5	230,1	367,5	280,2
2.8 Revenue from sales of long-term tangible and intangible assets	6.320,5	9.309,3	13.180,1	25.222	22.074,2	22.367,7
2.9 Revenue from fines and forfeiture	1.967,3	2.181,4	4.568	4.558,2	4.852,8	5.998,9
2.10 Other revenue not elsewhere classified	4.432,2	4.434,3	6.546,4	7.015,7	14.833,7	9.740
2.11 Revenue from goods and services	70.432,2	80.685,6	83.348,2	87.217,1	94.960,9	98.800,7
2.12 Pollution taxes	7.172,2	6.892,4	6.517,4	6.719,5	6.955,7	6.882,3
2.13 Tax on State-owned natural resources	2.373,9	2.513,4	4.339,2	4.203,9	4.683,2	6.089,9
2.14 Local fee	44.665,4	51.601,3	53.099,2	55.850,1	61.214,8	80.714,9
3. Special targeted grants from the state budget:	**969.277,10**	**906.867,30**	**950.094,60**	**1.010.548,50**	**1.031.540,20**	**1.003.487,30**
3.1 state delegated functions	298.455,7	158.207,3	126.592,6	130.888,4	138.174,3	147.895,0
3.2 student basket	559.681,8	561.225,1	565.527,5	576.340,3	592.049,4	627.527,6

[23] Nominal values.

(Values in thousands of Euros)	2013	2014	2015	2016	2017	2018
3.3 for investment projects	21.450,10	49.233,20	108.895,70	134.971,30	138.743,60	156.243,90[24]
3.4 for other grants	89.689,5	138.201,7	149.078,8	168.348,5	162.572,9	71.820,8
Total revenue and grants	**1.945.323,70**	**2.108.916,60**	**2.328.966,94**	**2.536.361,10**	**2.629.372,64**	**2.881.343,00**

From 2013 to 2018 there is a constant increasing trend of revenues and grants with an overall positive variation of 48,1%, as shown in the graph below (***Figure 79***).

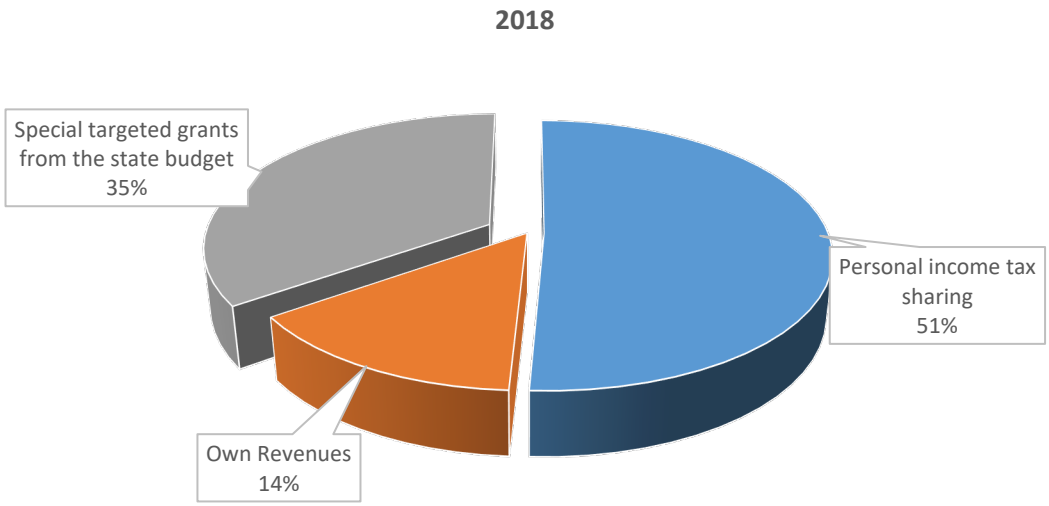
Figure 79 Dynamic of Revenues and Grants



The three main blocks of revenues, grants and PIT are distributed according to the following graph (***Figure 80***) that reports 2018 data. More than half of municipal sources is covered by PIT allocations.

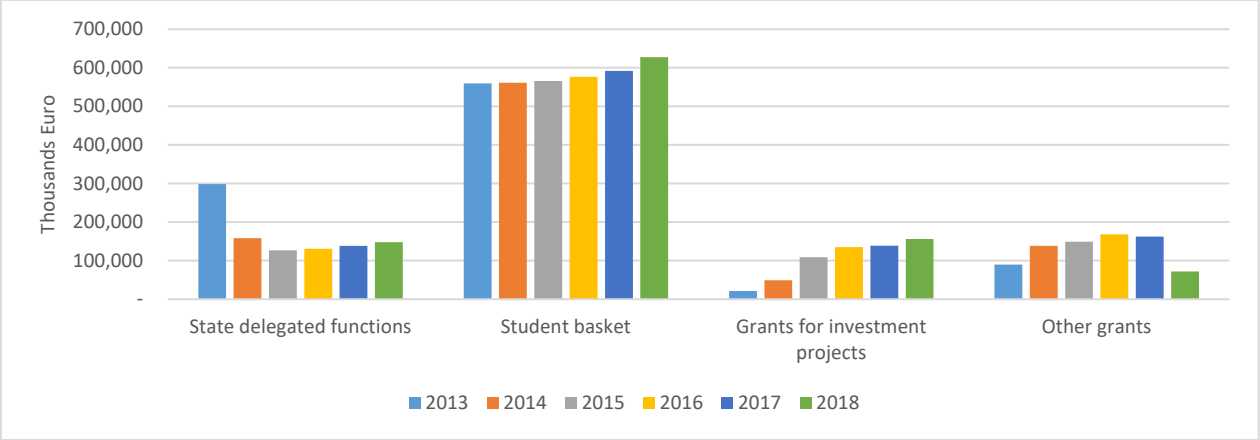
[24] From 2018, the State Investment Program is no longer approved by law. State institutions distribute grants to municipalities for the purchase of tangible and intangible assets.

Figure 80 Distribution of Revenues and Grants



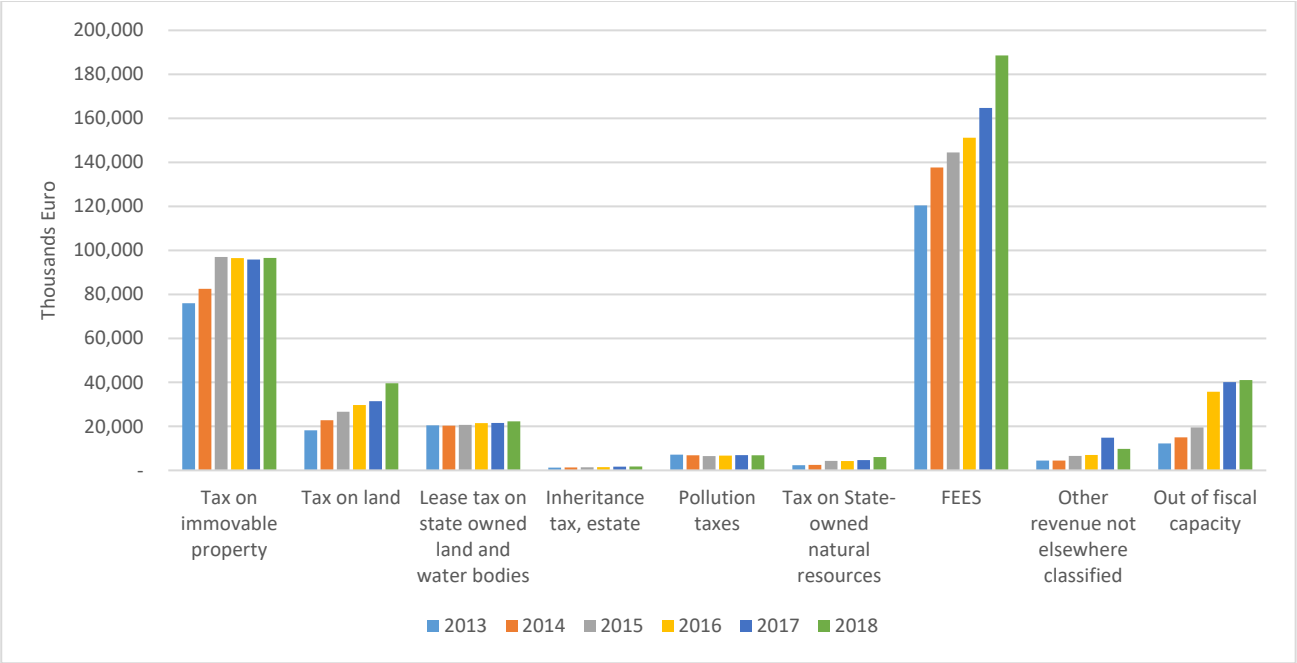
The following graph (***Figure 81***) shows the structure and the evolution of targeted grants for all the years of analysis and it is evident that the biggest portion of grants is allocated to the student basket.

Figure 81 Structure and evolution of Grants



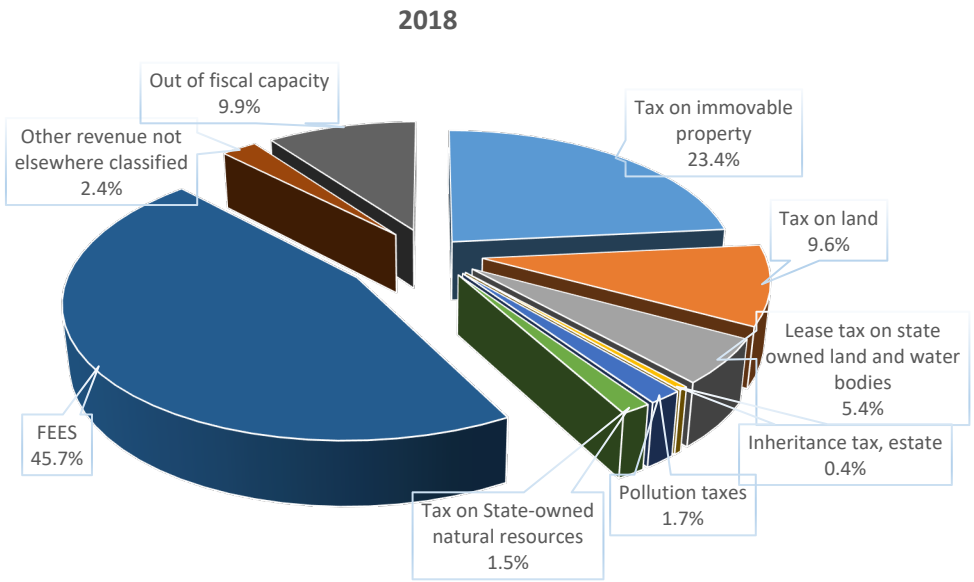
The following graph (***Figure 82***) reports the structure and the evolution of municipalities' own resources, split up by sub-item of classification.

Figure 82 Structure and evolution of Municipality own Revenues



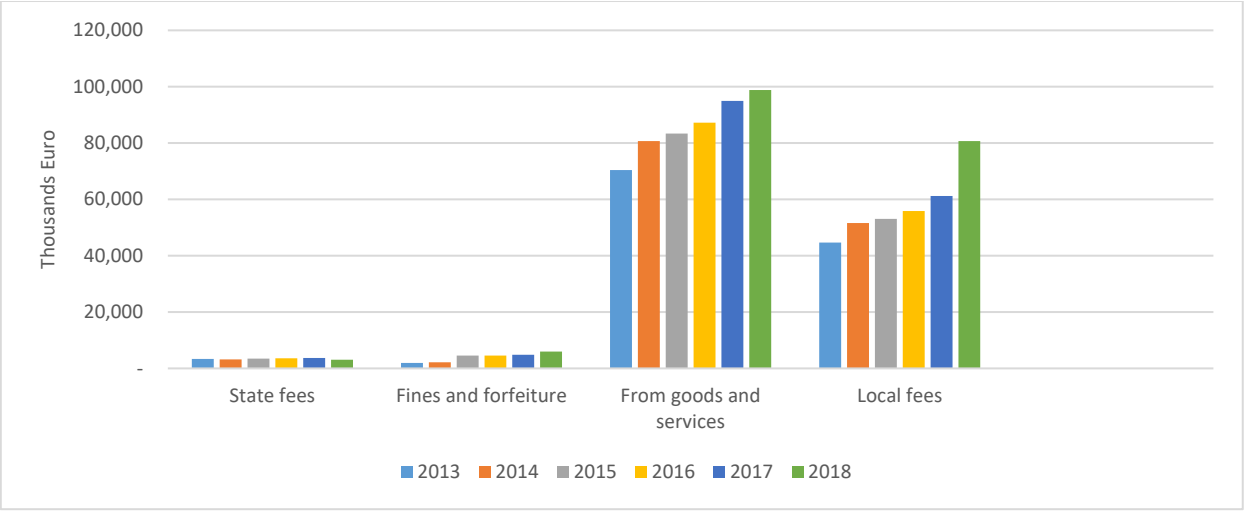
Revenue from fees represents the main component of municipal fiscal capacity (***Figure 83***) and its amount has progressively increased during the years.

Figure 83 Composition of Municipality own Revenues



Fees from goods and services and local fees cover the largest portion of total fees (***Figure 84***).

Figure 84 Revenues from Fees



Potential revenues from *Lease tax on state owned land and water bodies*, *Pollution taxes* and *Tax on State-owned natural resources* have been evaluated at the historical value, considering that the tax base is established at central level and the tax rate cannot be changed because it is linked to natural resources.

Revenues from *Inheritance tax, estate, Other revenue not elsewhere classified, Revenue from dividends, Revenue from interests and deposits and Revenue from sales of long-term tangible and intangible assets* have been considered as fiscal effort, as these are revenues not included in the equalisation system.

Revenues from local taxes will add to special targeted grants from the state budget and revenues from personal income tax (PIT) to complete the list of revenues included in the fiscal gap analysis.

Below it will be illustrated the methodology used to estimate each component of fiscal capacity, especially for *Tax on immovable property*, *Tax on land* and revenue from *Fees*.

Tax on immovable property is payable by Lithuanian and foreign, natural and legal, citizens.

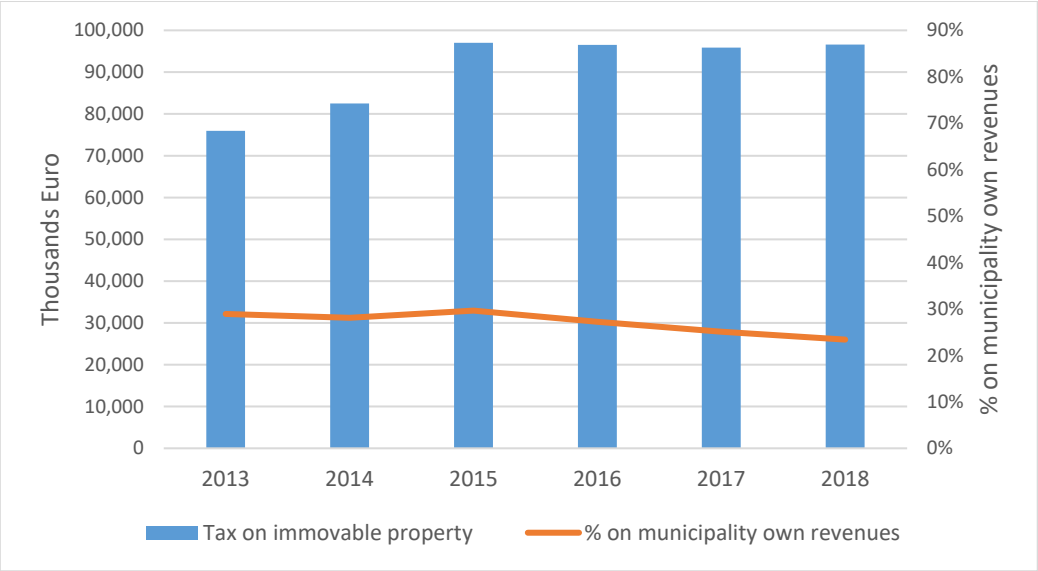
Revenue is almost totally allocated to the municipal budget (about 97%), except from the expensive real estate owned by private entities that is allocated to state budget (about 3%).

Real estate may be subject to different tax rates that range from 0,3% to 3%. Municipal councils establish a specific tax rate based on one or several of the following criteria:

- Purposes of immovable property;
- Legal status;
- Technical characteristics and maintenance condition;
- Categories of taxpayers (size, legal form or social situation);
- Location of immovable property in the territory of the municipality.

The following graph (***Figure 85***) reports the amount of historical revenues from tax on immovable property over the reference period and the impact on total municipality's own fiscal capacity.

Figure 85 Revenues from Tax on immovable property



Standard revenues from immovable property have been estimated through the Representative tax system; this implies that the evaluation of tax revenues is obtained by imposing a standard tax rate on the standard value of the tax base:

STANDARD TAX REVENUE = STANDARD TAX RATE x STANDARD TAX BASE

Standard tax base, which is equal to the ratio between actual revenues and the applied tax rate, allows to keep resources differentiations under control.

The distribution by territorial area of 2018 per capita revenues (mean values) from Property tax is displayed in the following table (***Table 64***), respectively for actually applied tax rate, minimum tax rate (0,3%) and average legal tax rate (1,65%, which is the average between minimum and maximum legal tax rate).

Table 64 Per-capita revenues from Tax on immovable property by Area

AREA	Actual average tax rate (Revenue per capita)	Minimum tax rate 0.3% (Revenue per capita)	Average legal tax rate 1,65% (Revenue per capita)
Big cities	55,58	21,51	118,33
Predominantly urban	20,07	9,62	52,92
Predominantly rural	14,13	6,05	33,27
Resort	82,17	38,67	212,67
LITHUANIA	**34,39**	**14,97**	**82,36**

For the analysis of the Fiscal gap, minimum tax rate (0,3%) of Property tax has been selected as the default value in order to identify fiscal imbalances in correspondence of the minimum level of fiscal effort.

Land tax must be paid by the owners (both natural and legal persons) of private lands except for forest lands. All revenues from land tax are allocated to the municipal budget.

The annual land tax rate is set by municipal councils and it can vary from 0,01% up to 4% of the land's market value.

Tax base is the average market value of the land, established for the period of 5 years by massive appraisal. According to the Law on land tax, the value reduction coefficient of 0,35 must be applied to lands of agricultural nature, except deserted land plots.

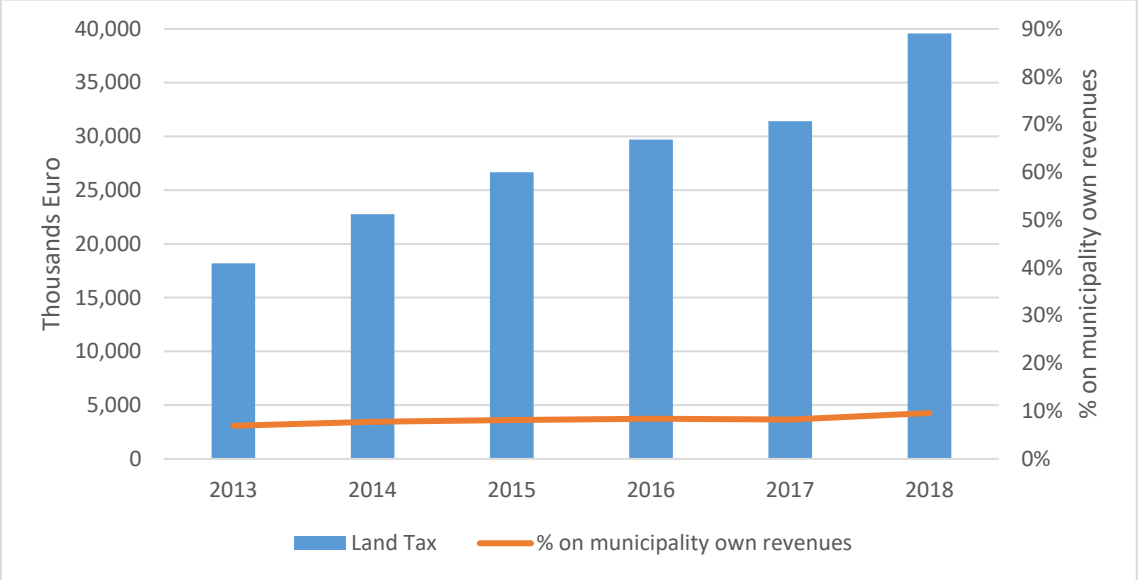
Lands owned by diplomatic and foreign missions, lands of Bank of Lithuania and lands of bankrupt companies are tax exempted.

Land tax exemptions are also applied to disabled land-owners, old-age pensioners and minors, providing that at the beginning of the taxation period there are no persons capable of working in the families of said land owners, and providing that the size of the land plot owned by them does not exceed the tax exempt area established by municipal councils.

Municipal councils have the right to reduce the amount of the land tax or grant exemption, compensating sums from their budgets.

The following graph (***Figure 86***) reports the amount of the historical revenue from tax on land over the reference period and the impact on municipal fiscal capacity resources.

Figure 86 Revenues from Land tax



The asset groups considered for land tax are given by the following types of land:

a) Agricultural land, Pond Fishery Farms (code 610);
b) Land of amateur gardens (code 611);
c) Other land (code 906);
d) Residential land (code 950);
e) Industrial and warehousing land (code 970);
f) Commercial land (code 972).

The distinction of land into different asset groups allows to control for the reduction (35%) applied to the land of agricultural nature.

Standard revenues from owned land have been estimated through a classical Representative tax system approach, so the evaluation of tax revenues is given by imposing a standard tax rate on the actual value of the tax base:

STANDARD TAX REVENUE = STANDARD TAX RATE x ACTUAL TAX BASE

The following table (***Table 65***) shows the 2018 average per capita revenues by area respectively for actual applied tax rate, minimum tax rate (0,01%) and average legal tax rate (2,01%, which is the average between minimum and maximum legal tax rate).

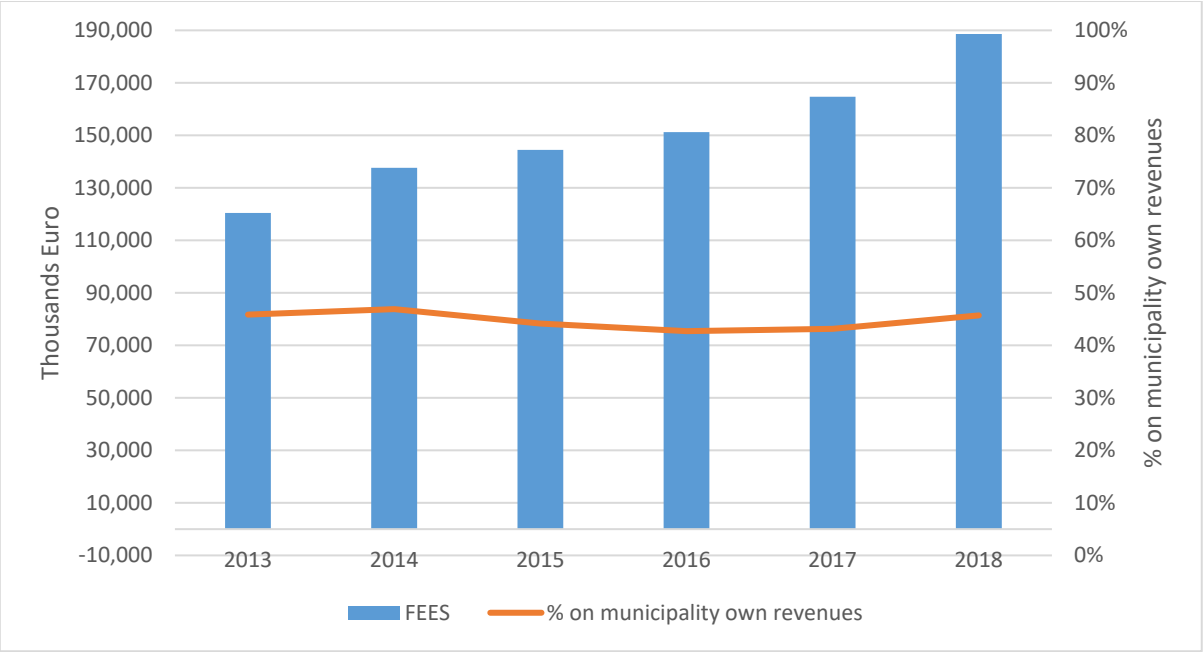
Table 65 Per capita revenues from Land tax by Area

AREA	Actual average tax rate (Revenue per capita)	Minimum tax rate 0.01% (Revenue per capita)	Average legal tax rate 2,01% (Revenue per capita)
Big cities	5,33	0,36	73,24
Predominantly urban	16,43	0,62	124,73
Predominantly rural	22,84	0,31	61,40
Resort	31,17	1,20	240,37
LITHUANIA	**14,09**	**0,41**	**81,49**

For the analysis of the Fiscal gap, minimum tax rate (0,01%) of Land tax has been selected as the default value in order to identify fiscal imbalances in correspondence of the minimum level of fiscal effort.

Revenues from fees, which include a long list of fees and tariffs related to the main services provided by municipalities (nurseries, cemetery services, local transport, issuance of certificates, etc.), represent the main source of local tax revenue of Lithuanian municipalities that corresponds, over all the reference period, to roughly 45% of own-source revenues, as shown in the following graph (***Figure 87***).

Figure 87 Revenues from Fees



In detail, revenues from fees include the following categories of fiscal revenues:

- State fees;
- Revenue from fines and forfeiture;
- Revenue from goods and services;
- Local fees.

Because of the absence of both standard tax rate and tax base, the application of the RTS approach would not have been possible. Consequently, in accordance with Lithuanian authorities, for the evaluation of revenues from fees it has been applied a *Regression based Fiscal Capacity* approach (RFCA). This method estimates a linear panel data model that relates actual revenues from local fees of Lithuanian municipalities to a set of explanatory variables and control variables.

The general econometric specification is reported in the following equation:

$$Y_{it} = \beta_1 X_{it} + \beta_2 FE_{it} + \beta_3 N_{it} + \beta_4 T_t + \varepsilon$$

In the equation, ***Y*** represents the actual local tax revenue (obtained adding up the different categories of revenues from fees previously listed), ***X*** is a vector of socio-economic variables, which can be used as proxies for the tax bases (local income, real estate values), ***FE*** provides information on the relative *level of the fiscal effort* exerted by each municipality in the tax rate setting, compared to the median behaviour, ***N*** is related to proxies of non-residents and ***ε*** is the idiosyncratic error component with zero mean and homoscedastic variance. As it was used a panel data, the model also includes time dummies ***T,*** in order to capture temporal shocks.

The variables used in the model and grouped by category are shown in the table below (***Table 66***).

Table 66 Fees RFCA variables

Category	Variable	Formula
Y	Actual local tax revenue (euro per inhabitant)	(State fees + Revenue from fines and forfeiture + Revenue from goods and services + Local fees) / Resident Population
X	Value-added cost of production by place of business (per capita)	Value-added cost of production by place of business (non-financial enterprises) / Resident Population
	Individuals living at risk of poverty or social exclusion (%)	Individuals living at risk of poverty or social exclusion (%)
FE	Implicit Tax rate (%)	(State fees + Revenue from fines and forfeiture + Revenue from goods and services + Local fees) / (Value-added cost of production by place of business (non-financial enterprises)) * 100
N	Number of tourists and cultural participants (per inhabitant)	(Number of visitors of tourism information centres + Number of tourists accommodated in accommodation establishments + Number of overnight stays in accommodation establishments + All event attendees and participants + Number of visits to the museum during the reporting year + Number of museum fund visitors during the reporting year) / Resident Population

The standard amount of revenues from fees of each Municipality (Y) is given by considering the proxies of the tax bases ***X***, the (median) fiscal effort ***FE*** and the proxies of non-residents ***N***, as follows:

$$Y_{it} = \beta_1 X_{it} + \beta_2 FE(median) + \beta_3 N_{it} + \beta_4 T_t$$

The parameters have been used to predict the amount of revenue each municipality would collect under median fiscal effort. The regression analysis has been employed to evaluate distinctively fiscal capacity and tax effort. The former depends on tax bases and standard tax rates. Including only the socio-economic variables (vector X) that are proxies for the tax bases, when computing the expected tax revenue, allows to isolate fiscal capacity from fiscal effort, the actual revenue being the sum of the two components. The factors that are excluded are related to the preferences of the resident citizens, the impact of the central government's flow of grants and the effects of local government inefficiency and/or tax evasion that are captured by the stochastic components.

The following table (***Table 67***) shows the 2018 average per capita revenues by area, respectively for actual implicit tax rate, minimum implicit tax rate (1° percentile of implicit tax rate distribution) and median implicit tax rate (50° percentile of implicit tax rate distribution).

Table 67 Per capita revenues from Fees by Area

AREA	Actual implicit tax rate (Revenue per capita)	Minimum implicit tax rate (1° percentile) (Revenue per capita)	Median implicit tax rate (50° percentile) (Revenue per capita)
Big cities	75,51	70,74	87,47
Predominantly urban	48,32	40,54	57,27
Predominantly rural	53,65	35,14	51,87
Resort	209,16	158,58	175,32
LITHUANIA	**69,88**	**53,58**	**70,31**

For the analysis of the Fiscal gap, minimum implicit tax rate (1° percentile of implicit tax rate distribution) of Fees has been selected as the default value in order to identify fiscal imbalances in correspondence of the minimum level of fiscal effort.

3.3. Analysis of Infrastructural gap

The analysis of infrastructural gap of Lithuanian municipalities, as already explained in paragraph **2.4 Measuring Infrastructural gap**, is based on a preliminary evaluation of infrastructure endowment through synthetic indexes approach.

The implementation process of the overall synthetic index of infrastructure endowment for Lithuanian municipalities consists of two macro-phases:

1- Construction of a synthetic index of infrastructure endowment for each selected function;
2- Construction of an overall synthetic index of infrastructure endowment considering all the selected infrastructural functions together.

The functions considered in the analyses are the following:

- Heating and hot water;
- Drinking water;
- Sewage water;
- Education;
- Culture and recreation;
- Road network.

Infrastructural data related to each function have been used for the construction of some function-based synthetic indexes of infrastructure endowment. In the following paragraphs the construction of such indexes and the type of information considered are explained in more details.

3.3.1 Heating and hot water

This paragraph reports a deeper explanation about the construction of a synthetic index of heating and hot water infrastructure endowment.

The district heating and hot water system is mainly organized in two macro-phases: production and distribution. In the production phase, boilers are involved in the generation of heat and hot water. Such boilers differ in their power capacity and thermal capacity. Therefore, the same number of boilers in terms of infrastructure endowment may result also in a very different output in terms of produced heat. This is the reason why in the evaluation of infrastructure endowment has been consider the total MW capacity of installed boilers for each municipality instead of the number of owned boilers. The second phase of the district heating system is the distribution of heat and hot water to the final users through the transfer net. The information used for the construction of the synthetic index of infrastructure endowment related to this function is reported in ***Table 68***.

Table 68 - Infrastructural information used for the heating and hot water index construction

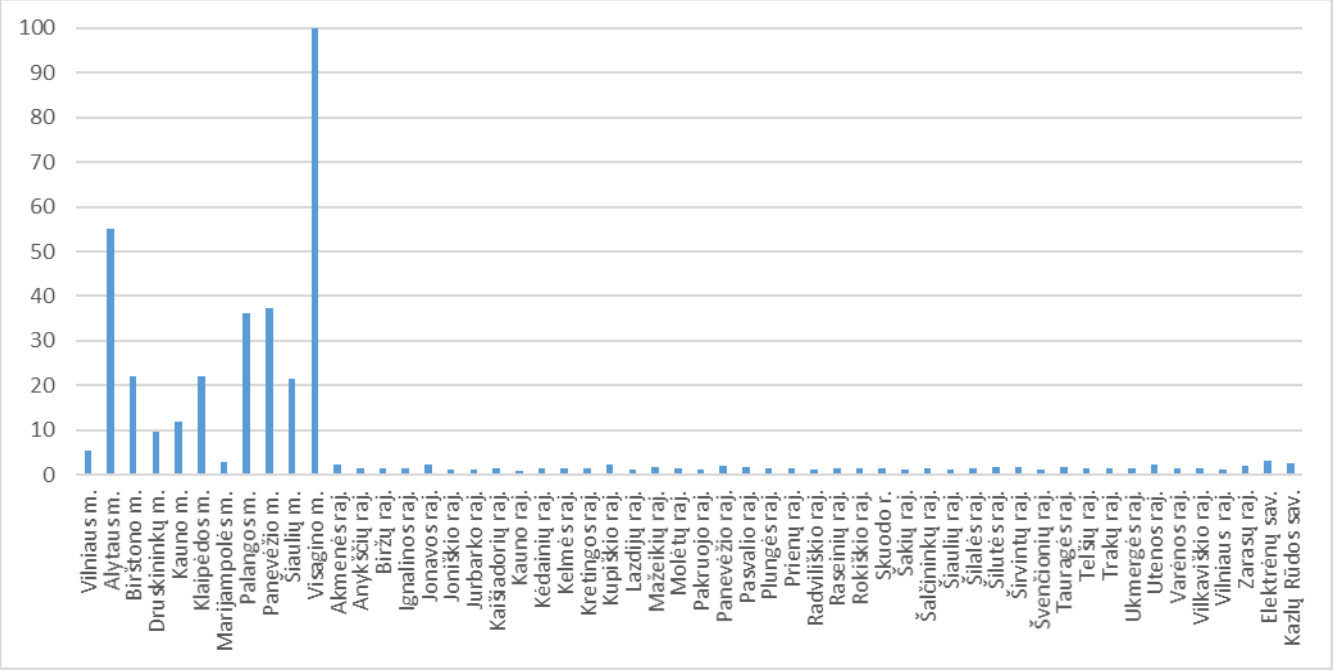
Service		Infrastructural data selected for the index construction
Heating and hot water	Production	• MW capacity of installed boilers
	Distribution	• Length of heat transfer net • Length of conditional heat transfer net

The dataset has been built starting from a set of information collected by the Lithuanian companies and provided by Lithuanian authorities. Three different cases of heating and hot water service provision can be described: a single municipality served by one company; a single municipality served by more than one company; or a single company serving more than one municipality. In order to have a full correspondence between municipality and company, in the case of a single municipality served by more than one company the infrastructure owned by different companies has been summed up in to the single municipality and in the case of a single company serving more than one municipality the infrastructural data has been split among the different municipalities served, using users as a weighting element.

Based on the infrastructural data previously reported, simple physical indicators have been constructed relating the endowment of each municipality to the corresponding population and land. Then, the synthetic index of heating and hot water infrastructure endowment has been created, with values ranging between 0 and 100, and the results are shown below.

Figure 88 shows that many municipalities present a very low level of infrastructure endowment. On the contrary, only few ones present very high values[25].

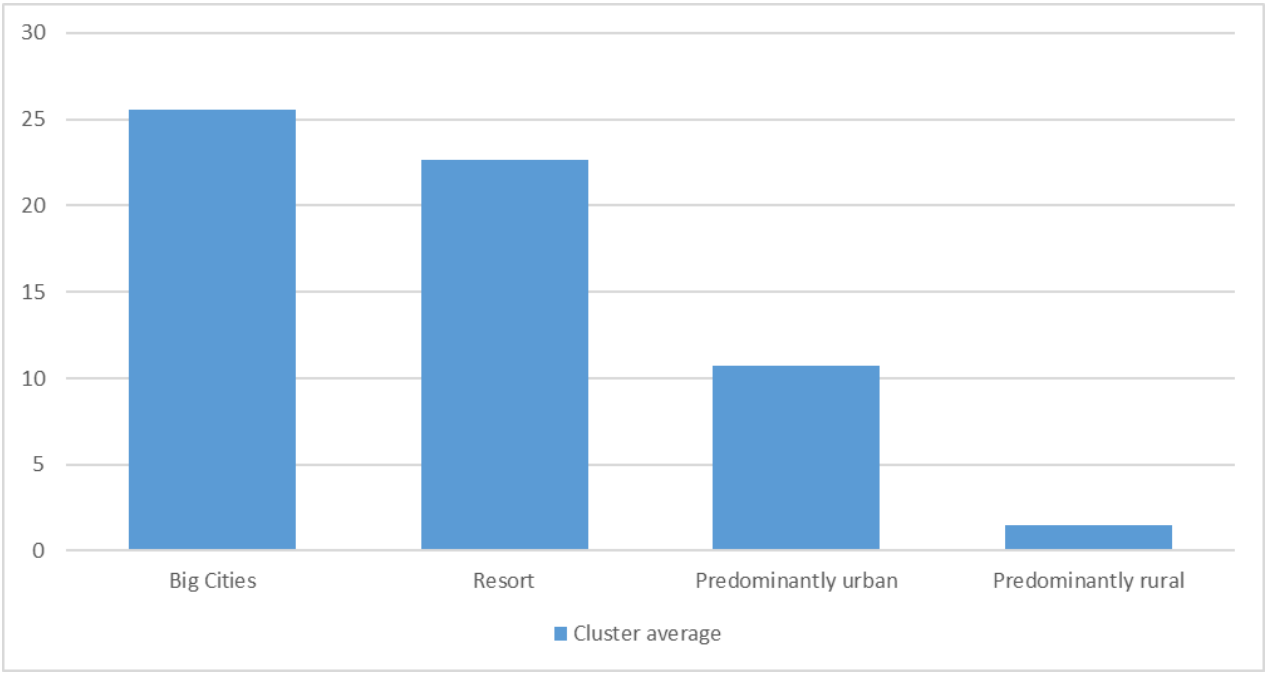
Figure 88 - Heating and hot water synthetic index - 2018



[25] For the following municipalities the synthetic index of *Heating and hot water* has not been calculated because of missing values in the dataset: Alytaus raj., Kalvarijos sav., Klaipėdos raj., Neringos sav., Pagėgių sav. and Rietavo sav.

Figure 89 shows the average synthetic index of heating and hot water infrastructures of the different clusters. It is possible to notice that *Resort* and *Big cities* have a very high endowment of infrastructure compared to the other clusters. *Predominantly rural* cluster shows low values of endowment.

Figure 89 - Heating and hot water synthetic index - cluster average - 2018



3.3.2 Drinking water

The Water Service is a normatively regulated service, linked to the administrative management of water that in Lithuania is managed by companies. Water service includes public services for the collection, supply and distribution of water for civil, agricultural and industrial use.

As far as water extraction is concerned, there is a number of different installations from country to country. In general, these activities are located far from inhabited centres, although not necessarily too far from them.

The abstraction can be carried out from springs, groundwater or artesian aquifers, running surface waters (rivers) or stagnant (lakes), underwater waters and, rarely, from rainwater.

The extraction of groundwater can be executed with an adduction system, consisting of one or more pressure pipes. The water mass flow rate is generally t 30-200 l/s for civil use and about 1000 l/s for industrial use, therefore there are two types of pipelines, gravity works and pumping works, also because of the type of water source. The first ones take advantage of a natural difference in height and do not involve any energy expenditure, whereas the second ones must be equipped with a pumping system and in addition to the construction costs, they will also bear operating costs. Finally, there is the whole water distribution system through its networks and systems. Starting from the characteristics of the service, a set of information has been selected for the construction of the synthetic index of infrastructure endowment (***Table 69***).

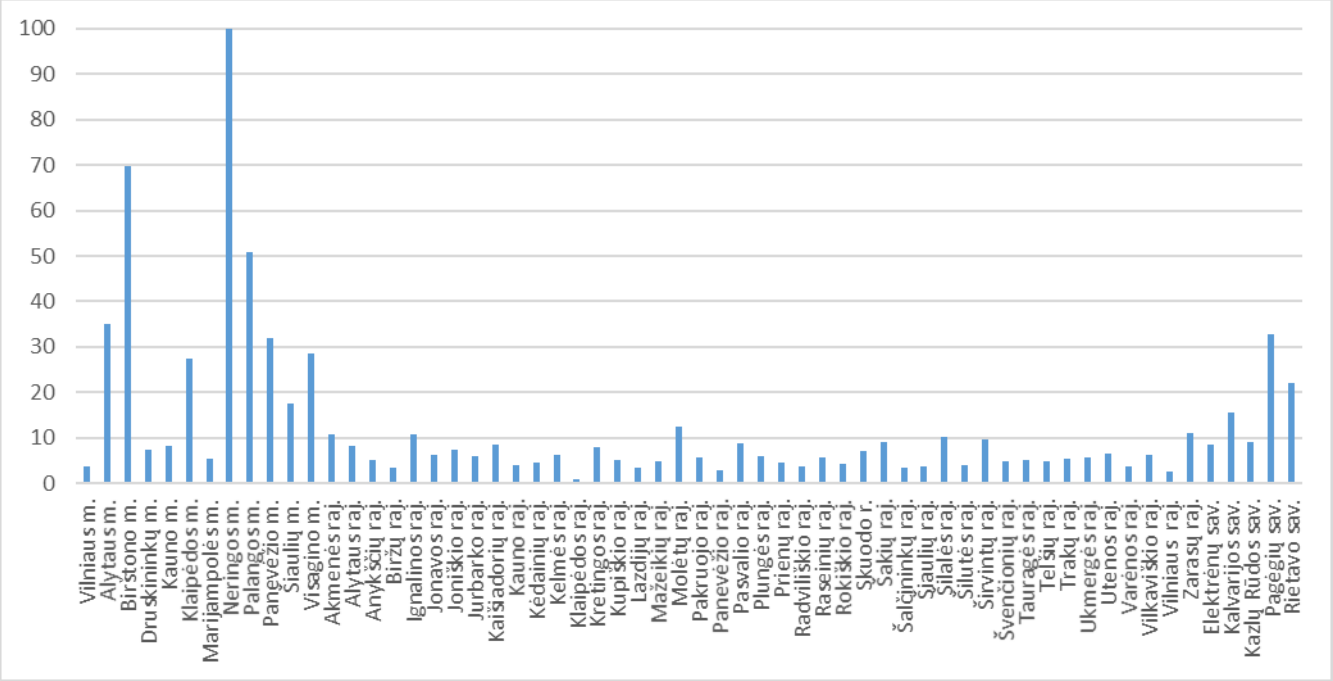
Table 69 - Infrastructural information used for the drinking water index construction

Service		Infrastructural data selected for the index construction
Drinking water	Production	• Number of wells • Number of pumps installed in wells
	Preparation	• Number of water aeration units • Number of towers • Number of tanks • Number of pumps installed
	Distribution	• Number of water pipes • Number of water lift stations • Number of pumps installed at water lift stations • Length of groundwater networks (km) • Number of water supply connections • Number of individual dwellings • Number of introductory (including sub -) accounting devices • Subscriber counters

The dataset has been built starting from a set of information collected by the Lithuanian companies and provided by Lithuanian authorities. Original data needed to be connected to each municipality. As in the case of heating and hot water, in fact, it is possible to have different pattern of service provision: a single municipality can be served by more than one company or a single company can serve more than one municipality. The data treatment has been the same as in the previous analysed function.

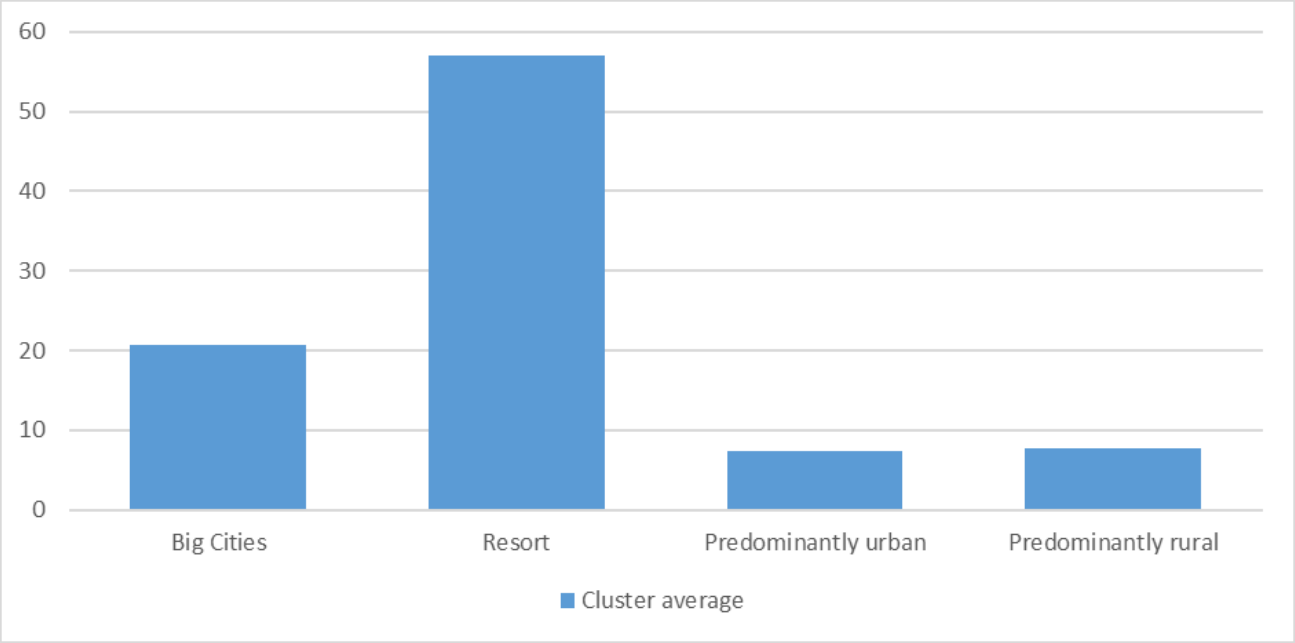
Figure 90 graphically shows the results of the computation of the synthetic index for drinking water function.

Figure 90 - Drinking water synthetic index - 2018



The following ***Figure 91*** shows the average synthetic index of drinking water infrastructures for the different clusters. It is possible to notice that *Resort* and *Big cities* have an average higher endowment of infrastructure than other clusters. *Predominantly urban* and *Predominantly rural* clusters show the lowest values.

Figure 91 - Drinking water synthetic index - cluster average - 2018



3.3.3 Sewage water

The sewage service deals with all wastewater, which is any water whose quality has been affected by domestic, agricultural and industrial activities, thus becoming unsuitable for direct use as it has been contaminated by different types of organic and inorganic substances dangerous for public health and the environment. For this reason, it cannot be re-introduced directly into the environment because final destinations such as land, sea, rivers and lakes are not able to receive a quantity of pollutants exceeding their self-purifying capacity without seeing the normal equilibrium of the ecosystem compromised. The sewage service is mainly composed by three phases: collection, treatment and sludge management. Starting from the characteristics of the service and considering such phases of the service provision, a set of information has been selected for the construction of the synthetic index of infrastructure endowment (***Table 70***).

Table 70 - Infrastructural information used for the sewage water index construction

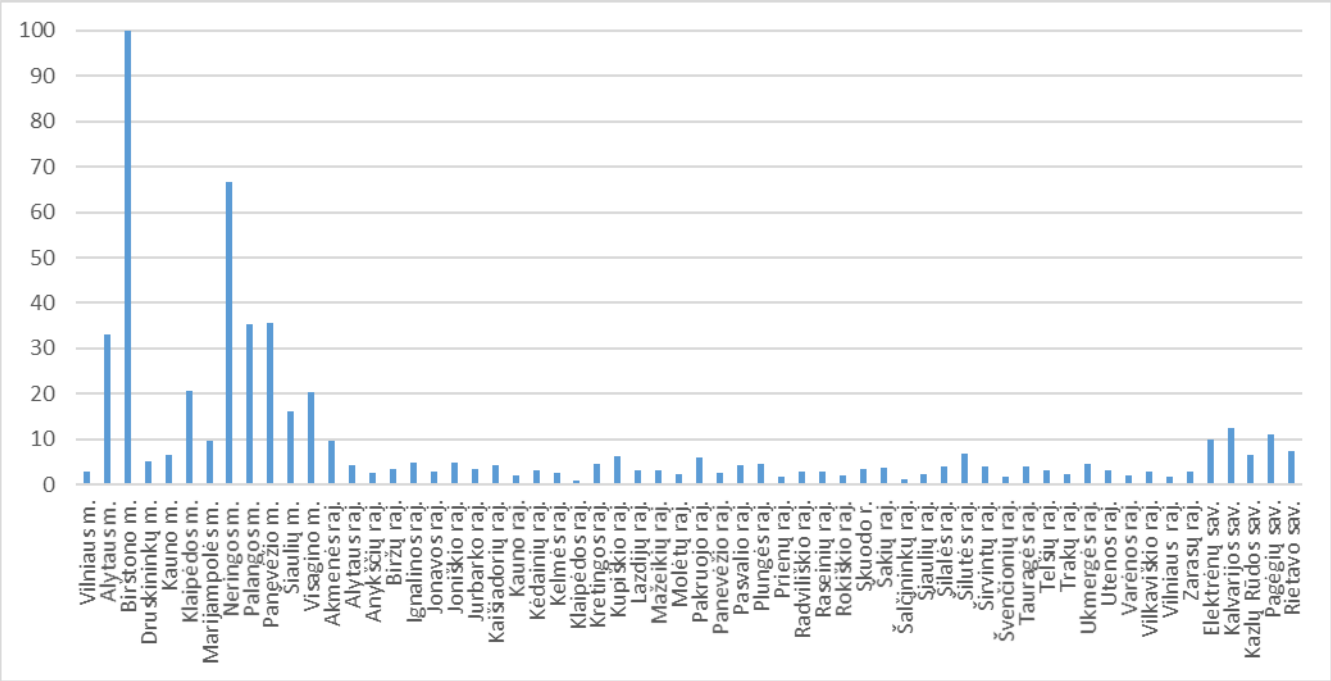
Service		Infrastructural data selected for the index construction
Sewage water	Collection	• Number of sewer systems • Number of sewage pumping stations • Number of pumps installed at pumping stations • Length of sewage networks (km) • Lumber of sewer outlets
	Treatment	• Number of biological treatment plants with mechanical treatment • Number of denitrifications with biological and mechanical treatment facilities • Number of pumps in sewage treatment plants • Number of other working machinery and equipment
	Sludge management	• Number of sewage sludge handling machines and equipment

The dataset has been built starting from a set of information collected by the Lithuanian companies and provided by Lithuanian authorities. As in the case of heating and hot water and drinking water it is possible

that a single municipality is served by more than one company or that a single company serves more than one municipality. Therefore, the original data have been connected to each municipality as in the previous cases.

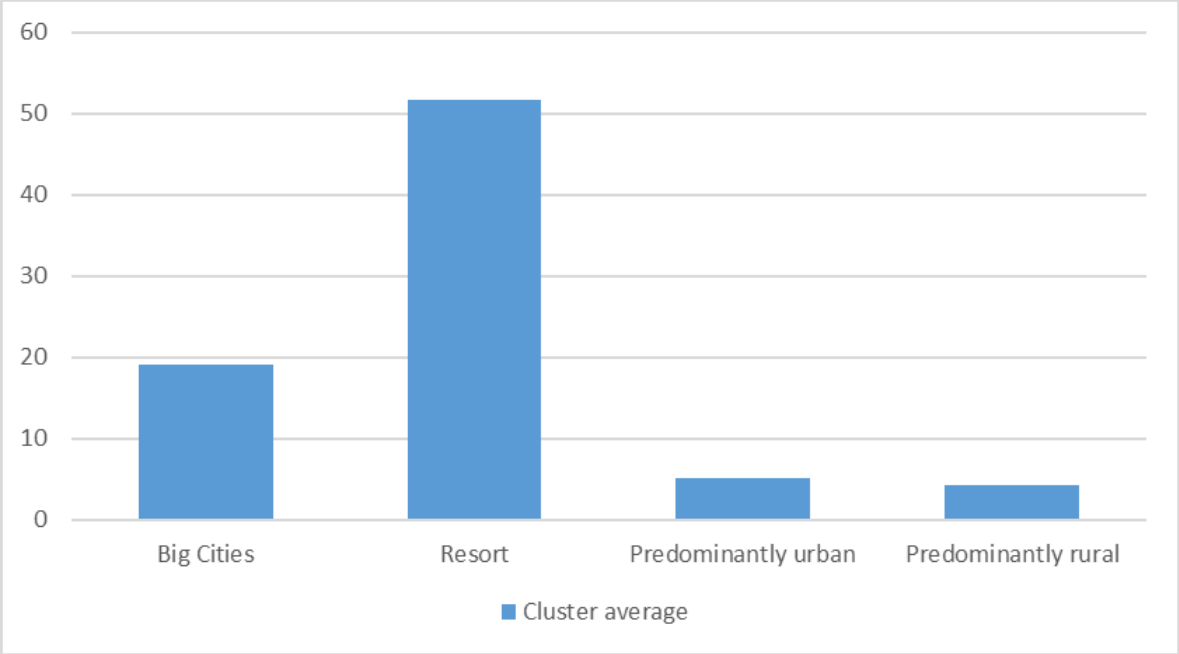
Figure 92 shows that many municipalities present very low values of infrastructure endowment. On the contrary, only few ones present very high values.

Figure 92 - Sewage water synthetic index - 2018



The following ***Figure 93*** shows the average synthetic index of sewage infrastructure distinct by different clusters. It is possible to notice that *Resorts* have a very high endowment of infrastructure followed by *Big cities*. Such municipalities are significantly above the remaining clusters. *Predominantly urban* and *Predominantly rural* clusters show very low values on average.

Figure 93 - Sewage water synthetic index - cluster average - 2018



3.3.4 Education

The inclusion of education sector inside the analysis is justified by the relevance of the sector itself that covers around half of municipalities current expenditures for the provision of essential services.

The data includes information about several educational facilities for all levels of education that has been provided for each institute, then it has been aggregated at a municipal level. The data are separated in base units and division, both considered in the aggregation process.
The information used for the construction of the synthetic index of infrastructure endowment related to this function is reported in ***Table 71***.

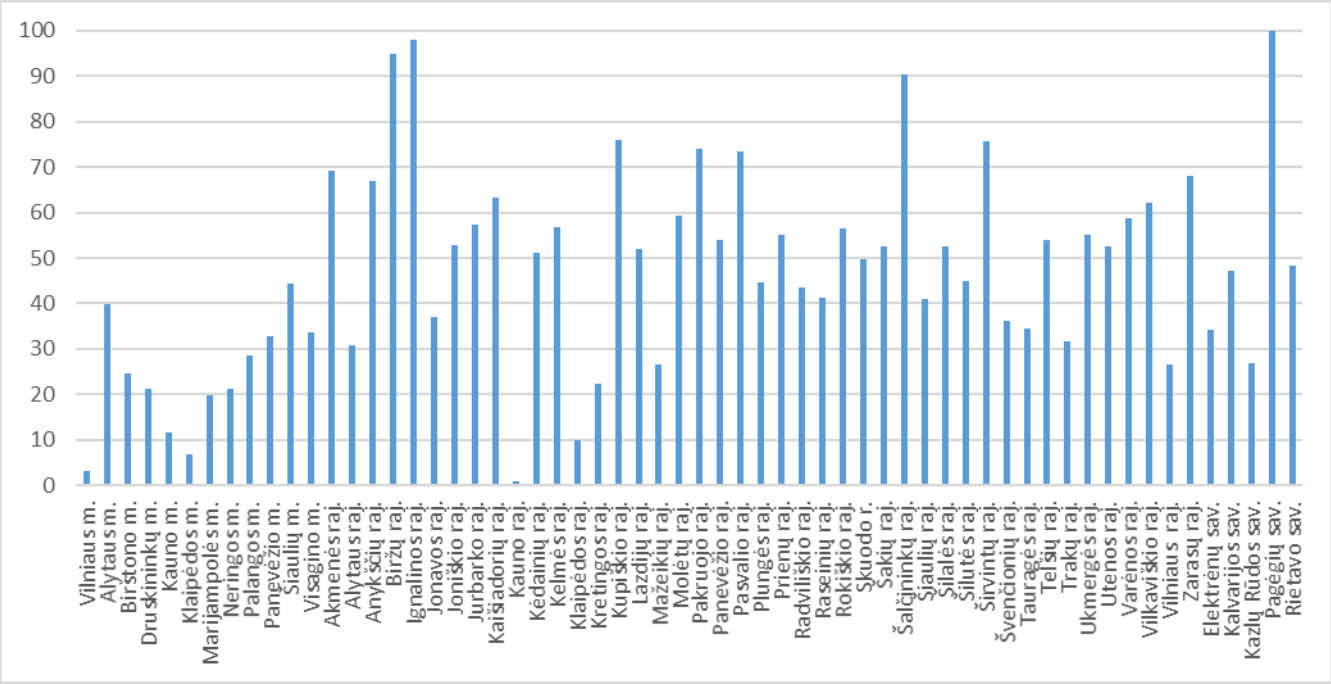
Table 71 - Infrastructural information used for the education index construction

Service	Infrastructural data selected for the index construction
Education	• Total area of premises • Laboratories • Places in hostels • Gyms • Libraries • Reading Rooms • Dining Rooms • Medical offices • Swimming pools • Stadiums • Number of school buses • School Museums

From one side, total area of school premises contributes quantitatively to the computation of the synthetic index, while the remaining set of infrastructures provides additional qualitative contribution. Merging quantitative and qualitative information assigns full value to the synthetic index. The results of the

computation of the synthetic index using information summarized in ***Table 71*** are provided by the following figure (***Figure 94***) that represents the infrastructural endowment of the education facilities for each municipality. It is possible to see that the heterogeneity of the index values is lower than the other functions. The analysis of education infrastructure shows that, on average, there are few imbalances between municipalities. The only exceptions concern some of the *Big cities* where some future investments should be considered.

Figure 94 - Education synthetic index - 2018



3.3.5 Culture and recreation

The set of functions analysed in this report is completed with a focus on culture and recreation. The facilities that are included in this function are representative of the infrastructural heritage of Lithuania prevalently oriented to touristic activity. Despite being a small country, Lithuania has a lot to offer in terms of both cultural and active tourism. The data includes information about several culture and recreation facilities, detailed in ***Table 72***.

Table 72 - Infrastructural information used for the education index construction

Service	Infrastructural data selected for the index construction
Culture and recreation	• Cultural centres, branches and other cultural institutions • Stadiums, swimming pools, other sport infrastructure • Branches of public libraries • Total area of museums

If total area of museums premises contributes quantitatively to the computation of the synthetic index, the remaining set of infrastructures provides an additional qualitative contribution. Merging together quantitative and qualitative information assigns full value to the synthetic index, which contains

differentiated information, but the use of areas for all information would give more consistency to the analysis.

Figure 95 – Culture and recreation synthetic index - 2018

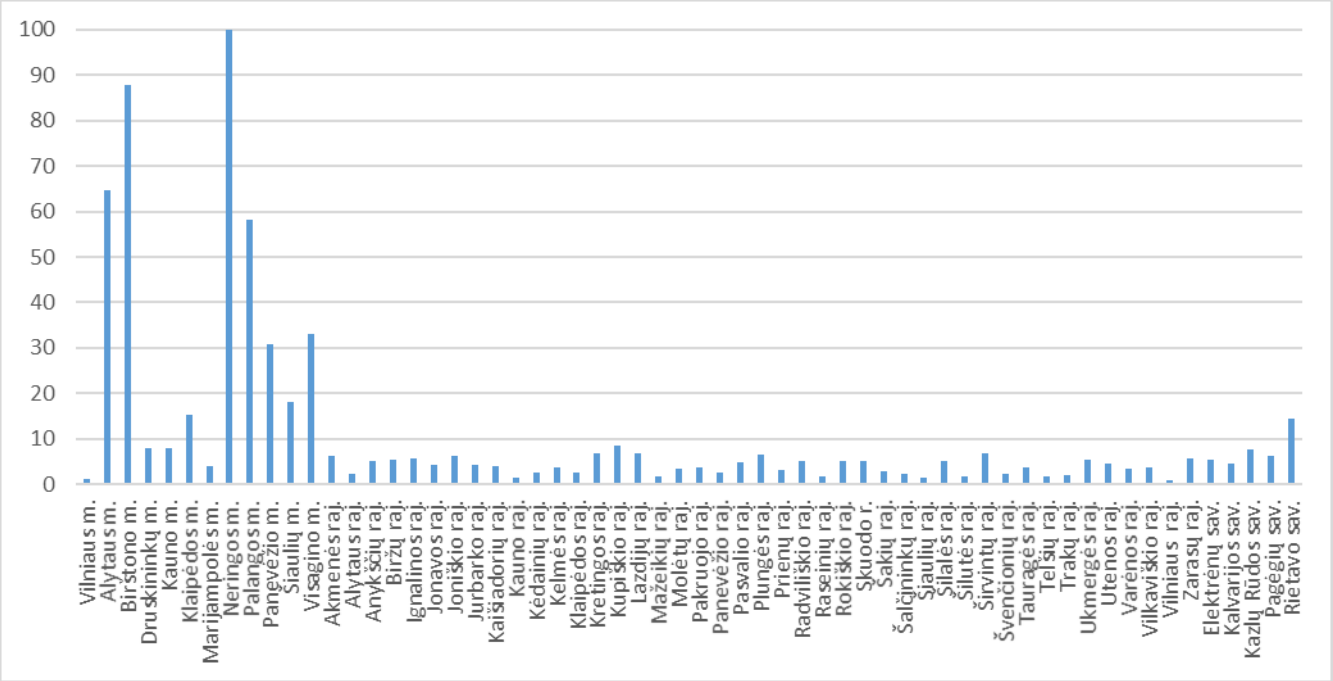


Figure 95 shows that many municipalities present a very low infrastructure endowment. On the contrary, only few ones present very high values.

Figure 96 – Culture and recreation synthetic index - cluster average - 2018

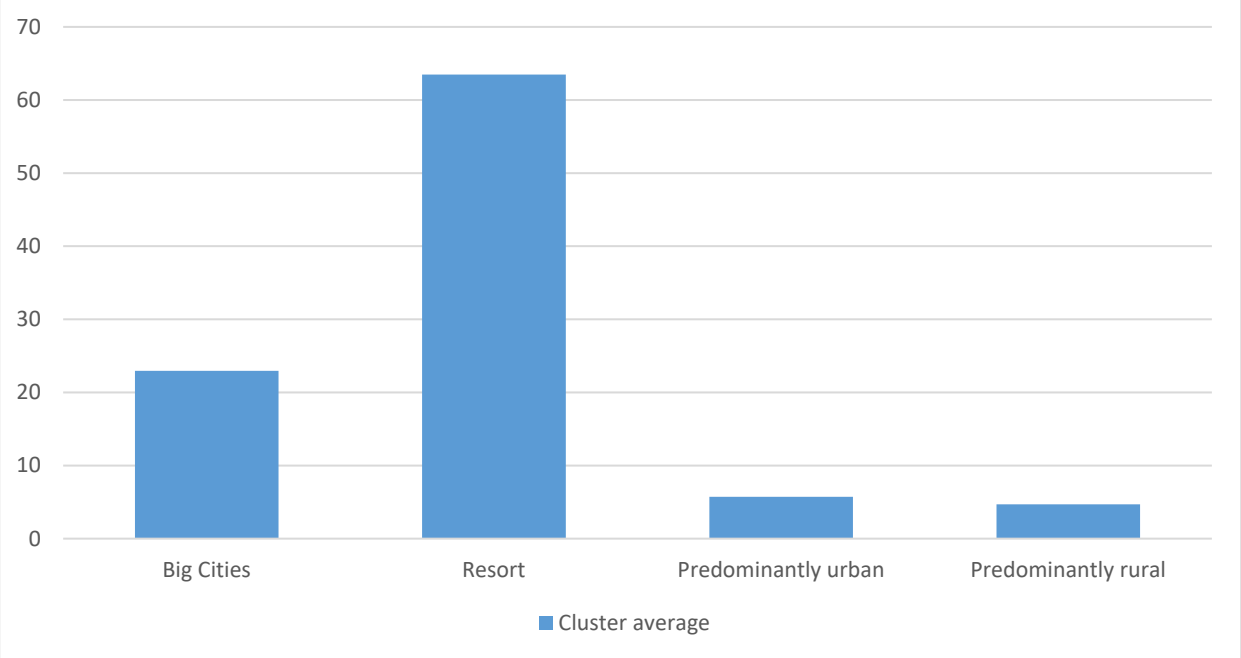


Figure 96 shows the average synthetic index of the different clusters. It is possible to notice that the cluster *Resort* has a very high level of cultural and recreation infrastructure endowment respect to the population and the territorial extension. Such a characteristic is mainly due to the touristic vocation of these municipalities. During the last years tourism in Lithuania has constantly increased. According to OECD (2020) the arrivals of international tourists in Lithuania has increased with an average annual rate of 8,2% between 2014 and 2018. National tourism must also be considered in addition to international tourism. It is reasonable to believe that a substantial part of the tourism flow is directed towards the *Resort* municipalities and to the capital city of Vilnius.
In addition, *Big cities* group has a quite high endowment of infrastructure, but significantly below the *Resort* municipalities. *Predominantly urban* and *Predominantly rural* are both significantly below the other clusters.

3.3.6 Synthetic Infrastructural gap analysis

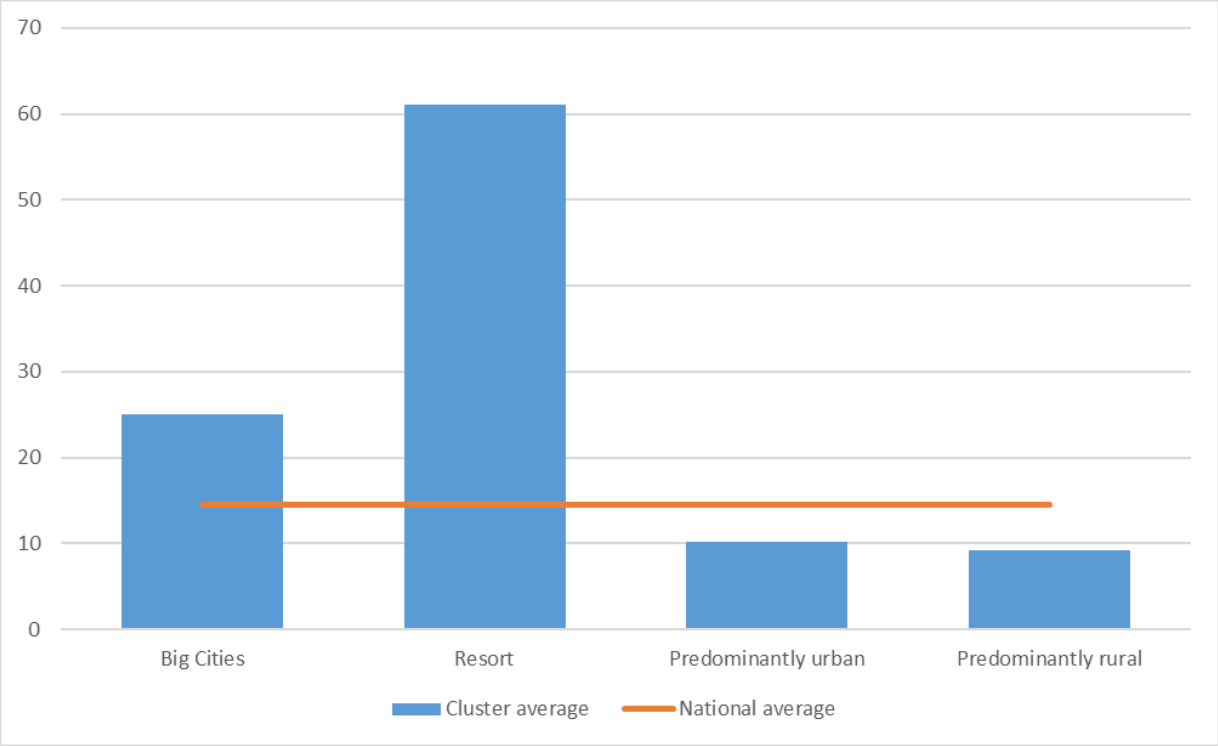
The total index of infrastructure endowment for Lithuanian municipalities is constructed through the aggregation of all the synthetic indexes discussed in previous paragraphs (heating and hot water, sewage and drinking water, education, culture and recreation), with the addition of roads network and it provides an idea of the different infrastructure endowment of Lithuanian municipalities[26].
Such total index of infrastructure endowment can be used also to provide a measure of the overall infrastructural gap of Lithuanian municipalities. The infrastructure endowment of the different territories, in fact, can be compared to understand the deficiency of infrastructure in some areas also in order to direct the government expenditure. Such deficiency, or inadequate level of infrastructure, is defined in literature as infrastructural gap (Bourque, 1985; Basile et al., 2001).

Therefore, the first way in which the infrastructural gap has been measured is through the comparison between municipality infrastructure endowment with national and cluster infrastructure average. National and cluster averages identify the *standard* level of infrastructure endowment which each municipality should guarantee. The distance to the standard can be assumed to be a proxy of the infrastructure gap. In particular, the use of cluster results provides an additional and extremely significant qualitative contribution to the analysis by focusing on the comparison between municipalities with the same contextual and structural characteristics.

Figure 97 shows the average infrastructure endowment of the different clusters compared to the national average. It is possible to notice that *Resort* municipalities have a very high endowment of infrastructure compared to the other clusters. In these municipalities, in fact, the infrastructures have to serve more than their own population and the endowment reflects the seasonal variation of service users. Also, *Big cities* are significantly more endowed compared to the national average. Such municipalities, in fact, have to serve a big population concentrated in a rather undersized area. The infrastructure endowment serves this purpose and therefore, keeping into account both the dimensions indirectly, the volume of infrastructure results quite high. *Predominantly urban* and *Predominantly rural* municipalities show a lower index value than the national average.

[26] For the following municipalities the total synthetic index has been calculated not including *Heating and hot water* because of missing values in the dataset: Alytaus raj., Kalvarijos sav., Klaipėdos raj., Neringos sav., Pagėgių sav. and Rietavo sav.

Figure 97 - Synthetic index 2018: Cluster and national average



The different infrastructure endowment of the clusters compared to the national average can be represented also as percentage differences (***Figure 98***).

Figure 98 – Infrastructure endowment 2018: Percentage difference between cluster and national average

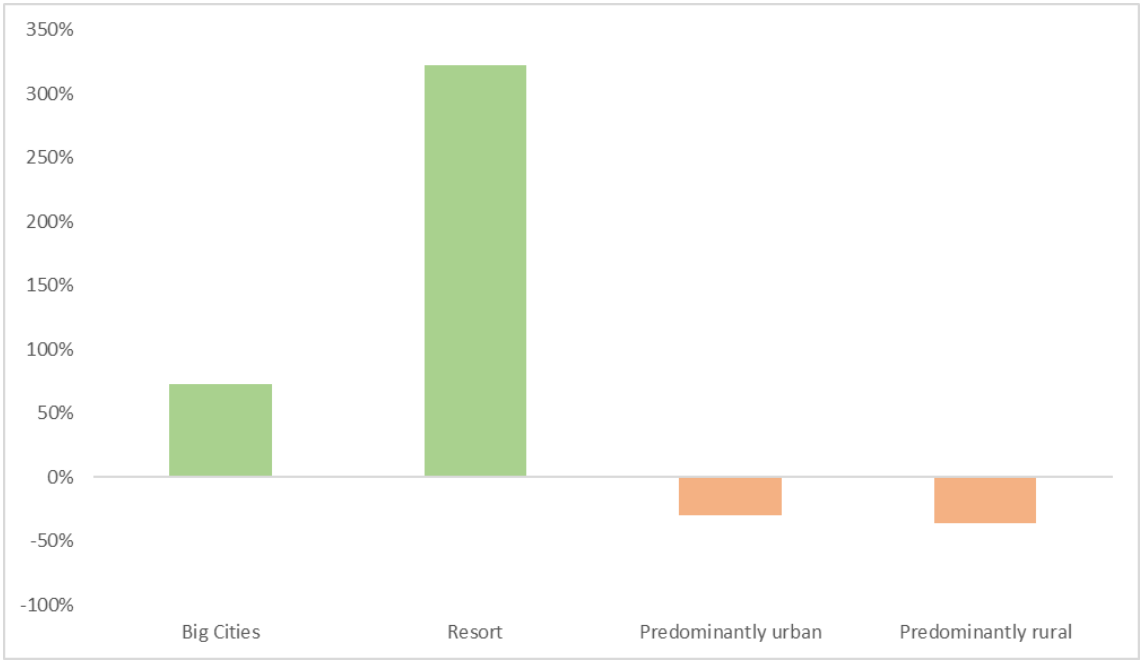
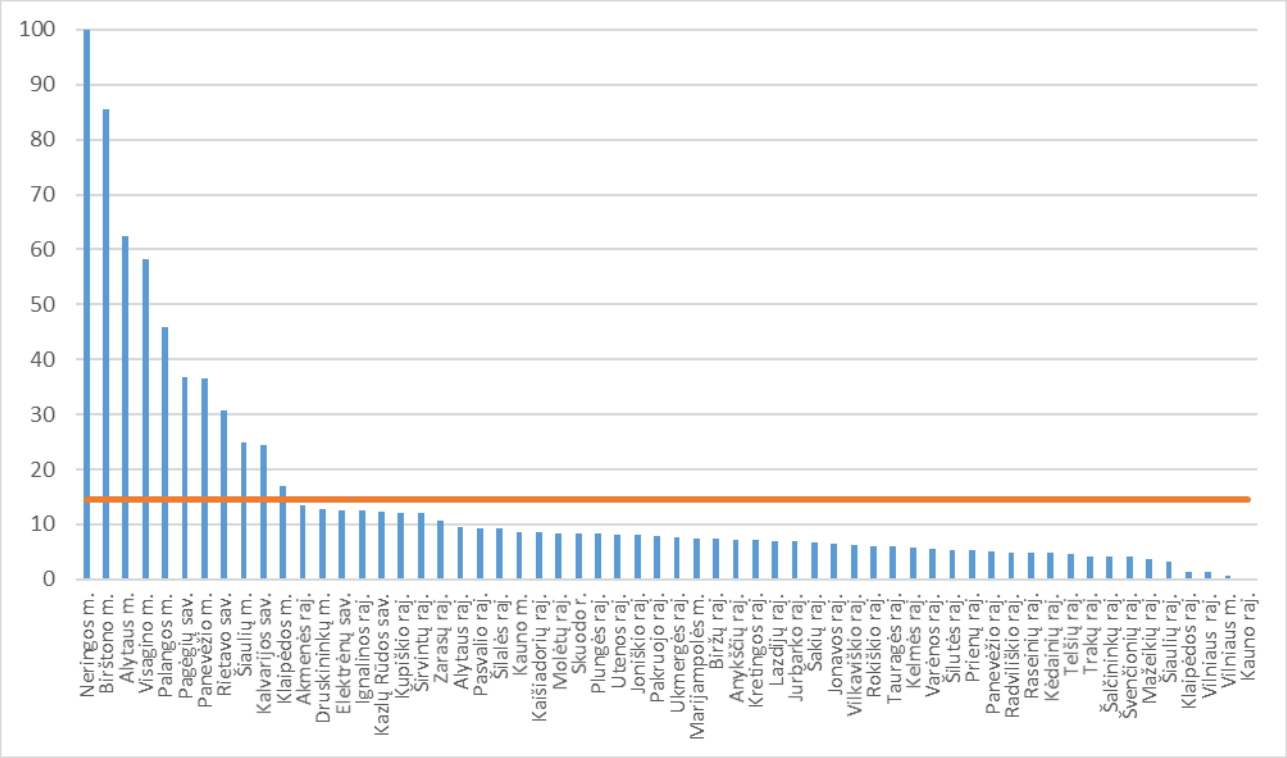


Figure 99 shows the detailed data for each municipality and highlights that many of them have an infrastructure endowment significantly below the national average and that only few ones present very high values.

Figure 99 – Municipal infrastructure endowment 2018: Comparison with national average



The municipalities with highest positive and negative infrastructural gap are detailed in ***Table 73***.

Table 73 – Total synthetic infrastructural gap

Rank	Total synthetic infrastructural gap (Positive Deviation from National mean)	Total synthetic infrastructural gap (Negative Deviation from National mean)
1	*Neringos m.*	*Kauno raj.*
2	*Birštono m.*	*Vilniaus m.*
3	*Alytaus m.*	*Vilniaus raj.*
4	*Visagino m.*	*Klapėdos raj.*
5	*Palangos m.*	*Šiaulių raj.*

The assessment can be furtherly explored comparing the value of each municipality with the average of the cluster it refers to, in order to take account only of entities with the same characteristics in the comparison.

Figure 100 shows the infrastructural gap of municipalities belonging to the *Big cities* cluster. It is possible to notice a certain heterogeneity in endowment between those municipalities. Vilniaus m. has the largest negative gap compared to the cluster average, followed by Kauno m. and Klaipėdos m., while Šiaulių m. shows a value close to the cluster average. Last, Panevėžio m. and Alytaus m. are significantly above the average.

Figure 100 – Infrastructure endowment 2018: *Big cities*

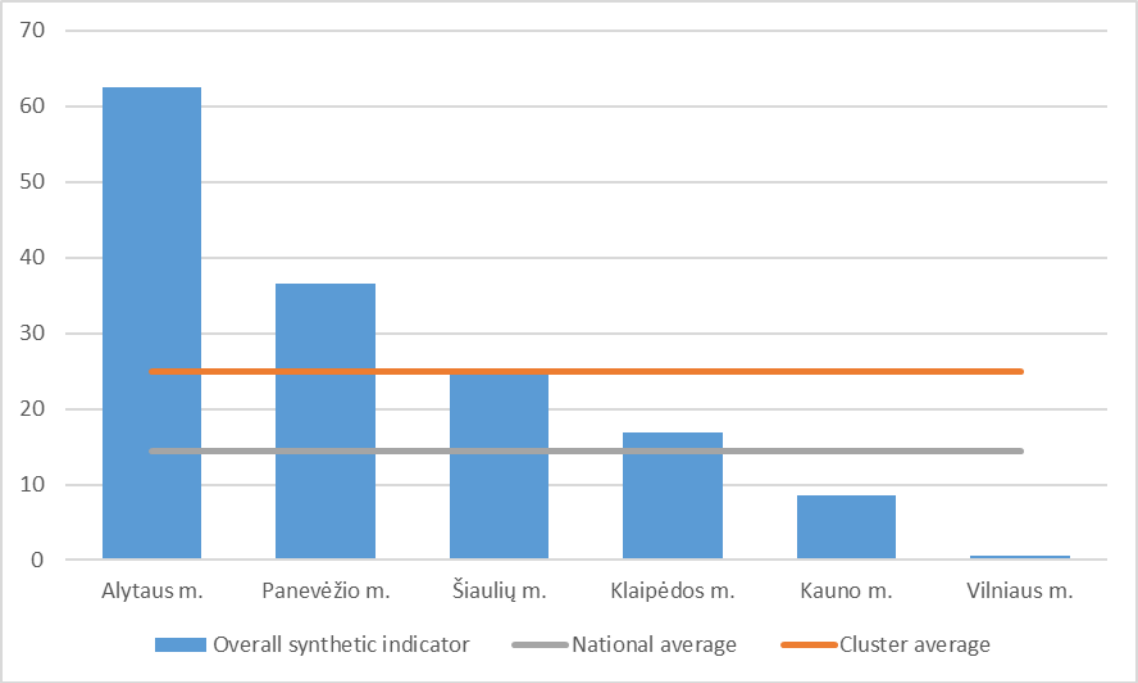


Figure 101 shows the municipal values and the cluster average for *Resort*. It is possible to notice a relevant difference in infrastructure endowment between Neringos m. and Bištorno on the one side and Palangos m. and Druskininkų m. on the other side: the former show a positive infrastructural difference compared to the cluster average; the latter have a very negative difference instead.

Figure 101 – Infrastructure endowment 2018: Resort

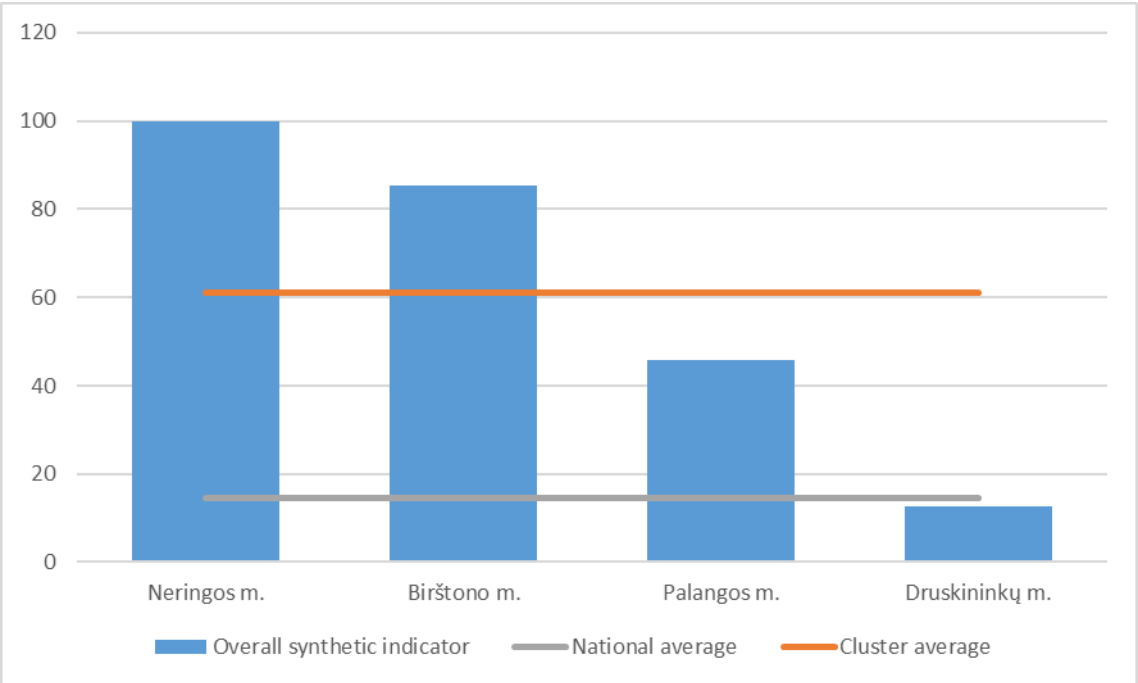


Figure 102 shows the gap between *Predominantly urban* municipalities and the cluster average. Kauno raj. results the Lithuanian municipality with the lowest level of infrastructure endowment considering both population and land dimensions. Quite the opposite Visagino m. is one of the municipalities with the highest level of endowment. Thus, the variability of infrastructure endowment and infrastructural gap is very high within the *Predominantly urban* municipalities.

Figure 102 – Infrastructure endowment 2018: *Predominantly urban*

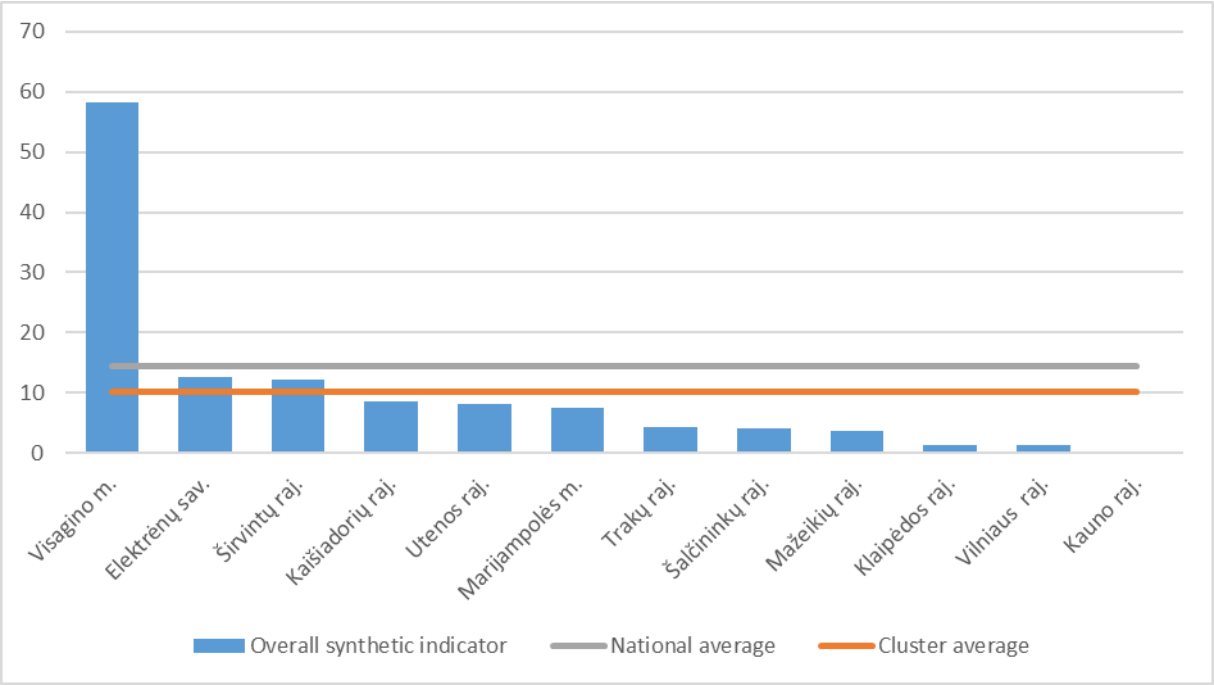
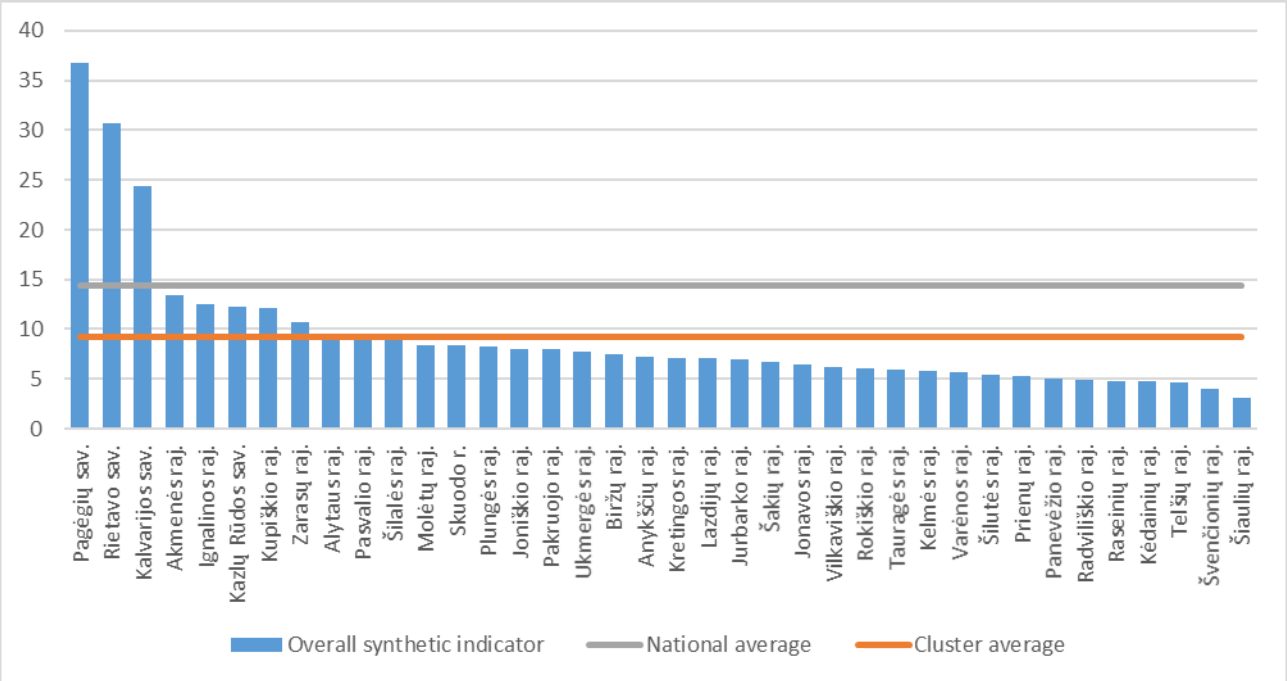


Figure 103 shows the municipal values and the cluster average for municipalities classified as *Predominantly rural*. In this case it is possible to notice that most of municipalities are very close to the cluster average. Just few municipalities show very high values of the index.

Figure 103 – Infrastructure endowment 2018: *Predominantly rural*



Another general definition of infrastructural gap given in literature is the gap between infrastructure available and needed, therefore as the difference between offer and demand of infrastructure. (Bourque 1985).

Therefore, an additional approach concerning the overall synthetic index takes into account a time measure of the infrastructure gap as the difference between the synthetic index referring to the 2018 infrastructure endowment and the synthetic index computed keeping into account the potential population in 2028 for each municipality. For the computation of the simple indicators for the different infrastructural functions, both the number of population 2028 and the land have been used for the standardization of the infrastructural data. For education service an estimation of the population 0-19 in 2028 has been done for each municipality. The infrastructural data used for the construction are the same for both the years. The steps followed for the construction are the same explained in paragraph **2.4 Measuring Infrastructural gap**.

The comparison between the two synthetic indexes, one referred to 2018 and the other related to 2028, obtained just changing the reference population but keeping the infrastructural data constant, gives the possibility to understand if a certain municipality is under-structured or over-structured considering the future demand of infrastructure and to formulate policy indications in this regard.

Figure 104 – Percentage difference between infrastructure endowment in 2018 and expected needed endowment in 2028

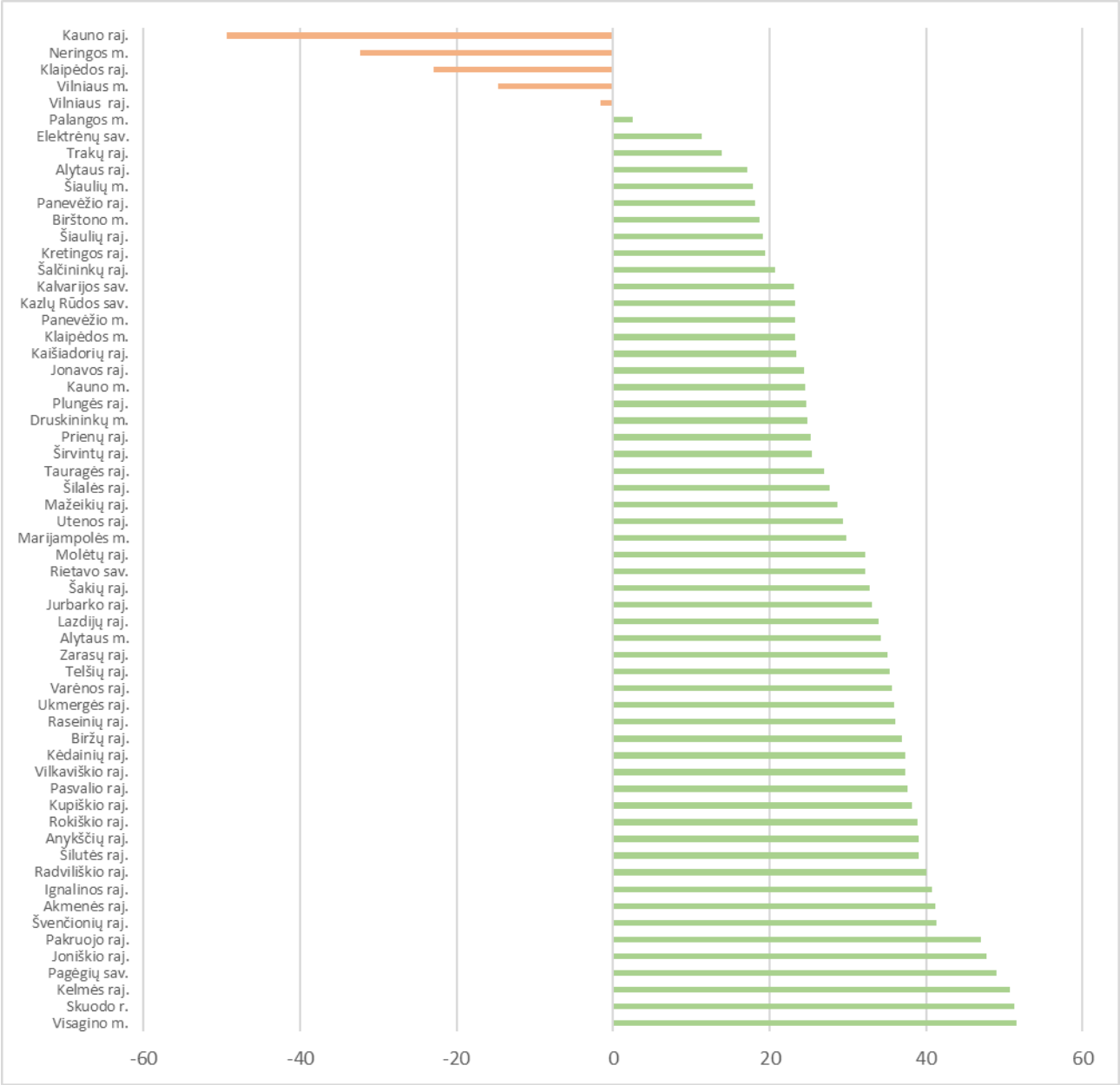


Figure 104 shows the percentage difference between the total synthetic index value of 2018 and the value of the total synthetic index representing the estimate of the infrastructure endowment needed in 2028. Such a measure gives the possibility to understand if a certain municipality is under-structured or over-structured respect to the future demand of infrastructure. It is possible to see that only five municipalities result under-structured (i.e. negative percentage difference) compared to the future expected infrastructure demand. All the other municipalities result over-structured.

In the next few years, in fact, Lithuania is expected to face some social and demographical changes that will lead to a reduction of the total population in the country and to a higher degree of urbanization, above all in the direction of Kauno and Vilniaus.

The comparison between the municipal values of the synthetic index referred to 2018 and the national and cluster average performed in previous paragraph has shown that *Big cities* are significantly more endowed with infrastructure compared to *Predominantly urban* and *Predominantly rural* municipalities. Even though such results could prompt policy makers to increase the infrastructural endowment in those under-structured groups of municipalities through new investments, those need to be interpreted in a more general perspective. Considering the variation in the future demand of infrastructure, in fact, some urban and rural territories could become over-sized. Particular attention is deserved by Vilniaus. According to the results provided in the previous paragraph, in fact, Vilniaus, both municipality and district, are under-structured. Nevertheless, such areas will witness an increase in their population. Therefore, it should be considered to plan medium-term investments in order to increase the infrastructure endowment and to satisfy the future potential demand of services. The same conclusions are valid for Kauno and Klapeidos.

Resorts deserve a separate discussion, since these municipalities are mainly characterized by a high touristic flow. In this case, the investment decisions aimed at increasing the infrastructure endowment should take into account the potential variation in the touristic flow more than the variation in population. Neringos, resulting under-structured in ***Figure 104***, is in this group.

Of course, all conclusions and suggestions provided in the previous paragraphs have to be read with reference to the analysis performed and to its limitations. First of all, the analysis is not exhaustive with regard to the functions considered for the evaluation of the infrastructure endowment. The choice of the included functions has been done mainly on the basis of available data and it would be interesting to extend future analyses to other services not considered here, such as municipal public transport and social security. Then, due to data availability, the calculation of the infrastructural endowment has been performed just in physical terms. In order to correctly evaluate the infrastructures endowment and the correspondent gap it would be useful to analyse data regarding both physical and monetary characteristics of the infrastructures. Further studies can follow this way and estimate the needed investment in infrastructure. Last, in order to perform a comparison between the infrastructure endowment of municipalities in 2018 and the need of infrastructure in 2028, an estimation of the potential demand of infrastructure in 2028 would be needed. The expected future variation of the population has been considered as a proxy of the expected variation in potential demand of infrastructure. However, the infrastructures are demanded both as consumption goods by individuals and as inputs into the production process by firms[27]. Further analyses should consider the expected variation both in population and in economic activities in order to provide a more exhaustive estimation of the variation in potential demand of infrastructures.

3.3.7 Infrastructure endowment: a comparison with services provided and expenditure

The evaluation of the infrastructure endowment through the synthetic indexes methodology has some advantages. Among them, synthetic indexes are particularly suitable for benchmarking different entities and for the comparison of different dimensions. Taking advantage of such properties, a comparison between the infrastructure endowment of Lithuanian municipalities, the level of service provided, the municipal current expenditure and the overall synthetic indicator of municipal performance has been carried out.

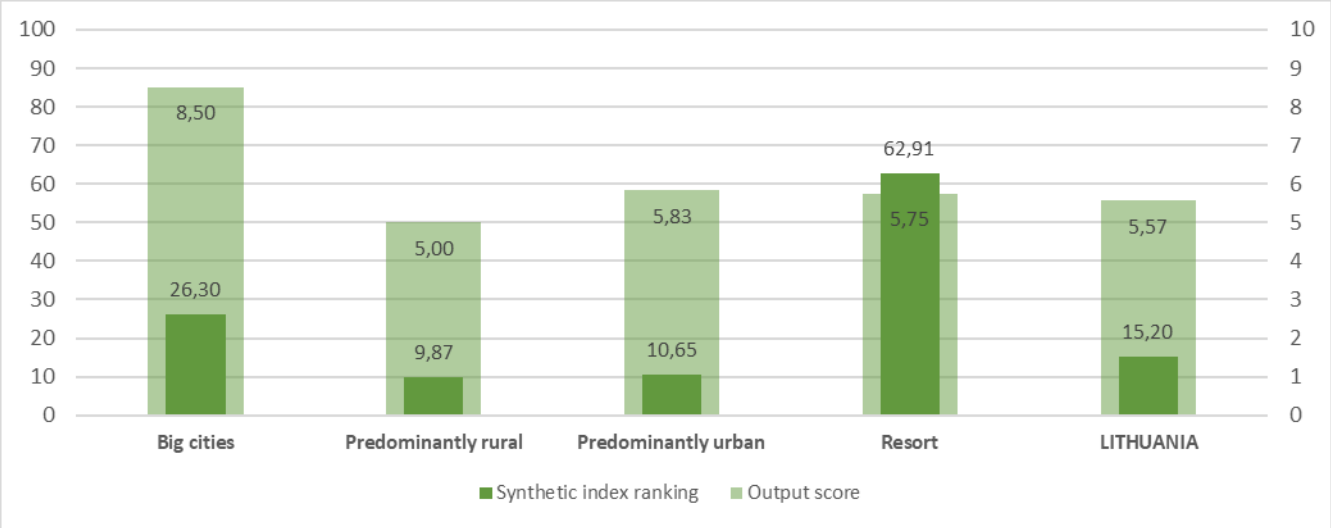
The level of service provided is expressed in term of output score and the current expenditure is evaluated as expenditure score (see chapter 2 for a methodological explanation on the construction of both the scores).

[27] Fay & Yepes, 2003.

The first comparison, between the infrastructure endowment of municipalities and the level of services provided, gives an idea of the level of use of the infrastructure and of the outcome of such use.

Figure 105 shows the comparison between the synthetic index of infrastructure endowment and the total output by cluster. It is possible to see that, on average, a higher value of the synthetic index of infrastructure endowment corresponds to a higher level of services provided. This relation is not verified for *Resort.* The infrastructure endowment of such municipalities, in fact, reflects their characteristic to be touristic areas and the seasonal variation of service users. The infrastructure of *Resort* must be able to serve more than their own population seasonally, but this phenomenon does not lead to an overall increase of the services provided. Therefore, those municipalities appear over-structured in ***Figure 105*** compared to the level of services provided.

Figure 105 – Comparison between synthetic index of infrastructure endowment and output score by cluster - 2018



The comparison can be carried out in more detail performing a within-cluster comparison, that is comparing the municipalities belonging to the same cluster among them in order to take account only of entities with the same characteristics.

Figure 106 shows the comparison between the infrastructure endowment and the level of services provided for *Big cities*. It is possible to notice that the level of services provided is not significantly dependent on the infrastructure endowment of the municipality.

Alytaus m. shows very high values of both output score and synthetic index of endowment. Kauno m. and Klaipėdos m. provide the same level of services as Alytaus m. but they are significantly less endowed in infrastructure. At the same way, Vilniaus m. presents an output score slightly lower than the three municipalities already analysed, but it is also strongly under-structured compared to them. Last, Panevėžio m. and Šiaulių m. provide the same level of services compared to Vilniaus m. but also a higher value of synthetic index of endowment. The level of services provided, in fact could not be considered fully dependent on the infrastructure endowment. The first consideration is that some municipalities can be more efficient in the use of infrastructure and in the services provision than others. In addition, some municipalities have the possibility to exploit more economies of scale in service provision. Therefore, an increase in infrastructure endowment could not necessarily lead to an increase of services provided and a low level of endowment is not synonymous of shortage of services.

Figure 106 - Comparison between synthetic index of infrastructure endowment and output score for Big cities - 2018

Figure 107 displays the comparison among municipalities belonging to *Resort* cluster. The impact of the touristic flow on the infrastructure endowment of such municipalities compared to the level of services provided, previously discussed, is clearly shown. Bištorno m. and Neringos m. are the municipalities with the highest number of tourists accommodated in accommodation establishments respect to the population. Such municipalities, in fact, have a very high endowment of infrastructure that, in the case of Neringos m. does not correspond to a high level of services provided. The infrastructure endowment is, for its nature, substantially steady during the year. On the contrary, the touristic flows are mainly seasonal. This leads to a disproportion between infrastructure endowment and the level of services provided, especially in very small municipalities considering the population such as Bištorno m. and Neringos m.. Such disproportion is less evident in larger municipalities, such as Druskininkų m. and Palangos m..

Figure 107 - Comparison between synthetic index of infrastructure endowment and output score for Resort - 2018

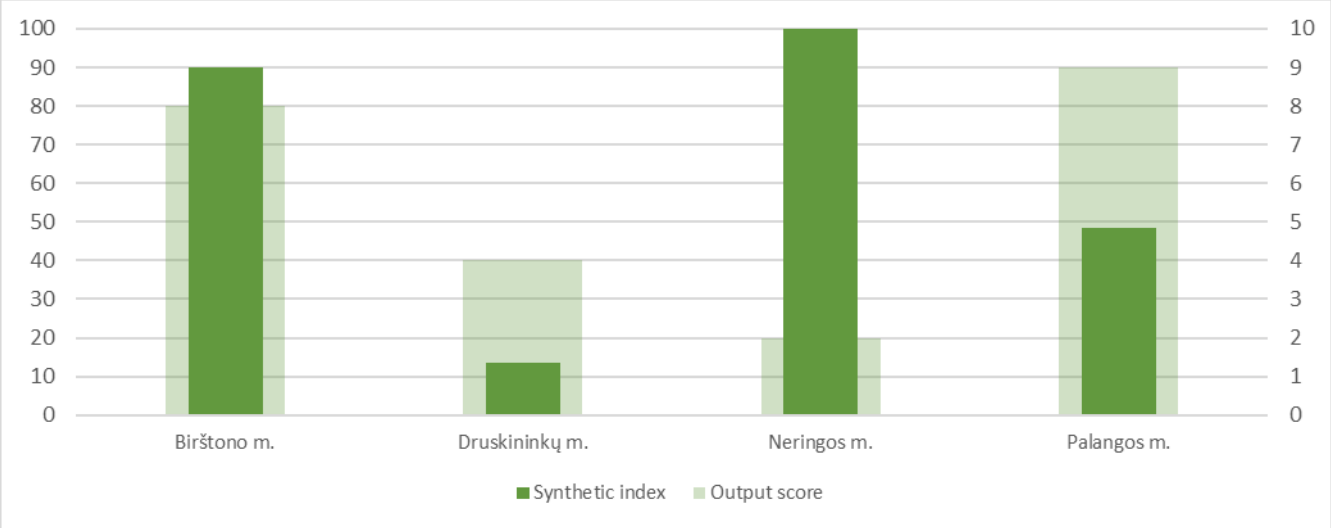


Figure 108 and ***Figure 109*** show the within cluster comparison for *Predominantly urban* and *Predominantly rural* respectively. Most of these municipalities can be considered under-structured accounting for their population and territorial extension, nevertheless some of them presents a very high output score.

Figure 108 - Comparison between synthetic index of infrastructure endowment and output score for Predominantly urban - 2018

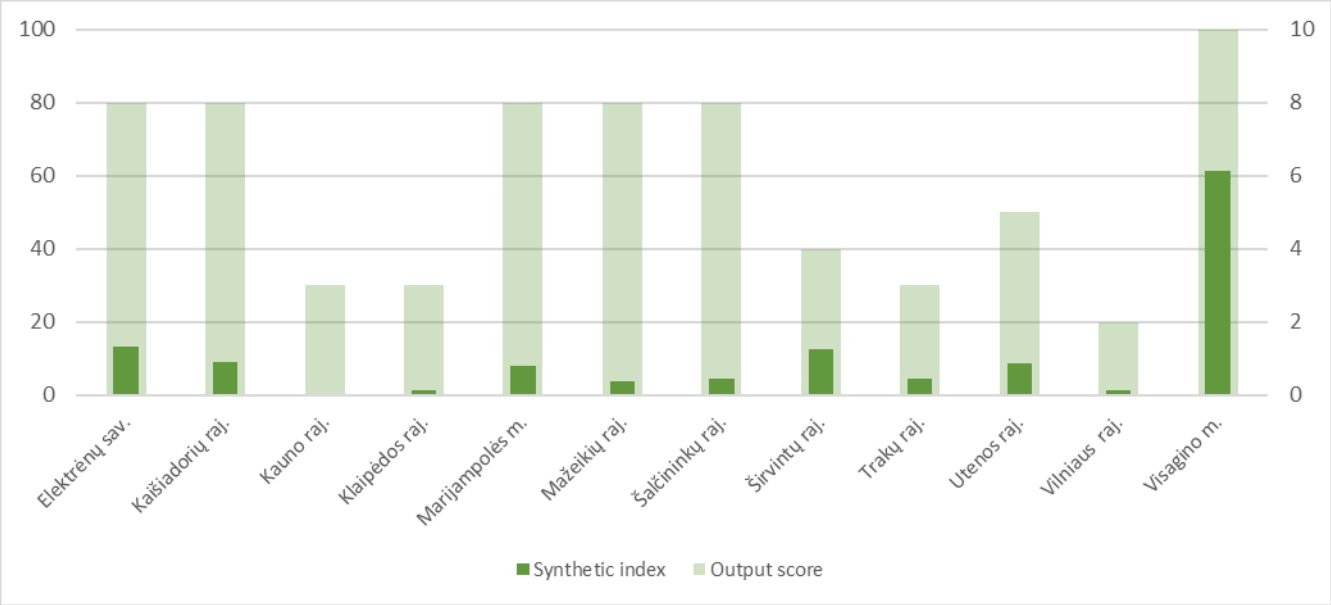
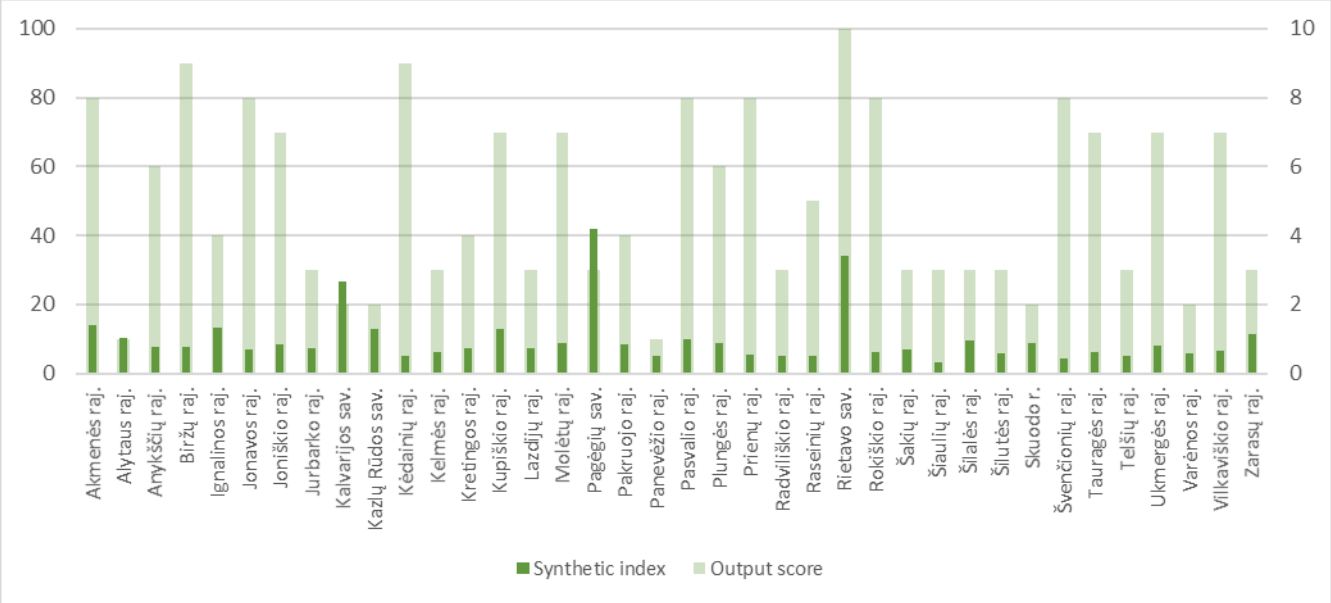
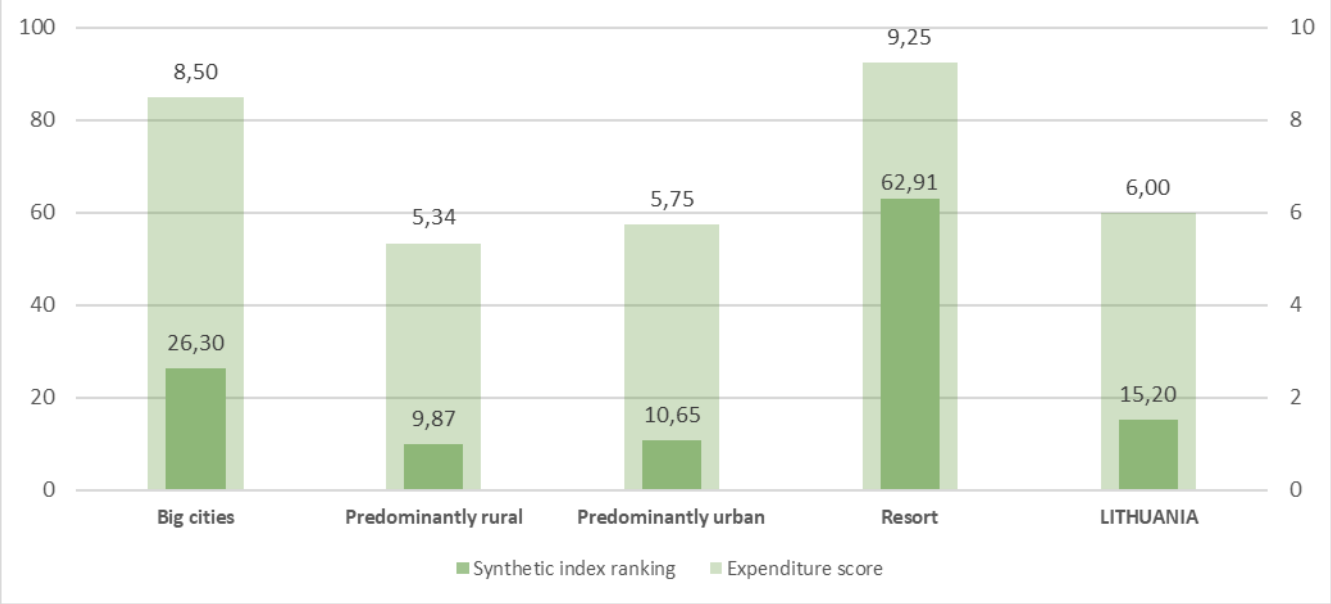


Figure 109 - Comparison between synthetic index of infrastructure endowment and output score for Predominantly rural - 2018



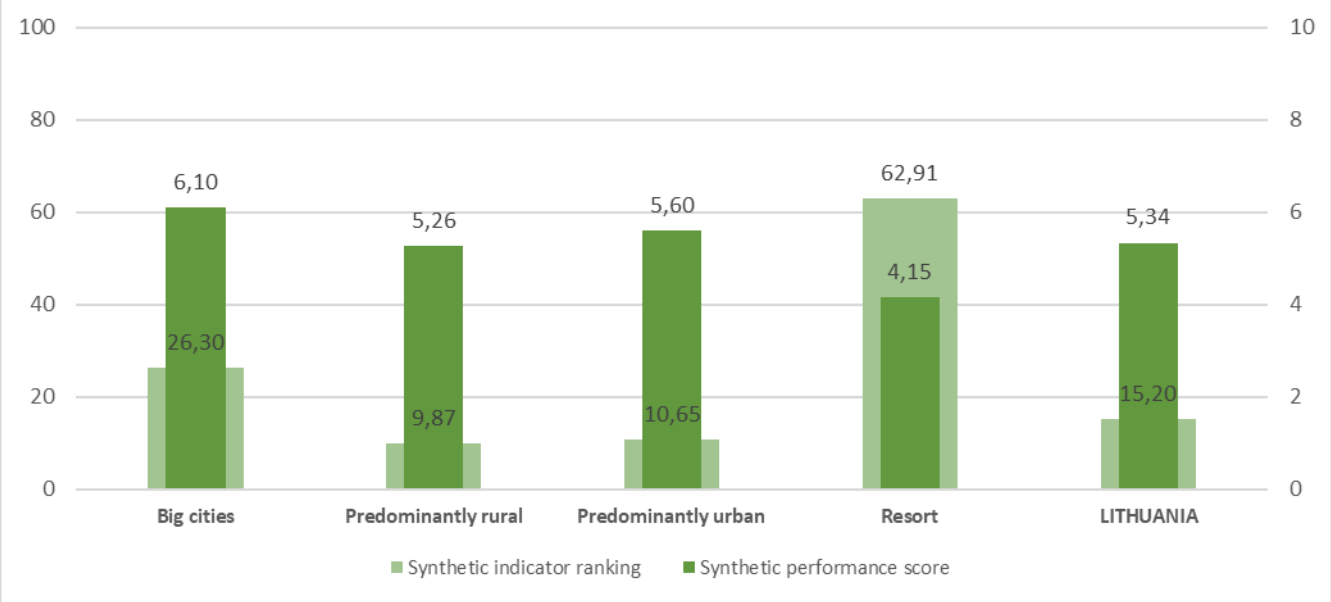
The second comparison has been carried out between the infrastructure endowment of municipalities and the municipal current expenditure (***Figure 110***). On average, the scaling of the two analysed variables is the same and to a higher infrastructure endowment correspond a higher municipal expenditure.

Figure 110 - Comparison between synthetic index of infrastructure endowment and expenditure score by cluster - 2018



Last, it is possible to compare the synthetic index of infrastructure endowment to the synthetic performance score (see paragraph **2.1 Measuring expenditure efficiency and productivity** for a detailed explanation). ***Figure 111*** shows that, on average, the performance score is related to the municipal infrastructure endowment. To a higher level of endowment, in fact, it corresponds a higher level of performance. Nevertheless, such relation is not fully verified if also *Resort* municipalities are included in the comparison. Some explanations for this phenomenon have already been provided in previous lines.

Figure 111 - Comparison between synthetic index of infrastructure endowment and synthetic performance score by cluster - 2018



Summarizing, the results of the comparisons performed in this paragraph show that, on average, the infrastructure endowment seems to have a correlation both to the level of services provided and to the amount of current expenditure. Nevertheless, the relation of endowment to services provided and the overall municipal performance is not always verified for *Resort* municipalities, due to their characteristic to be touristic areas and to the seasonal variation of service users. In addition, even though the above-mentioned relations seem to be verified on average, the level of services provided and the amount of current expenditures cannot be considered fully dependent on the infrastructure endowment, since some municipalities can be more efficient than others and some have the possibility to exploit more economies of scale. Therefore, an increase in infrastructure endowment could not necessarily lead to an increase of services provided or of current expenditures and a low level of endowment is not synonymous of shortage of services.

Of course, all the conclusions and the suggestions provided in the present paragraph have to be read with reference to the analysis performed and to its limitations, i.e. the calculation of the infrastructural endowment based just on the existing "physical endowments" of each municipality since the capital expenditures are not available, and this for each type of service analysed in this report. Further analysis could express public capital and infrastructural gap following a monetary approach, in order to estimate the needed investment in infrastructure also for other determinant services not considered here, such as municipal public transport and social security.

It is noteworthy here to remember that the synthetic index of infrastructure endowment has been calculated considering both population and territorial extension of each municipality as denominator in the construction of the simple indicators. On the contrary, output score and expenditure score consider population only.

4. OVERALL RESULTS

For each local government and at a macro level, Fiscal gap is a measure to quantify long-term fiscal and debt sustainability (also called "resource-requirements gap" or "needs capacity gap") and it is basically equal to the difference between expenditure needs and revenue raising capacity. If fiscal gap is different from zero then there is evidence of structural imbalance.

In general, fiscal gap analysis is important for many reasons and, without action, the increasing of deficit and the resulting debt accumulation could, in the long term, negatively affect economy.

Different forms of fiscal imbalance are discussed in this report (**2.3 Measuring Fiscal gap and Fiscal imbalance**) and Fiscal gap results depend on default values set for all policy variables considered in the analysis.

For the computation of *Vertical Fiscal Imbalance* (**VFI**), the total expenditure includes standard expenditure (SEN) for municipal functions that have been standardized and actual expenditures for the remaining ones. The following table (***Table 74***) displays municipal functions and the typology of expenditure considered (standard or actual).

Table 74 Type of expenditure by Function

FUNCTION	TYPE OF EXPENDITURE
General administration	Standard expenditure
Housing and utilities	Standard expenditure
Recreation, culture and religion	Standard expenditure
Education	Standard expenditure
Social security	Standard expenditure
Health protection	Actual expenditure
Fuel and energy	Actual expenditure
Transportation	Actual expenditure
Waste management	Actual expenditure
Water and Sewage treatment	Actual expenditure

The sources of municipality's own revenues considered for the computation of VFI include both standardized revenues and sources considered at the historical value.

The first group, standardized revenues, includes the following taxes:

- Property tax;
- Fees;
- Land tax.

The second group, whose potential has been evaluated at the historical value, includes:

- Lease tax on state owned land and water bodies;
- Tax on state owned natural resources;

- Pollution tax.

Values of 2018 VFI per inhabitant are reported in the following table (***Table 75***). *Predominantly rural* municipalities and *Resorts* display an evident vertical fiscal imbalance, if compared to other municipalities, that requires more central government interventions through grants.

Table 75 Vertical fiscal imbalance (2018)

AREA	Vertical fiscal imbalance (euro per inhabitant)
LITHUANIA	**776,63**
Big cities	676,02
Predominantly urban	775,02
Predominantly rural	894,93
Resort	918,44

The *Horizontal fiscal imbalance* (**Base HFI**), unlike VFI, also includes the portion of local government's expenditure that is financed by central government grants; more specifically it evaluates the special targeted grants (Earmarked Grants):

- Revenues for State delegated functions;
- Student basket;
- Revenues from other grants of the State budget.

Furthermore, In the computation of the Horizontal fiscal imbalance additional resources financed by central government, e.g. Personal Income Tax received from the State Tax Inspectorate, have been included.

The target value of the Horizontal fiscal imbalance should be 1, representing a perfect equilibrium between expenditures and revenues. If HFI is greater than 1 conversely there is evidence of resources deficit which should be filled with equalisation components; on the contrary, if the index is smaller than 1 there is evidence of surplus of resources.

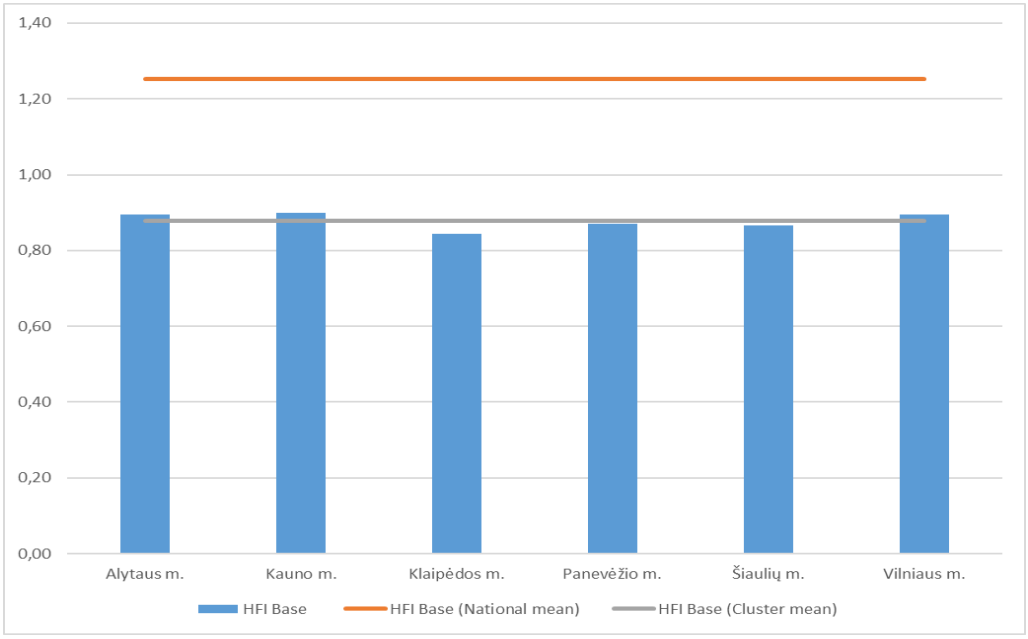
Values of 2018 HFI and its standard deviations by area are reported in the following table (***Table 76***). Before equalisation interventions, *Predominantly rural* and *Resort* municipalities display a more accentuated deficit of resources. *Predominantly urban* authorities are - on average - very close to the equilibrium balance, while *Big cities* seem to have no deficit imbalance.

Table 76 Horizontal fiscal imbalance (2018)

AREA	Horizontal fiscal imbalance	Standard deviation
LITHUANIA	**1,25**	**0,27**
Big cities	0,88	0,02
Predominantly urban	1,09	0,20
Predominantly rural	1,37	0,19
Resort	1,21	0,41

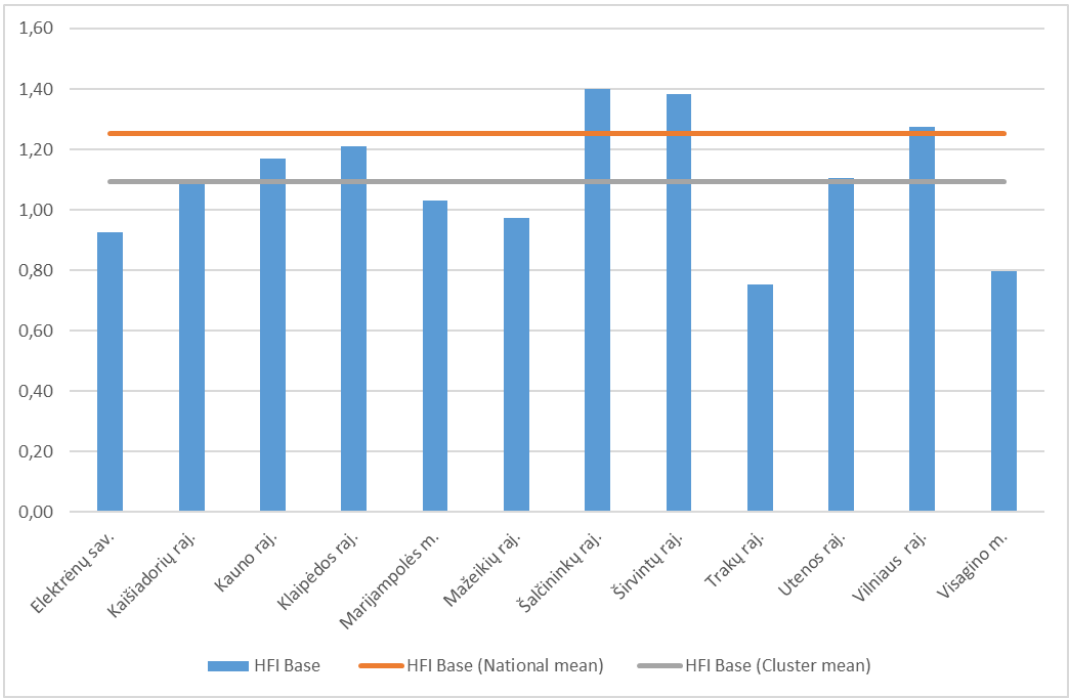
A within cluster analysis provides more details for each municipality compared to others having similar background features. *Big cities* show aligned values of the basic Horizontal fiscal imbalance (***Figure 112***), with only Klaipėdos m. slightly below the cluster average. All municipalities' imbalances are significantly below the unitary equilibrium value thus showing a surplus of resources even before equalisation interventions.

Figure 112 HFI Base – Big cities (2018)



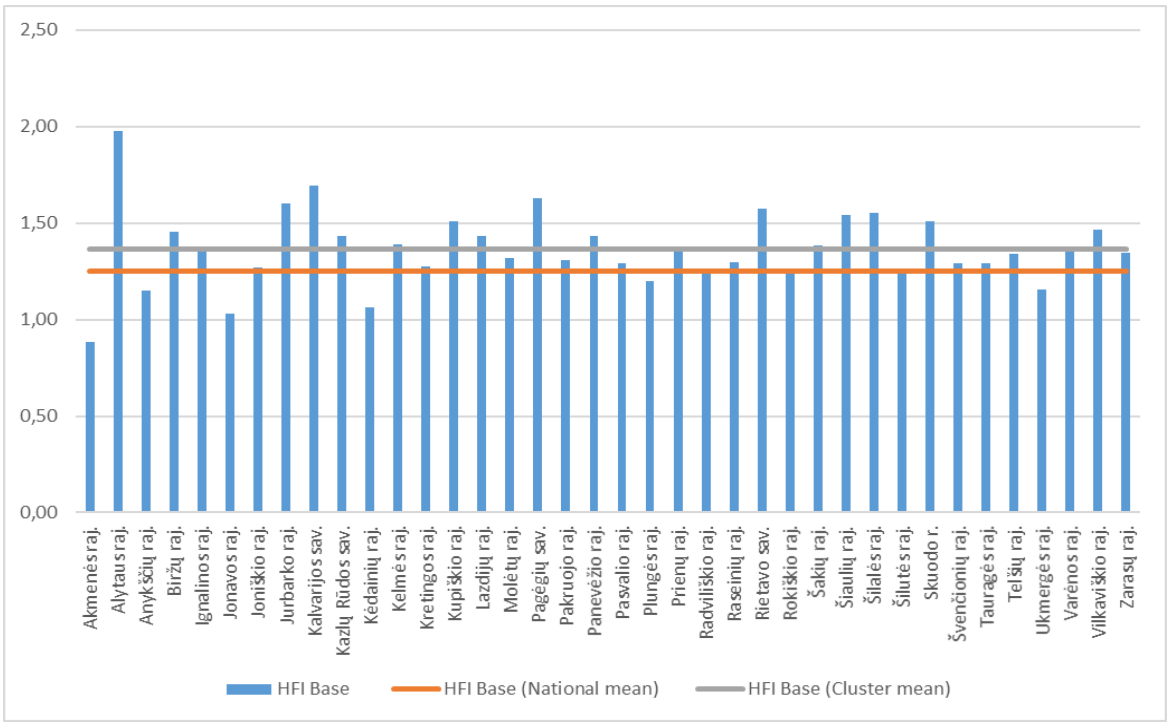
Predominantly urban municipalities show a heterogeneous trend around the average (***Figure 113***). Šalčininkų raj., Širvintų raj. and Vilniaus raj. display a high deficit imbalance with values of basic HFI higher than the national average. On the opposite side Trakų raj. and Visagino m. show a noticeable surplus financial condition.

Figure 113 HFI Base – Predominantly urban (2018)



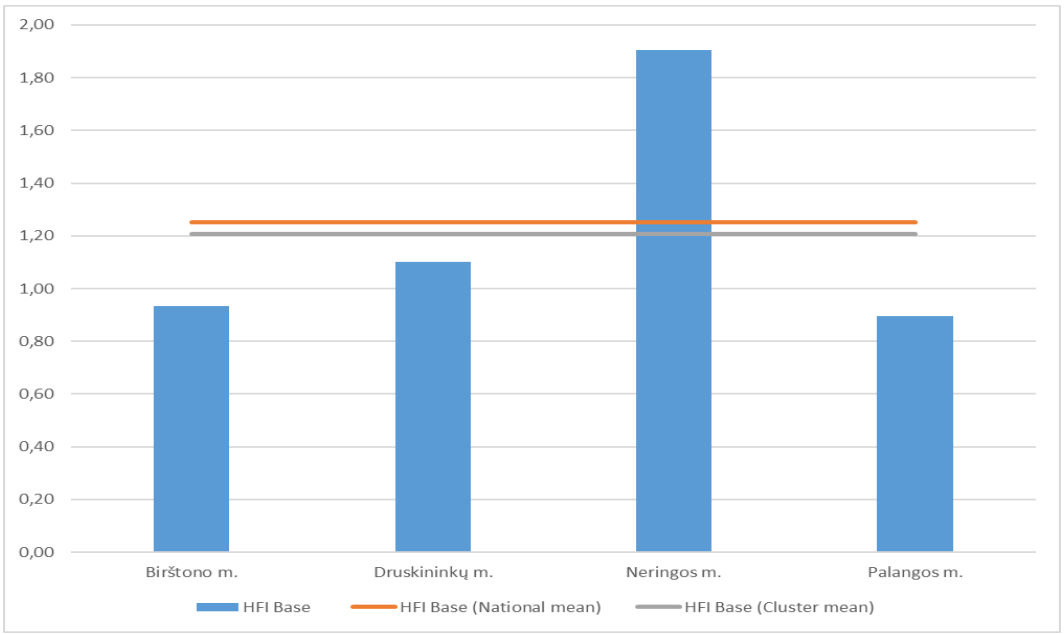
Basic Horizontal fiscal imbalance for *Predominantly rural* municipalities is constantly above the unit value (***Figure 114***), with the only exception of Akmenės raj.. Cluster mean is greater than national mean, implying a deficit condition that requires redistribution of equalisation resources.

Figure 114 HFI Base – Predominantly rural (2018)



As for the *Resorts*, only Neringos m. operates with an evident negative financial imbalance (***Figure 115***), which is not the case for the remaining municipalities of the cluster.

Figure 115 HFI Base – Resort (2018)



The same information related to Horizontal fiscal imbalance previously analysed through histograms could also be displayed with geographical maps, useful to visualize the territorial distribution of resources. The following map (***Figure 116***) shows the 2018 territorial distribution of the Base Horizontal fiscal imbalance. The prevalence of municipalities with values of HFI greater than 1 (bluish-green and dark bluish-green areas) is evident from the map, meaning that the intervention of equalisation components plays a fundamental role for the re-establishment of financial equilibrium. Only few municipalities (***Table 77***) give evidence of surplus of resources and just one, Mažeikių raj., shows a balanced ratio between expenditures and resources.

Figure 116 Municipality HFI Base (2018)

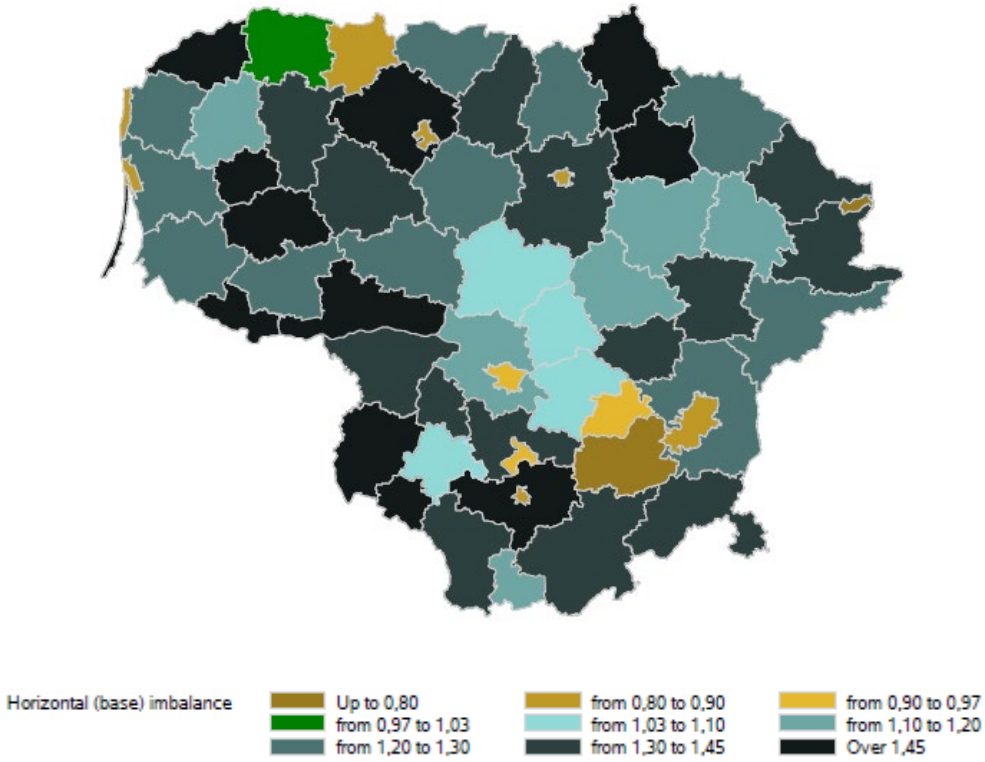
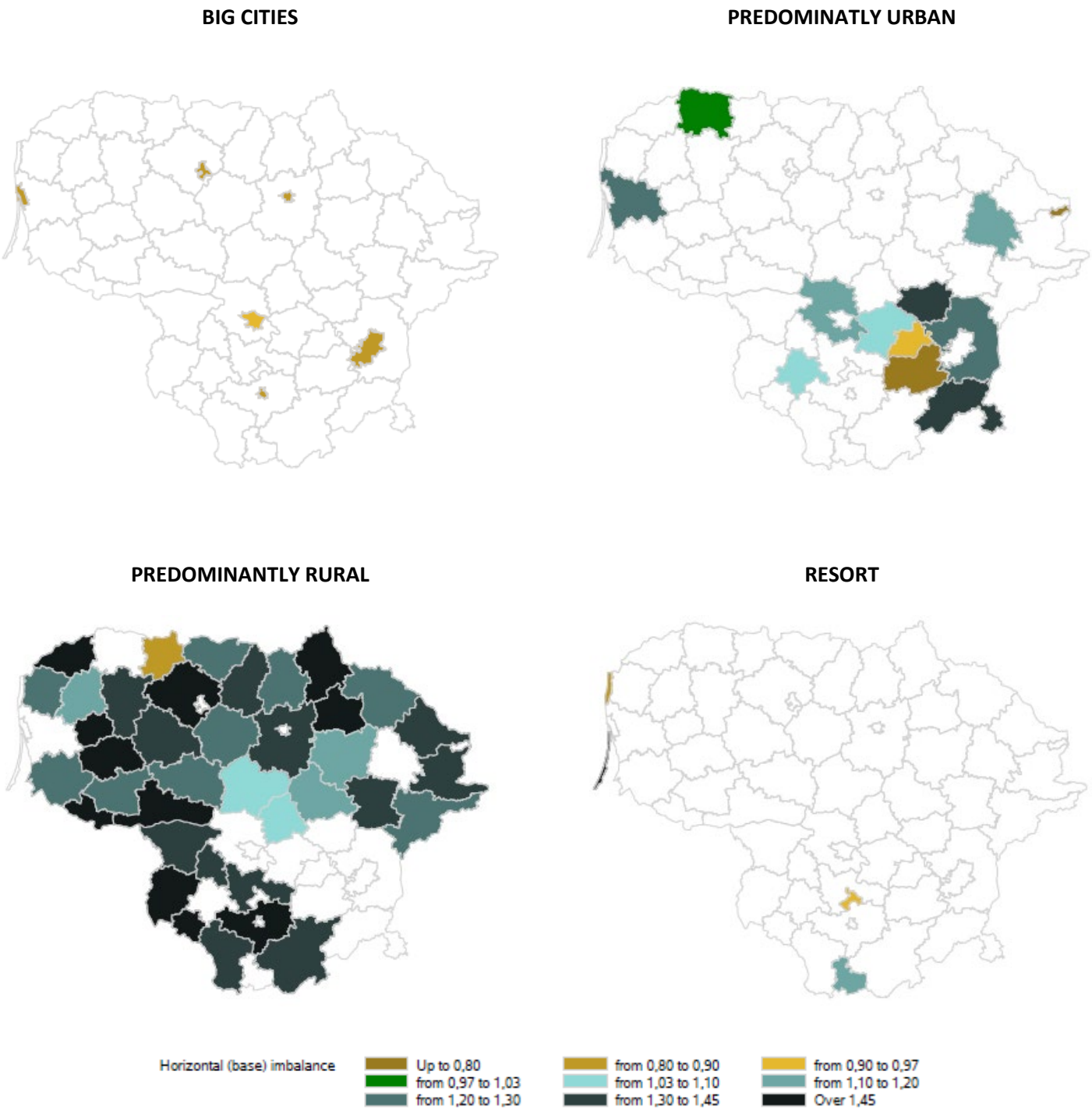


Table 77 Municipalities with Base HFI lower than one (2018)

MUNICIPALITY	
Akmenės raj.	Palangos m.
Alytaus m.	Panevėžio m.
Birštono m.	Šiaulių m.
Elektrėnų sav.	Trakų raj.
Kauno m.	Vilniauss m.
Klaipėdos m.	Visagino m.
	Mažeikių raj.

The decomposition of the territory into clusters (***Figure 117***) shows that most of municipalities with a surplus of resources belong to the *Big cities* group. On the other side, it emphasizes how *Predominantly rural* municipalities require equalisation interventions.

Figure 117 Municipality HFI Base by Cluster (2018)



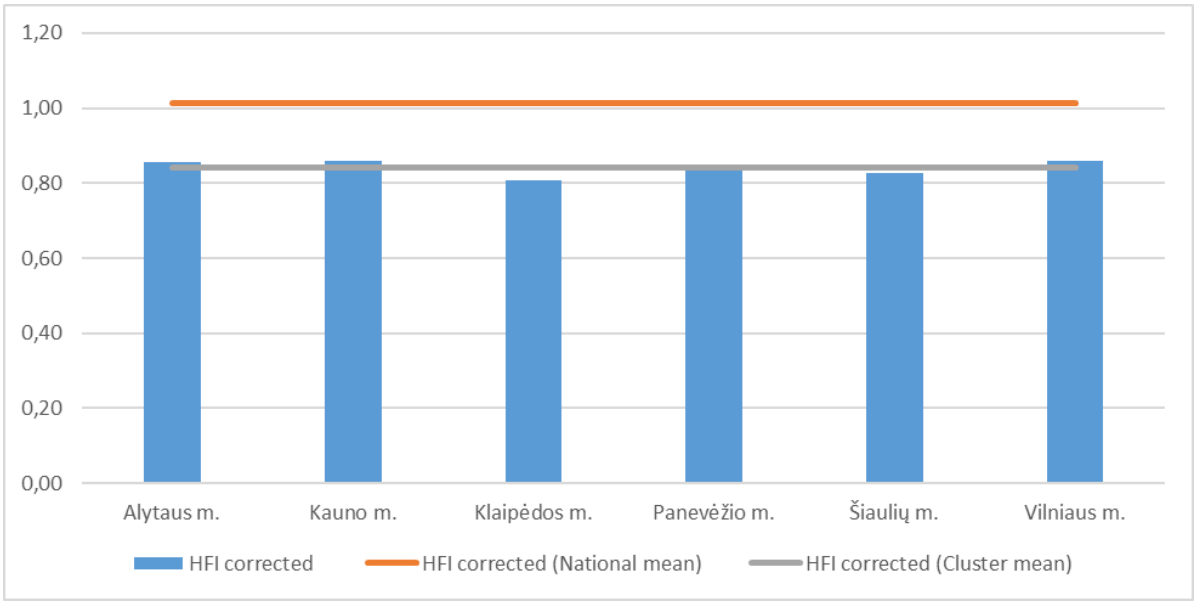
Values of the *Corrected HFI*, which includes also equalisation components (Equalization component to 90% of PIT average and Equalization component according to expenditure needs) among the resources distributed by the central government (**2.3 Measuring Fiscal gap and Fiscal imbalance**), as well as its standard deviations by area are reported in the following table (***Table 78***). On average, total area values are very close to the financial equilibrium, but a between clusters analysis highlights how *Predominantly rural* municipalities still show an imbalance tending to deficit.

Table 78 Corrected Horizontal fiscal imbalance (2018)

AREA	Horizontal fiscal imbalance (CORRECTED)	Standard deviation
LITHUANIA	**1,01**	**0,13**
Big cities	0,84	0,02
Predominantly urban	0,98	0,15
Predominantly rural	1,06	0,10
Resort	0,92	0,11

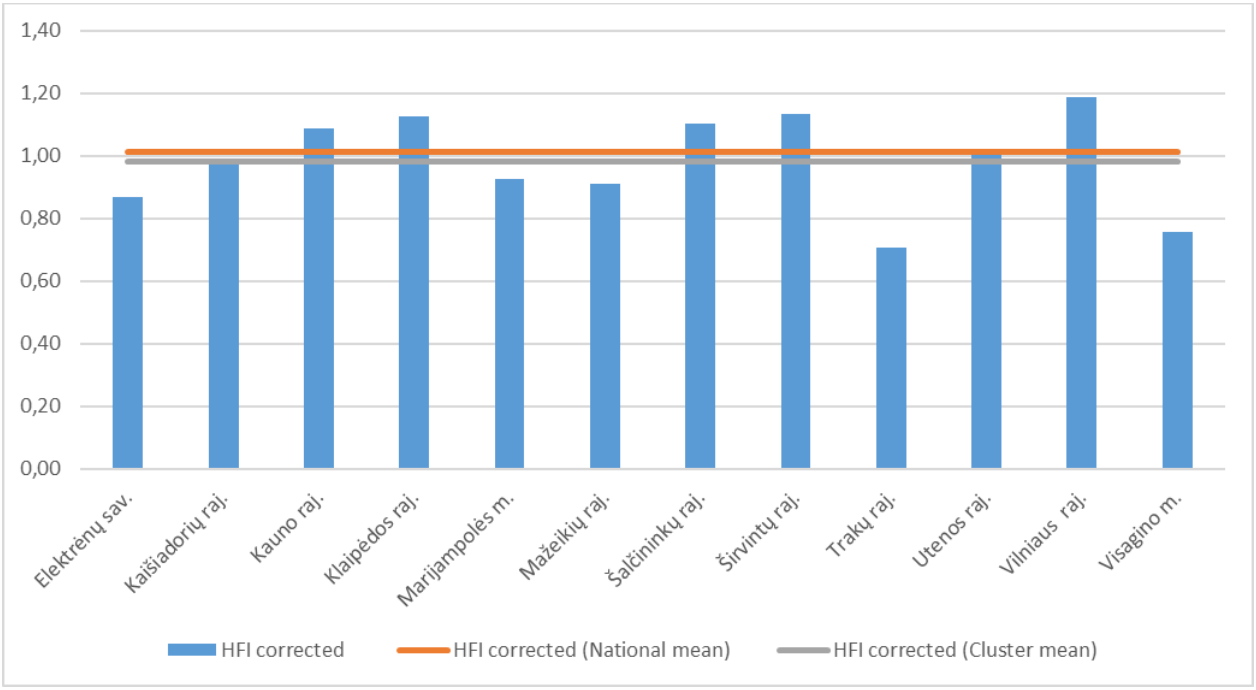
Big cities' financial situation further improves after the inclusion of equalisation components that contribute to reduce the index (***Figure 118***).

Figure 118 HFI Corrected – Big cities (2018)



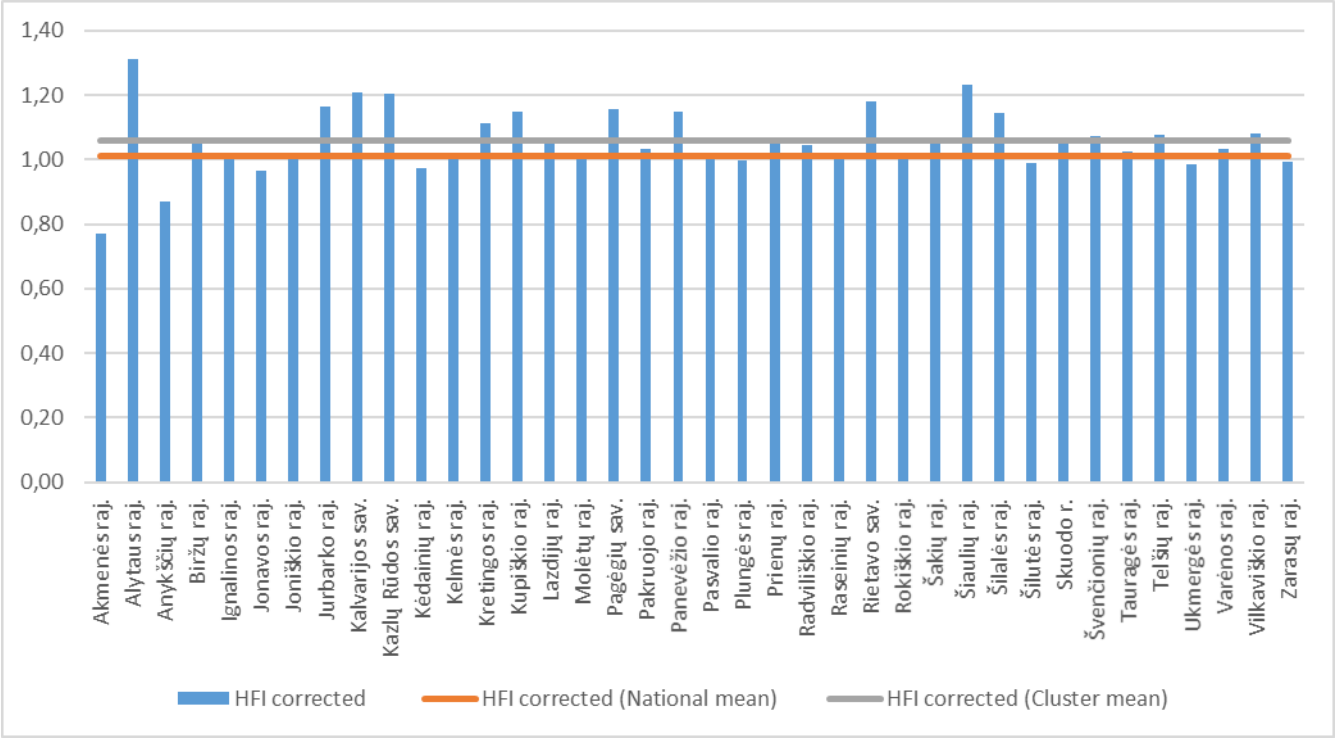
Most of *Predominantly urban* municipalities lie below the unit target value, with Kauno raj., Klaipėdos raj., Šalčininkų raj., Širvintų raj. and Vilniaus raj. still showing some imbalances (***Figure 119***).

Figure 119 HFI Corrected – Predominantly urban (2018)



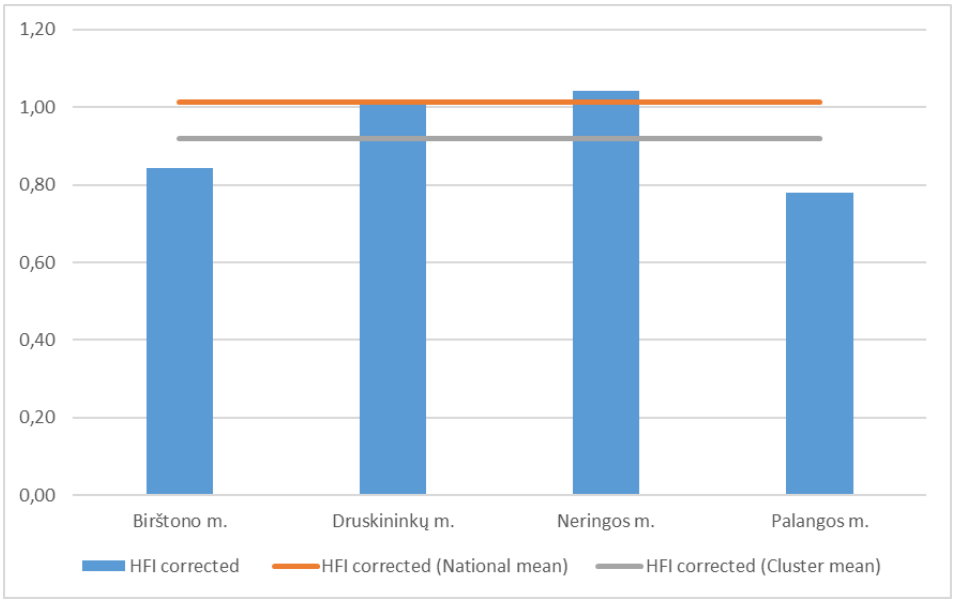
According to ***Figure 120***, the transfer of equalisation resources significantly improves the imbalances of *Predominantly rural* municipalities, but - on average - the expenditures are still slightly greater than the revenues.

Figure 120 HFI Corrected – Predominantly rural (2018)



Among *Resorts* the municipality of Neringos m. improves significantly the financial imbalance that goes from the initial 1,90 (base Horizontal fiscal imbalance) without equalisation resources to a final 1,04 with the inclusion of equalisation grants (***Figure 121***).

Figure 121 HFI Corrected – Resort (2018)



The following maps (***Figure 122*** and ***Figure 123***) illustrate the 2018 territorial distribution of the corrected Horizontal fiscal imbalance. The inclusion of equalisation grants ensures a better balance of the financial situation as evidenced by the increase in equilibrium zones (green areas with corrected HFI ranging from 0,97 to 1,03). At the same time, the number of municipalities having a deficit in the financial condition decrease significantly (many areas turn from dark bluish to light bluish).

Figure 122 Municipality Corrected HFI (2018)

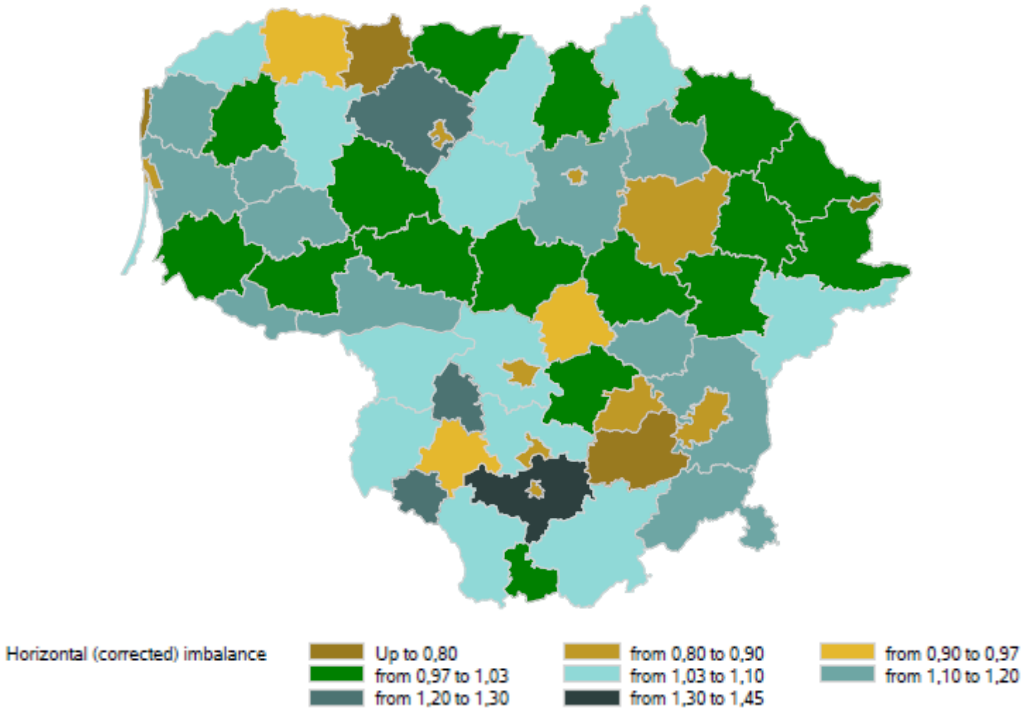
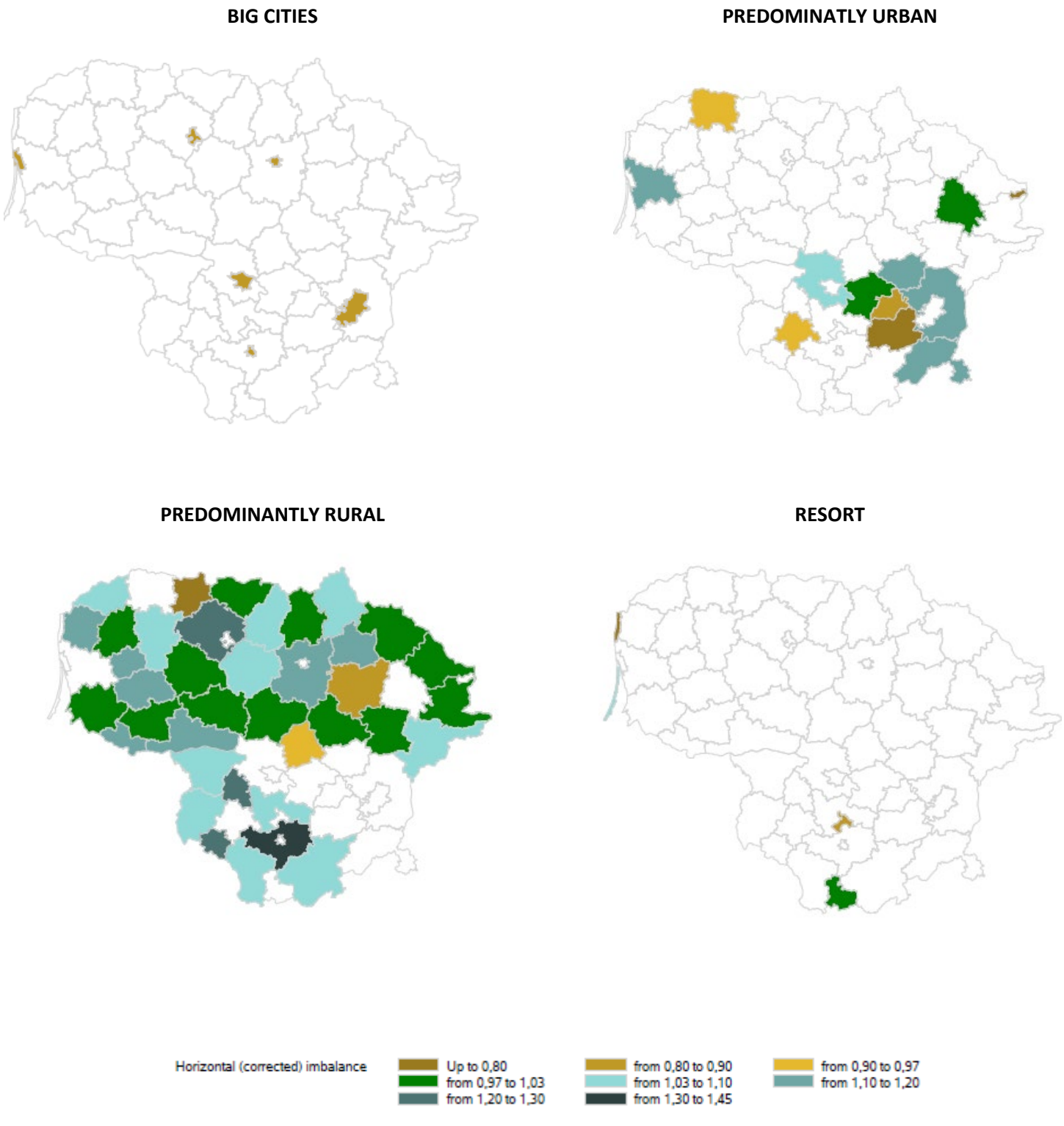


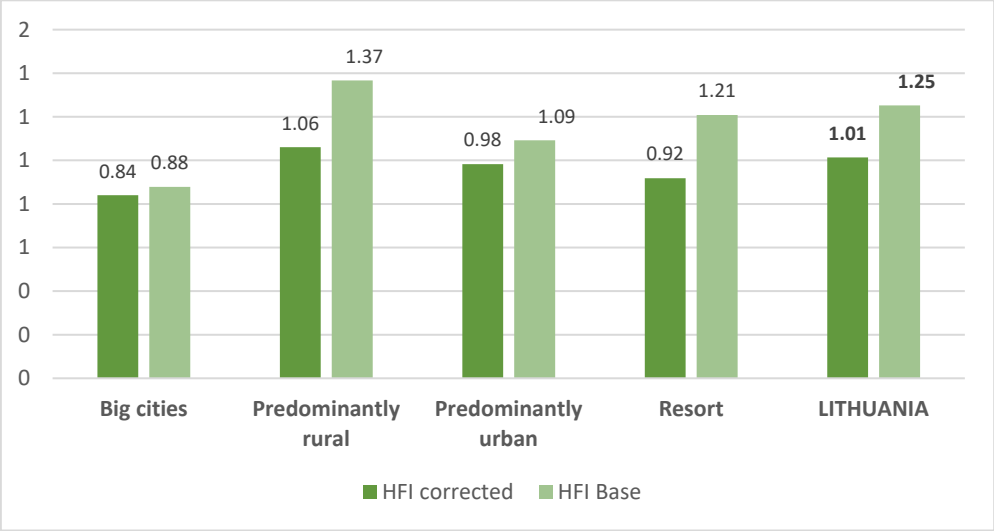
Figure 123 Municipality Corrected HFI by Cluster (2018)



The graph below (***Figure 124***) compares 2018 values of Horizontal fiscal imbalance, both basic and corrected computation, for all the territory of Lithuania and for each cluster.

From a between cluster analysis point of view, there is evidence that the redistribution of equalisation grants moves, on average, imbalances towards fiscal equilibrium for *Predominantly rural*, *Predominantly urban* and *Resort* municipalities, while *Big cities* further improve their surplus status.

Figure 124 Horizontal fiscal imbalance (base and corrected) (2018)



A direct comparison between basic and corrected Horizontal fiscal imbalance is provided also through an insight analysis within each cluster.
Except for *Big cities* (***Figure 125***) where, as explained before, equalisation grants improve a preceding positive financial condition, redistribution of equalisation resources brings the fiscal imbalance of each municipality closer to the unit value. This is extremely evident for *Predominantly urban* (***Figure 126***), *Predominantly rural* (***Figure 127***) municipalities and, among *Resort* (***Figure 128***), for Neringos.

Figure 125 Horizontal fiscal imbalance (base and corrected) – Big cities (2018)

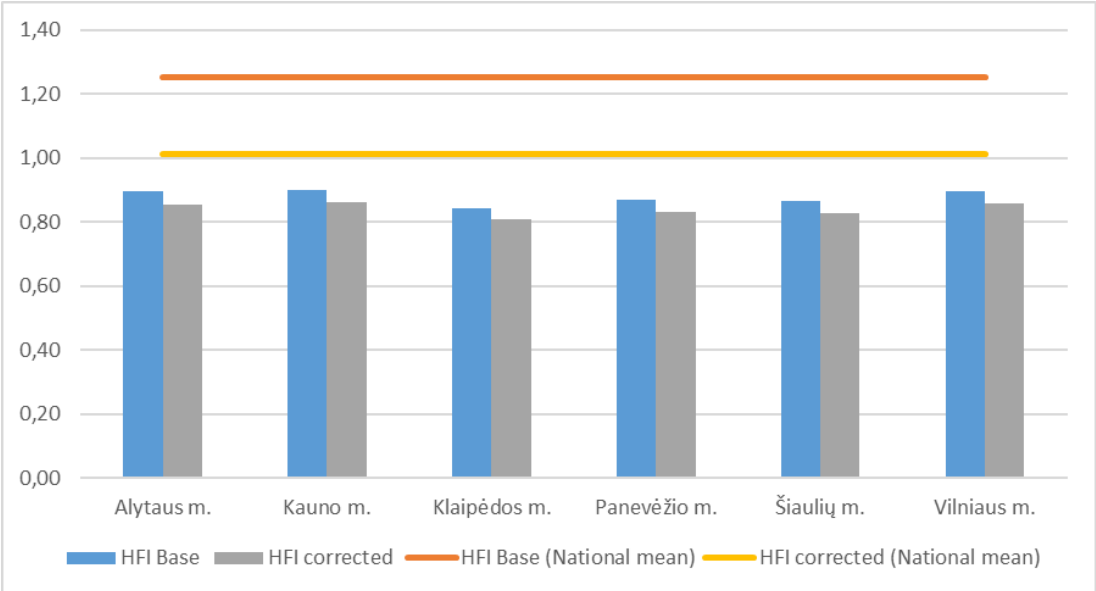


Figure 126 Horizontal fiscal imbalance (base and corrected) – Predominantly urban (2018)

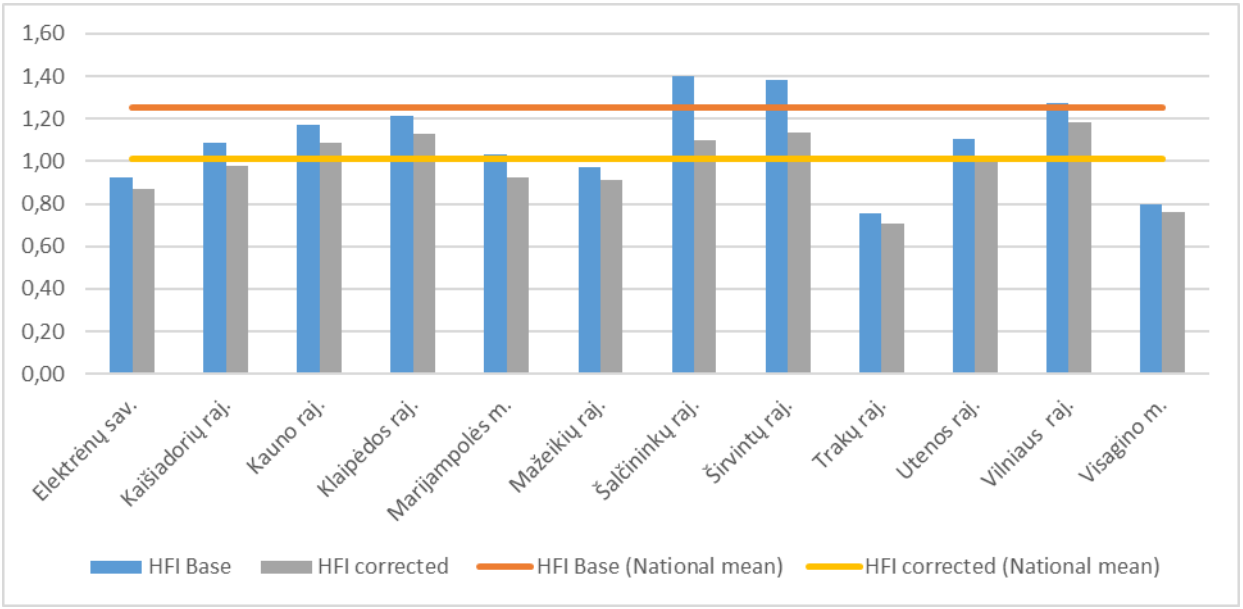


Figure 127 Horizontal fiscal imbalance (base and corrected) – Predominantly rural (2018)

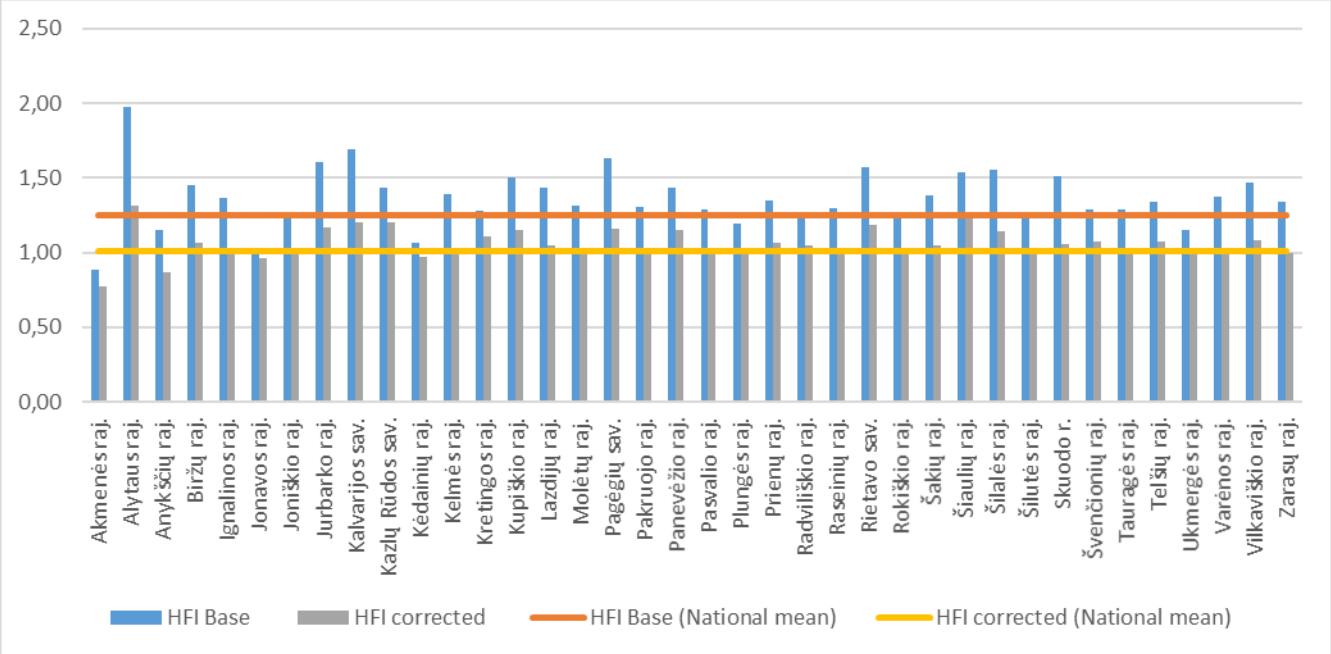
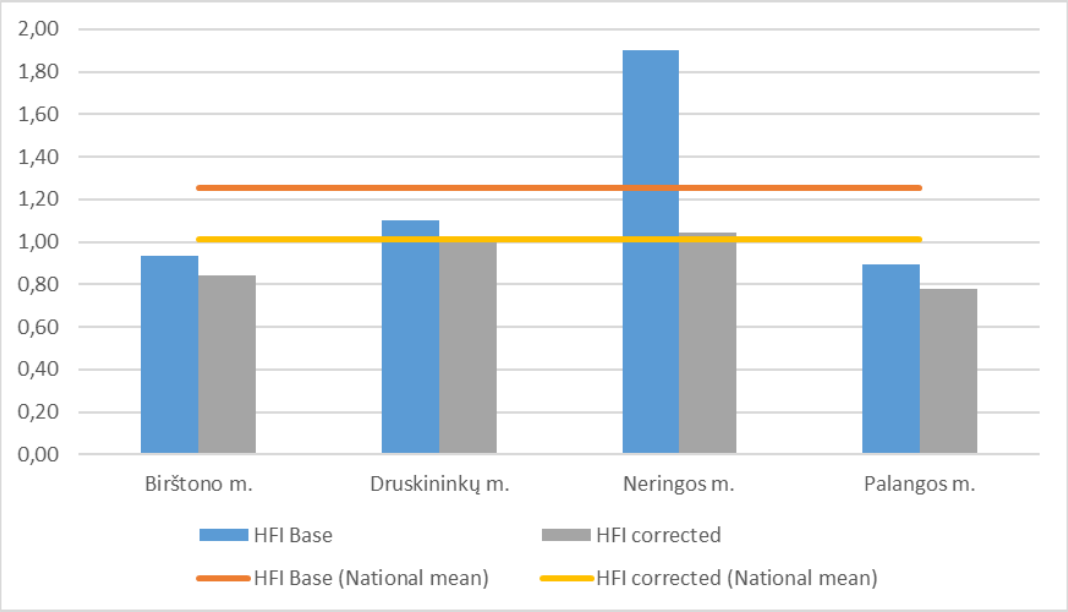


Figure 128 Horizontal fiscal imbalance (base and corrected) – Resort (2018)



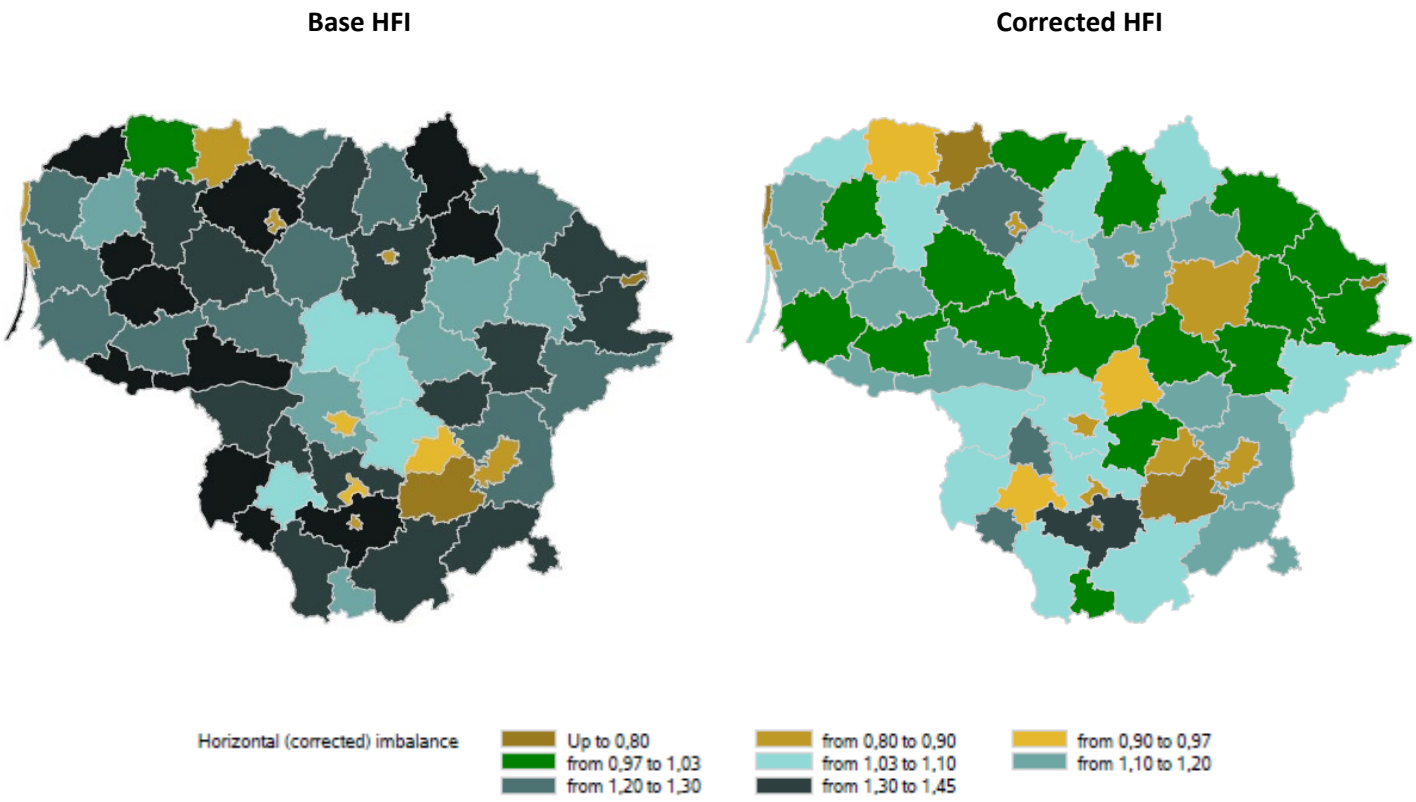
Another way to analyse the impact of the inclusion of equalisation components is to compare deviation indexes of base and corrected Horizontal fiscal imbalance, as shown in the following table (***Table 79***). The intervention of equalisation resources restricts the dispersion of corrected Horizontal fiscal imbalances around the average especially for *Predominantly rural* municipalities and *Resort* municipalities.

Table 79 Base and corrected HFI Standard deviation (2018)

AREA	STANDARD DEVIATION Horizontal fiscal imbalance (CORRECTED)	STANDARD DEVIATION Horizontal fiscal imbalance (BASE)
LITHUANIA	**0,13**	**0,27**
Big cities	0,02	0,02
Predominantly urban	0,15	0,20
Predominantly rural	0,10	0,19
Resort	0,11	0,41

A simple geographical comparison is also useful to visualize the effects of equalisation resources. Green areas (corresponding to values of HFI between 0,97 and 1,03) are more frequent (HFI closer to one) when considering the corrected Fiscal imbalance measure.

Figure 129 Base and corrected HFI Maps (2018)



Finally, for 2018, *Fiscal gap* (computed through a simple comparison between total expenditures and total revenues as explained in **2.3 Measuring Fiscal gap and Fiscal imbalance**) has been calculated for each municipality. The overall value of fiscal imbalance, equal to -5,14%, is reported in the following table (***Table 80***) along with statistics by cluster.

The conclusions are very similar to the ones proposed with the Horizontal fiscal imbalance analysis, with *Big cities* and *Resort* showing a general condition of surplus, while *Predominantly urban* and *Predominantly rural* municipalities display a growing deficit situation.

Table 80 Fiscal gap by Area (2018)

AREA	Fiscal gap (weighted Average)
LITHUANIA	-5,14%
Big cities	-15,25%
Predominantly urban	0,61%
Predominantly rural	4,86%
Resort	-9,48%

The following maps show fiscal gap values for the whole Lithuanian territory (***Figure 130***) and for each cluster (***Figure 131***). Dark areas identify values with a positive fiscal gap (deficit of resources), while lighter areas correspond to negative values of fiscal gap (surplus of resources).

Figure 130 Municipality Fiscal gap map (2018)

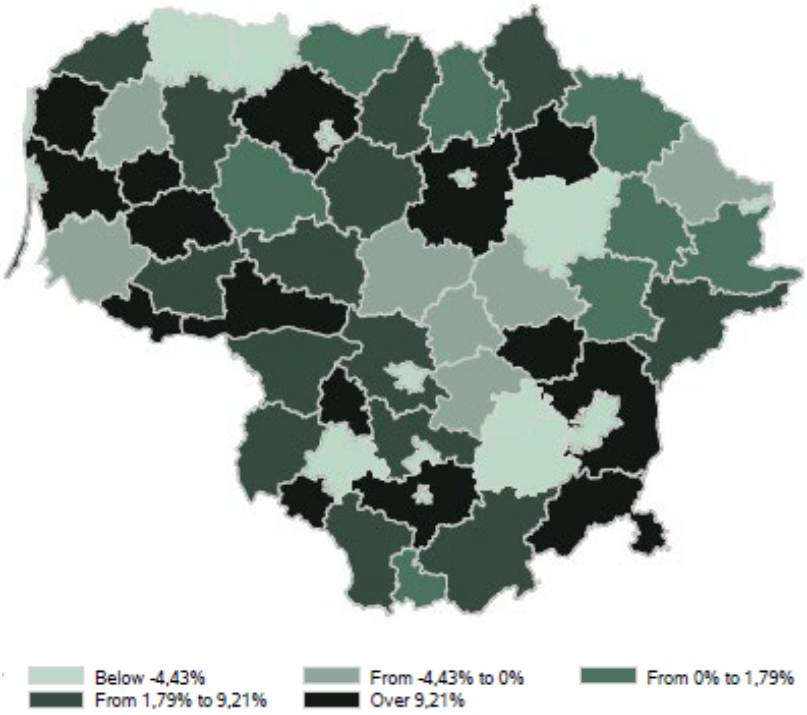
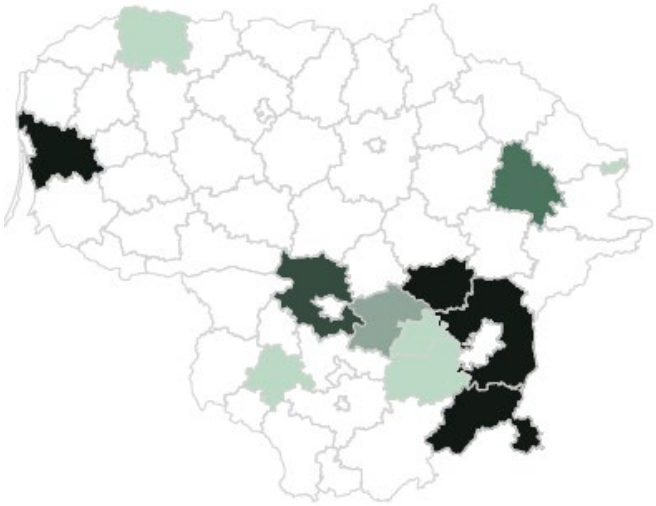


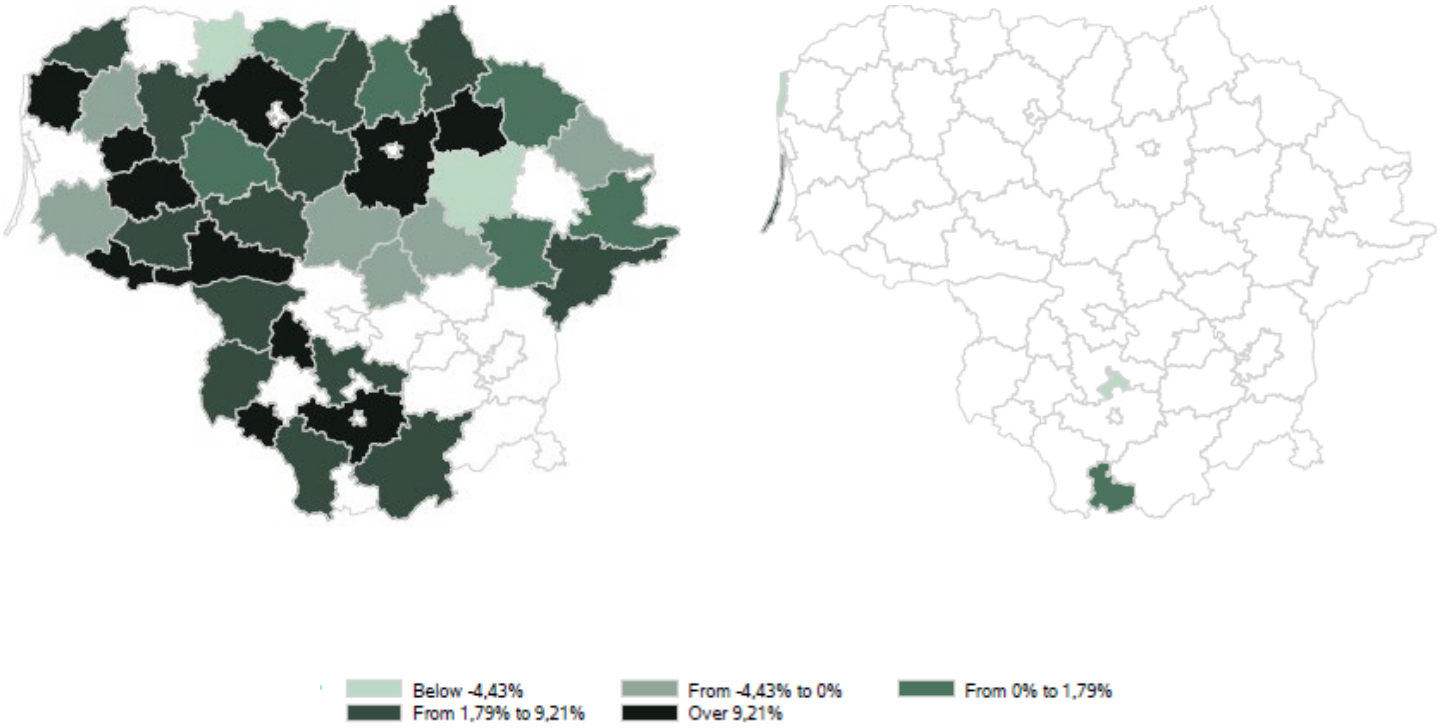
Figure 131 Municipality Fiscal gap map by Cluster (2018)

BIG CITIES

PREDOMINATLY URBAN



PREDOMINANTLY RURAL **RESORT**



The comparison between fiscal gap results and the overall synthetic infrastructural index provides (***Table 81***) interesting conclusions. Municipalities with a higher infrastructural endowment, *Big cities* and *Resorts*, prove to be the ones with level of revenues higher than the expenditures, which means that a financial surplus supports infrastructure's investments.

Table 81 Fiscal gap and Synthetic infrastructure index by Area (2018)

AREA	Fiscal gap (weighted Average)	Synthetic infrastructural index
LITHUANIA	**-5,14%**	15,20
Big cities	-15,25%	26,30
Predominantly urban	0,61%	10,65
Predominantly rural	4,86%	9,87
Resort	-9,48%	62,91

The fiscal imbalances, analyzed with Fiscal gap measure and Horizontal fiscal imbalance indexes, could be valued as estimates of the amount of deficit or surplus resources.

For each of the clusters as well as for the whole Lithuania territory, the following tables report the total amount of deficit accumulated and surplus produced, both in absolute amount (***Table 82***) and per capita values (***Table 83***). *Predominantly rural* municipalities incorporate the largest portion of debt. As already pointed out, all *Big cities* are in a positive condition with the highest per capita share of surplus.

Table 82 Deficit and surplus amount (2018)

AREA	Deficit (euro)	Surplus (euro)
LITHUANIA	**86.798.770**	**217.799.951**
Big cities	-	172.641.766
Predominantly urban	30.389.496	27.596.848
Predominantly rural	55.980.327	12.046.273
Resort	428.946	5.515.065

Table 83 Deficit and surplus per capita (2018)

AREA	Deficit (euro per inhabitant)	Surplus (euro per inhabitant)
LITHUANIA	**50,73**	**47,58**
Big cities	-	148,57
Predominantly urban	43,23	75,57
Predominantly rural	63,69	13,02
Resort	26,19	140,51

The following table (***Table 84***) shows the complete list of municipalities with the associated amount of deficit estimated with corrected Horizontal fiscal imbalance index including central equalization resources. The within cluster analysis shows that most of the municipalities with a debt condition belong to the *Predominantly rural* group (79% of all the municipalities with a financial debt position).

Table 84 Deficit - List of municipalities (2018)

Municipality	Cluster	Deficit (euro)	Deficit (euro per inhabitant)
Druskininkų m.	Resort	109.154	5,57
Neringos m.	Resort	319.792	99,19
Alytaus raj.	Predominantly rural	6.199.547	237,74
Biržų raj.	Predominantly rural	1.335.777	56,18
Ignalinos raj.	Predominantly rural	44.057	2,87
Joniškio raj.	Predominantly rural	238.143	11,03
Jurbarko raj.	Predominantly rural	3.848.835	147,79
Kauno raj.	Predominantly urban	6.195.436	66,87
Kelmės raj.	Predominantly rural	250.114	9,34
Klaipėdos raj.	Predominantly urban	5.441.638	96,95
Kretingos raj.	Predominantly rural	3.519.202	92,74
Kupiškio raj.	Predominantly rural	2.329.349	136,24
Lazdijų raj.	Predominantly rural	951.179	49,76

Municipality	Cluster	Deficit (euro)	Deficit (euro per inhabitant)
Molėtų raj.	Predominantly rural	101.995	5,71
Pakruojo raj.	Predominantly rural	638.451	32,66
Panevėžio raj.	Predominantly rural	4.482.632	125,44
Pasvalio raj.	Predominantly rural	39.120	1,63
Prienų raj.	Predominantly rural	1.434.497	54,15
Radviliškio raj.	Predominantly rural	1.560.340	43,14
Raseinių raj.	Predominantly rural	592.371	18,22
Rokiškio raj.	Predominantly rural	408.099	13,85
Skuodo r.	Predominantly rural	909.280	53,76
Šakių raj.	Predominantly rural	1.203.014	42,91
Šalčininkų raj.	Predominantly urban	2.880.684	92,14
Šiaulių raj.	Predominantly rural	7.573.381	183,78
Šilalės raj.	Predominantly rural	3.129.379	135,71
Širvintų raj.	Predominantly urban	1.773.424	113,90
Švenčionių raj.	Predominantly rural	1.490.020	62,39
Tauragės raj.	Predominantly rural	862.788	22,17
Telšių raj.	Predominantly rural	2.762.259	67,90
Utenos raj.	Predominantly urban	185.359	4,89
Varėnos raj.	Predominantly rural	680.525	31,27
Vilkaviškio raj.	Predominantly rural	2.609.562	72,27
Vilniaus raj.	Predominantly urban	13.912.955	144,06
Kalvarijos sav.	Predominantly rural	2.077.699	192,81
Kazlų Rūdos sav.	Predominantly rural	2.138.952	181,82
Pagėgių sav.	Predominantly rural	1.322.609	169,72
Rietavo sav.	Predominantly rural	1.247.150	165,36

5. POLICY SCENARIO ANALYSIS

According to the public finance literature (see Blöchliger et al. 2007, Blöchliger and Charbit 2008) fiscal equalisation aims at reducing or eliminating differences in net fiscal benefit across jurisdictions, i.e. the difference between the benefit that households derive from the consumption of public services and the taxes they have to pay. Usually, standard expenditure needs provide a measure for the benefits; instead, fiscal capacity is the primary measure for the level of taxes. Therefore, the primary goal of intergovernmental equalisation grants is to offset the gap between fiscal capacity and standard expenditure needs.

Before entering into the details of the goals of the policy scenarios is important to clarify that in the analysis we are considering both revenue and cost equalisation, where the former consist into a transfer of fiscal resources to reduce differences in a jurisdiction's per capita revenue raising capacity, while the latter consists into a transfer of fiscal resources to reduce differences in a jurisdiction's per capita cost of providing a standard set of public services. Moreover, we are considering either the possibility of horizontal equalisation, i.e. the transfer of fiscal resources between units at the same level of government, or the possibility of vertical equalisation, namely the transfer of fiscal resources from the central government to sub-central governments.

The scope of the policy scenarios is to measure the equity power of the actual Lithuanian equalization system. The analysis, based on the computation of the fiscal gap, takes into account the actual level of grants and tax sharing received by each local authority according to the existing equalisation system. Each policy scenario shows the evolution of the current financial structure of Lithuanian municipalities under the formulation of different assumptions regarding the standard level of services and the standard level of own revenues that, in turn, are the main policy variables that policymakers can move.

Although equity can be seen as the primary objective of fiscal equalization, policy scenarios also focus on the two other goals of fiscal equalization:

- efficiency in the allocation of resources among local authorities to minimize the distortion that positive (negative) fiscal gap can generate in attracting (discouraging) the location decision of firms and workers;
- stability in ensuring municipalities against asymmetric shocks that might hit their fiscal capacity and expenditure needs.

Both additional goals can be achieved when the flow of intergovernmental grants is structured in such a way to minimize the existence of positive or negative fiscal gaps.

The simulations provide short-run policy scenarios focused on the computation of the fiscal gap for each municipality. The analysis aims at evaluating the level of the vertical, and the horizontal fiscal unbalances that should be equalised to provide a similar minimum standard level of services in all municipalities also considering the same level of fiscal effort exerted in all local authorities.

In conclusion, the policy scenarios analyse the current financial structure of each municipality and highlight the local underfinanced authorities. Final policy recommendations include general suggestions for the implementation of future reforms of the actual equalisation system to eliminate the distortions of the current redistribution of resources for the provision of local services.

As reported in details in ***Table 85***, policy scenarios have been developed following different combinations of the variables that operate as determinants of the standard expenditure and fiscal capacity evaluation. In particular, all simulations are conducted considering two main blocks of potential policy interventions: the first block regarding the scope and volume of services that influence the level of current expenditure in the

main municipal functions (Education, Social Services, Culture and Recreation, General Administration and Housing); the second block regarding the level of fiscal capacity (or standard fiscal effort) that each municipality can use as its current source of revenues (property tax, land tax and local fees).

Table 85 Components of policy scenarios

Components of policy scenarios		Structural variables	Policy variables and Fiscal effort
Scope (volume) of services, budget expenditure	**Education**	Pupils, Kindergarten staff, number of schools, Labour costs	Teaching hours per pupil, % of expenditure out of pupil basket, % of graduate students, % of attending students, school sq. meters per pupil
	Social service	Resident population and Unemployment rate	Composite indicator of social services and Composite indicator of social benefits
	Culture and Recreation	Resident population, Cultural centres, Branches and other cultural institutions, Museum buildings, Branches of public libraries, Stadiums, Swimming pools and Other sport infrastructure	Number of participants by cultural centre, Number of visits by museums, Number of visits by library and number of participants in sports competitions by sport facility
	General administration	Resident population, Labour costs	
	Housing	Resident population and Unemployment rate, Residential apartments average sale price	
Own fiscal effort	**Fees**	Resident population, Unemployment rate, Value-added of production, Individuals living at risk of poverty or social exclusion and Number of Tourists	Implicit tax rate
	Property tax	Real estate values	Legal tax rate
	Land tax	Land values	Legal tax rate

As also shown in ***Table 85***, for each block of intervention, the set of variables considered in the implementation of the policy scenarios can be divided in two groups.

- The first group includes the "**structural variables**", i.e. variables that cannot be influenced by the municipal decisions on services provision and own sources of revenues, at least in the short/medium run. The set of structural variables includes the determinants of standard expenditure and fiscal capacity related to the characteristics of the Lithuanian economy, the structure of the Lithuanian population and the cost of input. For example, among these variables, we can find the number of pupils, the school premises, the resident population, the unemployment rate, culture and recreations facilities (such as museums, stadiums, public libraries etc.), the share of individuals living at risk of poverty and the tax base of the property tax and land tax (see ***Table 85*** for more details), the cost of labour and the cost of capital measured through the residential apartments average sale price. These variables can usually change only in the long run and cannot be set as a municipal benchmark since out of the scope of local politician influence (at least in the short/medium run). Therefore, they are kept fixed at their latest historical value in all the policy simulations (usually 2018 values). The long-run policy evaluation is out of the scope of our simulation and, therefore, it is left to the future development of this model. These variables, in future simulations exercises, can be used to evaluate how the fiscal gap will evolve considering different states of the Lithuanian economy as well as

various scenarios for the future evolution of the resident population. All these simulations involve a set of macro assumptions that are out of the scope of the current model.

- The second group includes the "**policy variables**", i.e. variables that in the short-medium run can be influenced by the policy decisions adopted at the municipal level on service provision (that in turns affect the level of current expenditure) and fiscal revenues. These variables are the focus of our simulation exercises since we evaluate the evolution of the fiscal imbalances (vertical and horizontal) considering the combination of different target values (cluster and national average) for each of them. The status quo scenario assumes that all the policy variables are set equal to the latest historical value (usually 2018) for each municipality. Therefore, the policy implications of each scenario have been evaluated in terms of deviation from the status quo. The set of policy variables include, essentially, indicators regarding the level of services provided in the education, social security and culture & recreation functions.

5.1 STRUCTURE OF POLICY SCENARIOS

Table 86 summarises the structure and the sequence of the policy scenarios. In particular, we observe the combination of different targets values for the policy variables with different values for the fiscal capacity variables. This combination gives rise to a matrix structure that results in 12 different scenarios. As reported in ***Table 86***, the policy variables options are indicated in the column labels generating three modalities: a national uniform target, a target value differentiated by clusters and the default option corresponding to the 2018 historical value of each municipality. We follow the same logic for the target values of fiscal capacity variables related to the standard tax rates. In this case, we have four different target values, as indicated in the row labels: a national uniform and minimum target, a target value differentiated by clusters and the default option corresponding to the 2018 historical value of each municipality. All structural variables are set at their 2018 historical values and, therefore, are taken out of the simulations.

Table 86 Scenario matrix generated by the combinations of policy variables with fiscal effort variables

Fiscal effort target values \ Policy variables target values	*Historical*	*Cluster*	*National*
Historical	*1a (baseline)*	*2a*	*3a*
Cluster	*1b*	*2b*	*3b*
National	*1c*	*2c*	*3c*
Minimum	*1d*	*2d*	*3d*

Table 86 divides the policy scenarios into four groups, that also allows us to identify the policy goal of each scenario:

1. scenario 1a, where we set all policy and fiscal effort variables at the municipal historical value, this is our default scenario to which we compare the results of other simulations;
2. scenarios 2a and 3a, where we change the level of services while the level of fiscal effort is kept at the 2018 historical level for each municipality, the policy goal is to orientate fiscal equalization to achieve a certain level of minimum standard services (national or cluster) considering the existing historical level of own municipal fiscal revenues;

3. scenarios 1b, 1c, 1d, where the level of services is kept constant at the 2018 historical level for each municipality and fiscal effort is changed to a different target, common to all municipalities, the policy goal is to orientate fiscal equalization to achieve the existing level of services provided by each local authority keeping constant the municipal fiscal effort at cluster or national level (average and minimum);
4. in conclusion, scenarios 2b, 3b, 2c, 3c, 2d, 3d, where we consider target values for both the level of services and the level of fiscal effort, in this case the policy goal is to orientate fiscal equalization to achieve different combination of minimum standard level of services (national or cluster) keeping constant municipal fiscal effort at cluster or national level (average and minimum).

Therefore, according to the target assigned to the policy variables and the target fixed for the fiscal effort, we can identify two main policy goals in our scenarios.

1. The first policy goal simulates the production of a minimum level of services equal to the cluster average.
2. The second policy goal, instead, simulates the provision of a minimum level of services equal to the national average.

For each of the two policy goals, we can evaluate how many resources are necessary to achieve the target level of services considering three different assumptions on the level of fiscal effort exerted by each municipality:

1. the national average;
2. the national minimum;
3. the cluster average.

Finally, each policy goal has been complemented with a set of policy recommendations regarding the potential direction for future reform of the actual equalisation system.

In ***Table 87***, we report the main financial and structural indicators used to analyse the default scenario taken as the baseline for the entire policy scenario analysis. In the benchmark, all policy variables and fiscal effort variables reported in ***Table 85*** are set at the 2018 historical value of each municipality. As reported in ***Table 87***, for the total of Lithuanian municipalities and for each cluster group, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); fiscal gap (column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N). The same indicators are replicated for each scenario and compared to those of the baseline.

In particular, the most critical indicators are those regarding the level of deficit and the level of surplus. Deficit values (see column C and G) correspond to the resources necessary to finance the minimum level of services indicated by the policy scenario. Instead, surplus values (see column D in particular) can have a double interpretation: either sources of revenue to finance the deficit, assuming some sort of horizontal equalisation, or resources to finance the extra level of services above the target. In our analysis, we have propended for this second interpretation.

In the baseline scenario reported in ***Table 87***, we can observe that Lithuanian municipalities are characterised by a negative fiscal gap (-6,46%) since standard expenditure (2,5 billion euros) is below standard revenues (2,68 billion euros). The initial negative fiscal gap is due to some efficiency gains derived from the standardisation procedure.

Actual equalisation grants are reducing the fiscal imbalances bringing the initial deficit from 201 million euros to 22 million euros. However, the final deficit is mainly concentrated in *Predominantly rural* and *Predominantly urban* municipalities. Instead, *Big cities* and *Resorts* after receiving equalisation grants present a general surplus.

As a result, there is evidence of an unequal distribution of resources that requires a revision of the actual equalisation system, especially in favour of rural areas that appear the most penalised.

Big cities, thanks to the higher amount of resources, can produce more services than the national average showing an overall level of output equal to 8,67 and an overall performance indicator of 6,60. Instead, *Resorts* municipalities appear the least efficient in the use of the resources, showing a level of service of 5,75 slightly above the national average and the worst performance index of 4,15. *Predominantly rural* municipalities, in line with their resource deficit, produce the lowest level of service showing an output index of 4,97 far below the national average. However, in terms of performance, the rural area is in line with the national average.

Table 88, ***Table 89*** and ***Table 90*** report a broad picture of the results for each policy scenario summarising the main financial indicators: the deficit (***Table 88***), the surplus (***Table 89***) and the overall fiscal imbalance (***Table 90***). Each index is computed considering the actual equalisation grants received in 2018 by each local authority. ***Table 91***, ***Table 92*** and ***Table 93***, instead, report the same financial indicators in euros per capita.

In particular, ***Table 88*** and ***Table 91*** show that the level of deficit increases as we set a cluster or national minimum target for the level of service and, at the same time, as we change the level of the actual fiscal effort to cluster, national or minimum standard level.

In general, the deficit of resource appears more influenced by the policy goal on services rather than the policy goal of own fiscal effort, given the low level of revenue decentralisation of Lithuanian local governments.

We observe the highest deficit when we set a national standard for the level of services and a minimum standard level for the fiscal effort. In this case, more than 232 million euros (82 euros per capita) are necessary to allow all municipalities to provide the same minimum standard level of services.

The level of surplus reported in ***Table 89*** and ***Table 92***, as well as the final fiscal imbalance reported in ***Table 90*** and ***Table 93***, show a similar trend across different policy goals to the one concerning the deficit. In particular, it is important to highlight that the highest level of fiscal imbalance is generally observed in *Predominantly rural* municipalities.

As a result, although all municipalities improved their fiscal gap after equalization, the rural area of the country benefits less from the existing equalisation system, and future reform should reduce the deficit of resources registered in this part of the country to increase the level of services provided to citizens living in a rural area.

Moreover, it is also important to highlight that *Big cities* show a large deficit when we set national targets for the level of services. This last effect is due to the variable “sq meters per pupil” which is particularly low in the urban area and generates a considerable request of additional resources when fixed at the national average especially in the higher density metropolitan area.

The next section reports the policy goals, as well as all the details about the settings and the results of each policy scenarios. In conclusion, the analysis has led to a specific policy recommendation for each policy simulation.

Table 87 Baseline scenario indicators, services and fiscal effort are set equal to 2018 historical values of each municipality

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without the inclusion of actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index)	Overall level of output (1-10 index)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal imbalance (I = G+H)					
Big cities	1.186.467.869	1.053.462.553	0	133.005.316	133.005.316	-561.690	85.402.006	84.840.316	-11,21%	0,94	0,90	6,60	8,67
Predominantly urban	474.404.780	461.274.741	-7.903.578	21.033.617	13.130.039	-28.938.149	3.129.189	-25.808.961	-2,77%	1,09	0,99	5,90	5,83
Predominantly rural	962.745.912	943.479.145	-14.416.769	33.683.536	19.266.767	-168.155.301	2.150.068	-166.005.233	-2,00%	1,24	0,99	5,51	4,97
Resort	59.662.333	51.835.467	0	7.826.866	7.826.866	-3.369.537	2.943.403	-426.134	-13,12%	1,11	0,89	4,15	5,75
Lithuania	2.683.280.895	2.510.051.906	-22.320.347	195.549.336	173.228.989	-201.024.677	93.624.666	-107.400.011	-6,46%	1,17	0,97	5,61	5,57

Table 88 Deficit in euros, additional resources needed to achieve the level of services set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

		Policy goal for the minimum level of services provided in each municipality		
Target value for the fiscal effort		*Historical (all municipalities provide their 2018 historical level of services)*	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***-22.320.347***	***-39.953.948***	***-114.613.866***
	Big cities	*0*	*-14.964.652*	*-44.760.395*
	Predominantly Urban	*-7.903.578*	*-2.286.856*	*-30.047.789*
	Predominantly Rural	*-14.416.769*	*-21.931.307*	*-39.169.115*
	Resorts	*0*	*-771.133*	*-636.567*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***-23.036.973***	***-21.448.348***	***-89.999.710***
	Big cities	*0*	*-2.034.023*	*-32.661.605*
	Predominantly Urban	*-9.438.495*	*-2.024.210*	*-22.747.665*
	Predominantly Rural	*-13.598.478*	*-17.169.819*	*-34.504.710*
	Resorts	*0*	*-220.296*	*-85.730*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***-25.637.136***	***-24.190.824***	***-74.669.285***
	Big cities	*0*	*-487.093*	*-16.732.228*
	Predominantly Urban	*-8.243.469*	*-1.121.882*	*-14.480.694*
	Predominantly Rural	*-17.393.667*	*-22.264.187*	*-43.273.267*
	Resorts	*0*	*-317.662*	*-183.096*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***-71.608.589***	***-129.818.499***	***-232.724.725***
	Big cities	*-40.718*	*-51.237.664*	*-93.640.366*
	Predominantly Urban	*-20.011.827*	*-18.843.973*	*-50.493.802*
	Predominantly Rural	*-51.103.004*	*-57.693.476*	*-86.681.736*
	Resorts	*-453.039*	*-2.043.387*	*-1.908.821*

Table 89 Surplus in euros, resources allocated to the provision of services above the target set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

		Policy goal for the minimum level of services provided in each municipality		
Target value for the fiscal effort		*Historical (all municipalities provide their 2018 historical level of services)*	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***195.549.336***	***72.637.720***	***36.873.524***
	Big cities	*133.005.316*	*18.985.501*	*5.352.174*
	Predominantly Urban	*21.033.617*	*15.153.618*	*6.657.633*
	Predominantly Rural	*33.683.536*	*31.787.949*	*17.417.383*
	Resorts	*7.826.866*	*6.710.652*	*7.446.334*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***240.903.757***	***98.769.914***	***56.897.162***
	Big cities	*146.226.115*	*19.275.671*	*6.474.182*
	Predominantly Urban	*51.374.702*	*43.697.139*	*28.163.676*
	Predominantly Rural	*35.967.440*	*30.128.656*	*15.855.174*
	Resorts	*7.335.500*	*5.668.448*	*6.404.130*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***269.982.318***	***127.990.789***	***68.045.136***
	Big cities	*169.682.396*	*41.185.023*	*14.001.087*
	Predominantly Urban	*63.648.474*	*56.263.609*	*33.365.503*
	Predominantly Rural	*27.968.942*	*23.429.337*	*12.830.043*
	Resorts	*8.682.506*	*7.112.821*	*7.848.503*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***112.511.893***	***30.176.587***	***22.658.698***
	Big cities	*78.813.890*	*1.026.368*	*0*
	Predominantly Urban	*19.421.174*	*17.990.042*	*13.382.953*
	Predominantly Rural	*12.016.207*	*9.196.554*	*6.576.441*
	Resorts	*2.260.622*	*1.963.622*	*2.699.304*

Table 90 Fiscal imbalance (Deficit + surplus) in euros considering the provision of services in line with the target set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

Target value for the fiscal effort	Policy goal for the minimum level of services provided in each municipality			
		Historical (all municipalities provide their 2018 historical level of services)	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***173.228.989***	***32.683.772***	***-77.740.342***
	Big cities	*133.005.316*	*4.020.850*	*-39.408.221*
	Predominantly Urban	*13.130.039*	*12.866.762*	*-23.390.157*
	Predominantly Rural	*19.266.767*	*9.856.642*	*-21.751.731*
	Resorts	*7.826.866*	*5.939.518*	*6.809.767*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***217.866.783***	***77.321.566***	***-33.102.548***
	Big cities	*146.226.115*	*17.241.648*	*-26.187.423*
	Predominantly Urban	*41.936.207*	*41.672.929*	*5.416.011*
	Predominantly Rural	*22.368.962*	*12.958.837*	*-18.649.536*
	Resorts	*7.335.500*	*5.448.152*	*6.318.400*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***244.345.182***	***103.799.965***	***-6.624.149***
	Big cities	*169.682.396*	*40.697.930*	*-2.731.141*
	Predominantly Urban	*55.405.005*	*55.141.727*	*18.884.809*
	Predominantly Rural	*10.575.275*	*1.165.150*	*-30.443.224*
	Resorts	*8.682.506*	*6.795.159*	*7.665.407*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***40.903.305***	***-99.641.912***	***-210.066.026***
	Big cities	*78.773.172*	*-50.211.295*	*-93.640.366*
	Predominantly Urban	*-590.653*	*-853.931*	*-37.110.849*
	Predominantly Rural	*-39.086.797*	*-48.496.922*	*-80.105.295*
	Resorts	*1.807.583*	*-79.765*	*790.483*

Table 91 Deficit in euros per capita, additional resources needed to achieve the level of services set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

Target value for the fiscal effort	Policy goal for the minimum level of services provided in each municipality			
		Historical (all municipalities provide their 2018 historical level of services)	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***-7,95***	***-14,22***	***-40,80***
	Big cities	*0,00*	*-12,21*	*-36,52*
	Predominantly Urban	*-14,58*	*-4,22*	*-55,43*
	Predominantly Rural	*-14,43*	*-21,96*	*-39,21*
	Resorts	*0,00*	*-18,20*	*-15,02*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***-8,20***	***-7,64***	***-32,04***
	Big cities	*0,00*	*-1,66*	*-26,65*
	Predominantly Urban	*-17,41*	*-3,73*	*-41,96*
	Predominantly Rural	*-13,61*	*-17,19*	*-34,54*
	Resorts	*0,00*	*-5,20*	*-2,02*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***-9,13***	***-8,61***	***-26,58***
	Big cities	*0,00*	*-0,40*	*-13,65*
	Predominantly Urban	*-15,21*	*-2,07*	*-26,71*
	Predominantly Rural	*-17,41*	*-22,29*	*-43,32*
	Resorts	*0,00*	*-7,50*	*-4,32*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***-25,49***	***-46,22***	***-82,85***
	Big cities	*-0,03*	*-41,81*	*-76,41*
	Predominantly Urban	*-36,92*	*-34,76*	*-93,15*
	Predominantly Rural	*-51,16*	*-57,76*	*-86,78*
	Resorts	*-10,69*	*-48,22*	*-45,04*

Table 92 Surplus in euros per capita, resources allocated to the provision of services above the target set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

Target value for the fiscal effort		Policy goal for the minimum level of services provided in each municipality		
		Historical (all municipalities provide their 2018 historical level of services)	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***69,62***	***25,86***	***13,13***
	Big cities	*108,53*	*15,49*	*4,37*
	Predominantly Urban	*38,80*	*27,96*	*12,28*
	Predominantly Rural	*33,72*	*31,82*	*17,44*
	Resorts	*184,69*	*158,35*	*175,71*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***85,76***	***35,16***	***20,26***
	Big cities	*119,32*	*15,73*	*5,28*
	Predominantly Urban	*94,78*	*80,61*	*51,96*
	Predominantly Rural	*36,01*	*30,16*	*15,87*
	Resorts	*173,10*	*133,76*	*151,12*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***96,12***	***45,57***	***24,22***
	Big cities	*138,45*	*33,61*	*11,42*
	Predominantly Urban	*117,42*	*103,79*	*61,55*
	Predominantly Rural	*28,00*	*23,45*	*12,84*
	Resorts	*204,88*	*167,84*	*185,20*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***40,06***	***10,74***	***8,07***
	Big cities	*64,31*	*0,84*	*0,00*
	Predominantly Urban	*35,83*	*33,19*	*24,69*
	Predominantly Rural	*12,03*	*9,21*	*6,58*
	Resorts	*53,34*	*46,34*	*63,70*

Table 93 Fiscal imbalance (Defict + surplus) in euros per capita, considering the provision of services in line with the target set in the policy scenario considering the level of actual equalisation grants and different target values for the fiscal effort

Target value for the fiscal effort		Policy goal for the minimum level of services provided in each municipality		
		Historical (all municipalities provide their 2018 historical level of services)	*Cluster (all municipalities provide the 2018 cluster target level of services)*	*National (all municipalities provide the 2018 national target level of services)*
Historical (all municipalities exert a fiscal effort equal to their 2018 historical value)	***Lithuania***	***61,67***	***11,64***	***-27,68***
	Big cities	*108,53*	*3,28*	*-32,16*
	Predominantly Urban	*24,22*	*23,74*	*-43,15*
	Predominantly Rural	*19,29*	*9,87*	*-21,78*
	Resorts	*184,69*	*140,16*	*160,69*
Cluster (all municipalities exert a fiscal effort equal to the 2018 cluster average)	***Lithuania***	***77,56***	***27,53***	***-11,78***
	Big cities	*119,32*	*14,07*	*-21,37*
	Predominantly Urban	*77,36*	*76,88*	*9,99*
	Predominantly Rural	*22,39*	*12,97*	*-18,67*
	Resorts	*173,10*	*128,56*	*149,10*
National (all municipalities exert a fiscal effort equal to the 2018 national average)	***Lithuania***	***86,99***	***36,95***	***-2,36***
	Big cities	*138,45*	*33,21*	*-2,23*
	Predominantly Urban	*102,21*	*101,73*	*34,84*
	Predominantly Rural	*10,59*	*1,17*	*-30,48*
	Resorts	*204,88*	*160,35*	*180,88*
Minimum (all municipalities exert a fiscal effort equal to the minimum national level)	***Lithuania***	***14,56***	***-35,47***	***-74,79***
	Big cities	*64,28*	*-40,97*	*-76,41*
	Predominantly Urban	*-1,09*	*-1,58*	*-68,46*
	Predominantly Rural	*-39,13*	*-48,55*	*-80,19*
	Resorts	*42,65*	*-1,88*	*18,65*

5.2 SCENARIO 2A Minimum standard services by cluster and Historical fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the cluster target for each municipality considering the actual equalisation grants and the municipal fiscal effort equal to the 2018 historical level.

Table 94 reports the component of the policy scenario 2A (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at a cluster target, and fiscal effort at the historical level setting, in the fiscal capacity models, the tax rates at the 2018 historical level of each municipality.

Table 95 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 94***, and shown by the results displayed in ***Table 95***, the main policy recommendation is reforming the equalisation system to redistribute more resources towards *Predominantly rural* municipalities and *Big cities*. The reform is necessary to compensate a deficit of 40 million euros, allowing most of the big cities and the municipalities in the rural areas to provide services in line with their cluster standard.

Table 94 POLICY SCENARIO 2A minimum standard services by cluster and historical fiscal effort

Policy actions and outcomes		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 cluster average (BC = 6,81, PU = 8,00, PR = 10,00, R = 8,33), % of expenditure out of pupil basket is set at the 2018 cluster average (BC = 52%, PU = 49%, PR = 48%, R = 57%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%[28].
	Social service	The composite indicator of social services and Composite indicator of social benefits are set equal to the 2018 standard number of users that takes into account the median value by cluster of the users per target population[29].
	Culture and Recreation	Number of participants by cultural centre (BC = 345, PU =61, PR =61, R =89), Number of visits by museums (BC =4522, PU =1390, PR =2103, R =9136), Number of visits by library (BC =32286, PU =8856, PR =5369, R =18745) and Number of participants in sports competitions by sport facility (BC =321, PU =108, PR =106, R =195), are set equal to the 2018 cluster median[30].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set at the 2018 actual value of each municipality
	Property tax	Legal tax rate is set at the 2018 actual value of each municipality
	Land tax	Legal tax rates are set at the 2018 actual value of each municipality
Policy goal	Ensure a minimum level of services equal to the cluster average.	
Policy recommendation	Revise the equalisation system to redistribute more resources towards most of the *Predominantly rural* municipalities and the *Big cities* to compensate for a resource deficit of 40 million euros.	

[28] Teaching hours, % of graduate students and % of attending students have not been set by cluster since Education attainment cannot be differentiated over the territory.

[29] Median values have been selected in accordance with the standard level of outputs (**3.1.2 Social security**).

[30] Median values have been selected in accordance with the standard level of outputs (**3.1.3 Recreation, culture and religion**).

Table 95 POLICY SCENARIO 2A minimum standard service by cluster and historical fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.186.467.869	1.182.447.020	-14.964.652	18.985.501	4.020.850	-45.081.583	937.432	-44.144.150	-0,34%	1,03	0,99	7,67	8,67
Predominantly urban	474.404.780	461.538.018	-2.286.856	15.153.618	12.866.762	-31.356.116	5.283.878	-26.072.238	-2,71%	1,06	0,96	5,97	6,33
Predominantly rural	962.745.912	952.889.270	-21.931.307	31.787.949	9.856.642	-176.576.194	1.160.836	-175.415.358	-1,02%	1,25	0,99	5,60	5,68
Resort	59.662.333	53.722.815	-771.133	6.710.652	5.939.518	-4.638.572	2.325.091	-2.313.482	-9,96%	1,12	0,90	4,90	6,50
Lithuania	2.683.280.895	2.650.597.123	-39.953.948	72.637.720	32.683.772	-257.652.465	9.707.237	-247.945.228	-1,22%	1,18	0,98	5,83	6,17
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	0,00% 0	5,60% 140.545.217	79,00% -17.633.601	-62,85% -122.911.616	-81,13% -140.545.217	28,17% -56.627.788	-89,63% -83.917.429	-130,86% -140.545.217	5,24%	0,45%	0,65%	4,04%	10,78%
Big cities	0,00% 0	12,24% 128.984.467	nc -14.964.652	-85,73% -114.019.815	-96,98% -128.984.467	7926,07% -44.519.893	-98,90% -84.464.574	-152,03% -128.984.467	10,87%	9,54%	9,54%	16,16%	0,00%
Predominantly urban	0,00% 0	0,06% 263.278	-71,07% 5.616.722	-27,96% -5.879.999	-2,01% -263.278	8,36% -2.417.967	68,86% 2.154.689	-1,02% -263.278	0,06%	-2,70%	-2,74%	1,13%	8,57%
Predominantly rural	0,00% 0	1,00% 9.410.125	52,12% -7.514.538	-5,63% -1.895.587	-48,84% -9.410.125	5,01% -8.420.893	-46,01% -989.232	-5,67% -9.410.125	0,98%	0,25%	0,36%	1,62%	14,29%
Resort	0,00% 0	3,64% 1.887.348	nc -771.133	-14,26% -1.116.214	-24,11% -1.887.348	37,66% -1.269.035	-21,01% -618.313	-442,90% -1.887.348	3,16%	0,25%	1,60%	18,07%	13,04%

5.3 SCENARIOS 3A National minimum standard service and Historical fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the national target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the 2018 historical level.

Table 96 reports the component of the policy scenario 3A (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at a national target, and fiscal effort at the historical level setting, in the fiscal capacity models, the tax rates at the 2018 historical level of each municipality.

Table 97 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 96***, and shown by the results displayed in ***Table 97***, the main policy recommendation is to reform the equalisation system redistributing more resources towards *Predominantly rural* municipalities, *Big cities* and *Predominantly urban* municipalities. The reform is necessary to compensate a deficit of 115 million euros, allowing most of the Lithuanian municipalities, except *Resorts* that already receive enough resources, to provide services at least in line with the national target.

Table 96 POLICY SCENARIO 3A national minimum standard service and historical fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 national average (8,17 sq m.), % of expenditure out of pupil basket is set at the 2018 national average (50%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%.
	Social service	The composite indicator of social services per 1000 inhabitants (1,27) and Composite indicator of social benefits per 1000 inhabitants (32,05) are set equal to the 2018 national target corresponding to the maximum standard value[31].
	Culture and Recreation	Number of participants by cultural centre (345), Number of visits by museums (9136), Number of visits by library (32286) and Number of participants in sports competitions by sport facility (321), are set equal to the 2018 national target corresponding to the maximum standard value [32].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set at the 2018 actual value of each municipality
	Property tax	Legal tax rate is set at the 2018 actual value of each municipality
	Land tax	Legal tax rates are set at the 2018 actual value of each municipality
Policy goal	Ensure a minimum level of services equal to the national average.	
Policy recommendation	Revise the equalisation system to redistribute more resources mainly towards *Predominantly rural* municipalities, *Big cities* and *Predominantly urban* municipalities to compensate for a resource deficit of 115 million euros.	

[31] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

[32] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

Table 97 POLICY SCENARIO 3A national minimum standard service and historical fiscal effort, general results and comparison with the baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.186.467.869	1.225.876.090	-44.760.395	5.352.174	-39.408.221	-87.573.221	0	-87.573.221	3,32%	1,06	1,02	8,33	8,67
Predominantly urban	474.404.780	497.794.937	-30.047.789	6.657.633	-23.390.157	-66.462.357	4.133.201	-62.329.157	4,93%	1,14	1,03	6,47	6,00
Predominantly rural	962.745.912	984.497.644	-39.169.115	17.417.383	-21.751.731	-207.810.994	787.263	-207.023.731	2,26%	1,29	1,02	5,95	5,37
Resort	59.662.333	52.852.567	-636.567	7.446.334	6.809.767	-4.390.301	2.947.067	-1.443.233	-11,41%	1,10	0,89	5,30	6,50
Lithuania	2.683.280.895	2.761.021.238	-114.613.866	36.873.524	-77.740.342	-366.236.873	7.867.531	-358.369.342	2,90%	1,22	1,01	6,25	5,90
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	0,00% 0	10,00% 250.969.331	413,50% -92.293.519	-81,14% -158.675.812	-144,88% -250.969.331	82,19% -165.212.196	-91,60% -85.757.135	-233,68% -250.969.331	9,35%	4,13%	4,37%	11,41%	5,99%
Big cities	0,00% 0	16,37% 172.413.537	nc -44.760.395	-95,98% -127.653.143	-129,63% -172.413.537	15491,03% -87.011.531	-100,00% -85.402.006	-203,22% -172.413.537	14,53%	12,56%	12,57%	26,26%	0,00%
Predominantly urban	0,00% 0	7,92% 36.520.196	280,18% -22.144.212	-68,35% -14.375.984	-278,14% -36.520.196	129,67% -37.524.208	32,09% 1.004.012	-141,50% -36.520.196	7,70%	4,13%	4,11%	9,60%	2,86%
Predominantly rural	0,00% 0	4,35% 41.018.499	171,69% -24.752.346	-48,29% -16.266.153	-212,90% -41.018.499	23,58% -39.655.694	-63,38% -1.362.805	-24,71% -41.018.499	4,26%	3,58%	3,67%	7,93%	7,94%
Resort	0,00% 0	1,96% 1.017.100	nc -636.567	-4,86% -380.532	-12,99% -1.017.100	30,29% -1.020.764	0,12% 3.664	-238,68% -1.017.100	1,70%	-0,81%	0,20%	27,71%	13,04%

5.4 SCENARIOS 1B Historical level of services and Cluster fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance services equal to the 2018 historical level of each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the cluster average.

Table 98 reports the component of the policy scenario 1B (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the 2018 historical level of each municipality, and fiscal effort at a cluster target considering, in the fiscal capacity models, the tax rates at the cluster average.

Table 99 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 98***, and shown by the results displayed in ***Table 99***, the main policy recommendation is to consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. In particular, most of the *Resort* municipalities exert a fiscal effort above the cluster average; instead, other municipalities, and in particular those in the *Predominantly urban* cluster exert a fiscal effort below the average of their cluster; therefore by aligning the fiscal effort at least at the cluster average will provide more own resources reducing the necessity of equalization grants with the exception of *Resorts* that, instead, would need more intergovernmental grants.

Table 98 POLICY SCENARIO 1B historical level of services and cluster fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil, sq meter per pupil, % of expenditure out of pupil basket, % of graduate students and % of attending students are set equal to the 2018 historical value of each municipality.
	Social service	The composite indicator of social services per 1000 inhabitants and Composite indicator of social benefits per 1000 inhabitants are set equal to the 2018 historical value of each municipality.
	Culture and Recreation	Number of participants by cultural centre, Number of visits by museums, Number of visits by library and Number of participants in sports competitions by sport facility are set equal to the 2018 historical value of each municipality.
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 cluster average (BC = 0,77%, PU = 0,99%, PR = 1,78%, R = 4,14%).
	Property tax	Legal tax rate is set equal to the 2018 cluster average (BC = 0,78%, PU = 0,63%, PR = 0,70%, R = 0,64%).
	Land tax	Legal tax rate is set equal to the 2018 cluster average, Agricultural/Pond/Gardens (BC = 0,28%, PU = 0,70%, PR = 1,15%, R = 0,31%), Residential/Industrial/Commercial (BC = 0,41%, PU = 0,65%, PR = 1,05%, R = 0,34%).
Policy goal	Ensure the historical level of services in each municipality with a uniform fiscal effort equal to the average cluster level.	
Policy recommendation	Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. With the exception of resorts, where most of the local authorities already exert an intense fiscal effort, by levelling fiscal capacity at the cluster average the availability of own resources will be higher and more equally redistributed, especially in the cluster of predominantly urban municipalities where most of the local authorities exhibit a very low fiscal effort. In particular, the fiscal effort can be increased in the category of land tax.	

Table 99 POLICY SCENARIO 1B historical level of services and cluster fiscal effort, general results and comparison with the baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance corrected by actual equalisation grants (K)	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.199.688.668	1.053.462.553	0	146.226.115	146.226.115	-1.174.629	99.235.744	98.061.115	-12,19%	0,94	0,90	6,60	8,67
Predominantly urban	503.210.947	461.274.741	-9.438.495	51.374.702	41.936.207	-25.726.640	28.723.846	2.997.207	-8,33%	1,05	0,95	5,90	5,83
Predominantly rural	965.848.108	943.479.145	-13.598.478	35.967.440	22.368.962	-165.716.028	2.812.990	-162.903.038	-2,32%	1,24	0,98	5,51	4,97
Resort	59.170.967	51.835.467	0	7.335.500	7.335.500	-2.921.721	2.004.221	-917.500	-12,40%	1,12	0,89	4,15	5,75
Lithuania	2.727.918.690	2.510.051.906	-23.036.973	240.903.757	217.866.783	-195.539.018	132.776.801	-62.762.217	-7,99%	1,17	0,96	5,61	5,57
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	1,66% 44.637.794	0,00% 0	3,21% -716.626	23,19% 45.354.421	25,77% 44.637.794	-2,73% 5.485.659	41,82% 39.152.135	41,56% 44.637.794	-1,53%	-0,68%	-0,82%	0,00%	0,00%
Big cities	1,11% 13.220.798	0,00% 0	nc 0	9,94% 13.220.798	9,94% 13.220.798	109,12% -612.940	16,20% 13.833.738	15,58% 13.220.798	-0,98%	-0,24%	-0,23%	0,00%	0,00%
Predominantly urban	6,07% 28.806.167	0,00% 0	19,42% -1.534.917	144,25% 30.341.085	219,39% 28.806.167	-11,10% 3.211.510	817,93% 25.594.657	111,61% 28.806.167	-5,57%	-3,59%	-3,64%	0,00%	0,00%
Predominantly rural	0,32% 3.102.195	0,00% 0	-5,68% 818.291	6,78% 2.283.904	16,10% 3.102.195	-1,45% 2.439.273	30,83% 662.922	1,87% 3.102.195	-0,31%	-0,09%	-0,15%	0,00%	0,00%
Resort	-0,82% -491.367	0,00% 0	nc 0	-6,28% -491.367	-6,28% -491.367	-13,29% 447.816	-31,91% -939.182	-115,31% -491.367	0,72%	1,07%	0,59%	0,00%	0,00%

5.5 SCENARIOS 1C Historical level of services and National fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance services equal to the 2018 historical level of each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the national average.

Table 100 reports the component of the policy scenario 1C (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the 2018 historical level of each municipality, and fiscal effort at the national target considering, in the fiscal capacity models, the tax rates at the national average.

Table 101 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 100***, and shown by the results displayed in ***Table 101***, the main policy recommendation is to consider the fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. As evidence of inequality in the actual system, only municipalities in the *Predominantly rural* cluster exert a fiscal effort above the national average and are therefore penalized by the actual equalization system, being unable to provide services in line with the national average; instead, other local authorities (and in particular *Predominantly urban* municipalities) display a fiscal effort below the national average being, therefore, favoured by the actual equalization system.

Table 100 POLICY SCENARIO 1C historical level of services and national fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil, sq meter per pupil, % of expenditure out of pupil basket, % of graduate students and % of attending students are set equal to the 2018 historical value of each municipality.
	Social service	The composite indicator of social services per 1000 inhabitants and Composite indicator of social benefits per 1000 inhabitants are set equal to the 2018 historical value of each municipality.
	Culture and Recreation	Number of participants by cultural centre, Number of visits by museums, Number of visits by library and Number of participants in sports competitions by sport facility are set equal to the 2018 historical value of each municipality.
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 national average (1,42%)[33].
	Property tax	Legal tax rate is set equal to the 2018 national average (0,69%).
	Land tax	Legal tax rate is set equal to the 2018 national average, Agricultural/Pond/Gardens (0,92%), Residential/Industrial/Commercial (0,86%).
Policy goal	Ensure the historical level of services in each municipality with a uniform fiscal effort equal to the average national level.	
Policy recommendation	Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. With the exception of Predominantly rural municipalities, most of the local authorities (and especially those in the predominantly urban cluster) exert fiscal effort below the national average. By levelling fiscal capacity at the national average, the availability of own resources will be higher and equalization grants can be distributed more equally. In particular, the fiscal effort can be increased in the category of land tax.	

[33] This value corresponds to the 41° percentile of the implicit tax rate distribution that provides standard revenues close to the historical values for all municipalities.

Table 101 POLICY SCENARIO 1C historical level of services and national fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.223.144.949	1.053.462.553	0	169.682.396	169.682.396	0	121.517.396	121.517.396	-13,87%	0,92	0,89	6,60	8,67
Predominantly urban	516.679.746	461.274.741	-8.243.469	63.648.474	55.405.005	-21.779.558	38.245.563	16.466.005	-10,72%	1,03	0,93	5,90	5,83
Predominantly rural	954.054.420	943.479.145	-17.393.667	27.968.942	10.575.275	-176.928.852	2.232.127	-174.696.725	-1,11%	1,26	1,00	5,51	4,97
Resort	60.517.973	51.835.467	0	8.682.506	8.682.506	-3.109.592	3.539.099	429.506	-14,35%	1,11	0,88	4,15	5,75
Lithuania	2.754.397.089	2.510.051.906	-25.637.136	269.982.318	244.345.182	-201.818.003	165.534.185	-36.283.818	-8,87%	1,17	0,96	5,61	5,57
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	2,65% 71.116.193	0,00% 0	14,86% -3.316.789	38,06% 74.432.982	41,05% 71.116.193	0,39% -793.326	76,81% 71.909.519	66,22% 71.116.193	-2,42%	-0,23%	-0,66%	0,00%	0,00%
Big cities	3,09% 36.677.080	0,00% 0	nc 0	27,58% 36.677.080	27,58% 36.677.080	-100,00% 561.690	42,29% 36.115.390	43,23% 36.677.080	-2,66%	-1,92%	-1,85%	0,00%	0,00%
Predominantly urban	8,91% 42.274.966	0,00% 0	4,30% -339.891	202,60% 42.614.857	321,97% 42.274.966	-24,74% 7.158.591	1122,22% 35.116.375	163,80% 42.274.966	-7,96%	-5,71%	-5,61%	0,00%	0,00%
Predominantly rural	-0,90% -8.691.492	0,00% 0	20,65% -2.976.898	-16,97% -5.714.595	-45,11% -8.691.492	5,22% -8.773.551	3,82% 82.059	-5,24% -8.691.492	0,89%	1,45%	1,07%	0,00%	0,00%
Resort	1,43% 855.640	0,00% 0	nc 0	10,93% 855.640	10,93% 855.640	-7,71% 259.945	20,24% 595.695	200,79% 855.640	-1,23%	0,21%	-0,42%	0,00%	0,00%

5.6 SCENARIOS 1D Historical level of services and Minimum fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance services equal to the 2018 historical level of each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the minimum national level.

Table 102 reports the component of the policy scenario 1D (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the 2018 historical level of each municipality, and fiscal effort at the minimum target considering, in the fiscal capacity models, the minimum tax rates.

Table 103 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 102***, and shown by the results displayed in ***Table 103***, the main policy recommendation is to consider the fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. As evidence of inequality, by setting standard tax rates at the minimum uniform level, we have registered a total fiscal effort of 132 million euros unevenly distributed across municipalities. In particular, *Predominantly rural* municipalities exert the largest fiscal effort, and will benefit the most from the increase of equalization grants. In this context, there is evidence that the absence of fiscal capacity equalisation is penalizing especially rural areas. The total fiscal effort should be compensated by equalization grants and, eventually, used by each municipality exclusively to finance services above standard.

Table 102 POLICY SCENARIO 1D historical level of services and minimum fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil, sq meter per pupil, % of expenditure out of pupil basket, % of graduate students and % of attending students are set equal to the 2018 historical value of each municipality.
	Social service	The composite indicator of social services per 1000 inhabitants and Composite indicator of social benefits per 1000 inhabitants are set equal to the 2018 historical value of each municipality.
	Culture and Recreation	Number of participants by cultural centre, Number of visits by museums, Number of visits by library and Number of participants in sports competitions by sport facility are set equal to the 2018 historical value of each municipality.
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 1st percentile of the distribution (0,43%).
	Property tax	Legal tax rate is set equal to the minimum value (0,3%).
	Land tax	Legal tax rates are set equal to the minimum value, Agricultural/Pond/Gardens (0,01%), Residential/Industrial/Commercial (0,01%).
Policy goal	Ensure the historical level of services in each municipality with a uniform fiscal effort equal to the minimum national level.	
Policy recommendation	Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. The total fiscal effort, evaluated in 132 million (produced mainly by the property tax), can be compensated by more equalization grants to ensure equality among municipalities especially in favour of rural municipalities.	

Table 103 POLICY SCENARIO 1D historical level of services and minimum fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators without actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.132.235.725	1.053.462.553	-40.718	78.813.890	78.773.172	-4.424.112	35.032.284	30.608.172	-6,96%	0,98	0,94	6,60	8,67
Predominantly urban	460.684.088	461.274.741	-20.011.827	19.421.174	-590.653	-48.353.537	8.823.884	-39.529.653	0,13%	1,13	1,02	5,90	5,83
Predominantly rural	904.392.349	943.479.145	-51.103.004	12.016.207	-39.086.797	-224.672.184	313.388	-224.358.797	4,32%	1,35	1,05	5,51	4,97
Resort	53.643.050	51.835.467	-453.039	2.260.622	1.807.583	-6.445.417	0	-6.445.417	-3,37%	1,27	0,97	4,15	5,75
Lithuania	2.550.955.211	2.510.051.906	-71.608.589	112.511.893	40.903.305	-283.895.251	44.169.556	-239.725.695	-1,60%	1,26	1,03	5,61	5,57
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	-4,93% -132.325.684	0,00% 0	220,82% -49.288.242	-42,46% -83.037.443	-76,39% -132.325.684	41,22% -82.870.574	-52,82% -49.455.110	-123,21% -132.325.684	4,85%	7,65%	5,85%	0,00%	0,00%
Big cities	-4,57% -54.232.145	0,00% 0	nc -40.718	-40,74% -54.191.426	-40,77% -54.232.145	687,64% -3.862.423	-58,98% -50.369.722	-63,92% -54.232.145	4,25%	4,50%	4,31%	0,00%	0,00%
Predominantly urban	-2,89% -13.720.692	0,00% 0	153,20% -12.108.249	-7,67% -1.612.443	-104,50% -13.720.692	67,09% -19.415.388	181,99% 5.694.696	-53,16% -13.720.692	2,90%	3,62%	3,07%	0,00%	0,00%
Predominantly rural	-6,06% -58.353.564	0,00% 0	254,47% -36.686.235	-64,33% -21.667.329	-302,87% -58.353.564	33,61% -56.516.884	-85,42% -1.836.680	-35,15% -58.353.564	6,32%	8,56%	6,58%	0,00%	0,00%
Resort	-10,09% -6.019.283	0,00% 0	nc -453.039	-71,12% -5.566.244	-76,91% -6.019.283	91,28% -3.075.880	-100,00% -2.943.403	-1412,53% -6.019.283	9,75%	13,86%	9,81%	0,00%	0,00%

5.7 SCENARIOS 2B Minimum standard services by cluster and Cluster fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the cluster target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the 2018 cluster level.

Table 104 reports the component of the policy scenario 2B (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the cluster target, and fiscal effort at the cluster level setting, in the fiscal capacity models, the tax rates at the 2018 cluster average for each municipality.

Table 105 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 104***, and shown by the results displayed in ***Table 105***, to ensure a minimum level of services equal to the cluster average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a resource deficit of 40 million euros, initially quantified considering the historical fiscal effort (see ***Table 95***). More grants should be redistributed in favour of *Predominantly rural* municipalities and *Big cities*. Moreover, to ensure a fairer redistribution of resources, fiscal capacity should be also considered in the equalisation system. In particular, by setting the standard fiscal effort at the cluster average, half of the deficit can be financed by municipal funds. Mainly *Predominately urban* municipalities can finance the extra resources needed to increase the level of services using their own fiscal revenues.

Table 104 POLICY SCENARIO 2B minimum standard services by cluster and cluster fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 cluster average (BC = 6,81, PU = 8,00, PR = 10,00, R = 8,33), % of expenditure out of pupil basket is set at the 2018 cluster average (BC = 52%, PU = 49%, PR = 48%, R = 57%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%[34].
	Social service	The composite indicator of social services and Composite indicator of social benefits are set equal to the 2018 standard number of users that takes into account the median value by cluster of the users per target population[35].
	Culture and Recreation	Number of participants by cultural centre (BC = 345, PU =61, PR =61, R =89), Number of visits by museums (BC =4522, PU =1390, PR =2103, R =9136), Number of visits by library (BC =32286, PU =8856, PR =5369, R =18745) and Number of participants in sports competitions by sport facility (BC =321, PU =108, PR =106, R =195), are set equal to the 2018 cluster median[36].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 cluster average (BC = 0,77%, PU = 0,99%, PR = 1,78%, R = 4,14%).
	Property tax	Legal tax rate is set equal to the 2018 cluster average (BC = 0,78%, PU = 0,63%, PR = 0,70%, R = 0,64%).
	Land tax	Legal tax rate is set equal to the 2018 cluster average, Agricultural/Pond/Gardens (BC = 0,28%, PU = 0,70%, PR = 1,15%, R = 0,31%), Residential/Industrial/Commercial (BC = 0,41%, PU = 0,65%, PR = 1,05%, R = 0,34%).
Policy goal	Ensure a minimum level of services equal to the cluster average with a uniform fiscal effort equal to the average cluster level.	
Policy recommendation	Reform the equalisation system to redistribute more resources mainly towards the *Predominantly rural* municipalities and the *Big cities* to compensate for a resource deficit of 40 million euros, initially quantified considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the cluster average, half of the deficit can be financed by municipal funds. Mainly *Predominately urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues.	

[34] Teaching hours, % of graduate students and % of attending students have not been set by cluster since Education attainment cannot be differentiated over the territory.

[35] Median values have been selected in accordance with the standard level of outputs (**3.1.2 Social security**).

[36] Median values have been selected in accordance with the standard level of outputs (**3.1.3 Recreation, culture and religion**).

Table 105 POLICY SCENARIO 2B minimum standard services by cluster and cluster fiscal effort, general results and comparison with the baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.199.688.668	1.182.447.020	-2.034.023	19.275.671	17.241.648	-34.002.125	3.078.773	-30.923.352	-1,44%	1,03	0,99	7,67	8,67
Predominantly urban	503.210.947	461.538.018	-2.024.210	43.697.139	41.672.929	-25.107.935	27.841.864	2.733.929	-8,28%	1,02	0,92	5,97	6,33
Predominantly rural	965.848.108	952.889.270	-17.169.819	30.128.656	12.958.837	-173.383.256	1.070.093	-172.313.163	-1,34%	1,25	0,99	5,60	5,68
Resort	59.170.967	53.722.815	-220.296	5.668.448	5.448.152	-4.212.354	1.407.506	-2.804.848	-9,21%	1,13	0,90	4,90	6,50
Lithuania	2.727.918.690	2.650.597.123	-21.448.348	98.769.914	77.321.566	-236.705.670	33.398.236	-203.307.434	-2,83%	1,17	0,97	5,83	6,17
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	1,66% 44.637.794	5,60% 140.545.217	-3,91% 871.999	-49,49% -96.779.422	-55,36% -95.907.423	17,75% -35.680.993	-64,33% -60.226.430	-89,30% -95.907.423	3,62%	-0,31%	-0,24%	4,04%	10,78%
Big cities	1,11% 13.220.798	12,24% 128.984.467	nc -2.034.023	-85,51% -113.729.645	-87,04% -115.763.668	5953,54% -33.440.436	-96,39% -82.323.233	-136,45% -115.763.668	9,77%	9,23%	9,24%	16,16%	0,00%
Predominantly urban	6,07% 28.806.167	0,06% 263.278	-74,39% 5.879.368	107,75% 22.663.522	217,39% 28.542.890	-13,24% 3.830.215	789,75% 24.712.675	110,59% 28.542.890	-5,51%	-6,47%	-6,55%	1,13%	8,57%
Predominantly rural	0,32% 3.102.195	1,00% 9.410.125	19,10% -2.753.050	-10,55% -3.554.880	-32,74% -6.307.930	3,11% -5.227.955	-4,22% -1.079.975	-3,80% -6.307.930	0,66%	0,11%	0,17%	1,62%	14,29%
Resort	-0,82% -491.367	3,64% 1.887.348	nc -220.296	-27,58% -2.158.418	-6,28% -2.378.714	25,01% -842.817	-52,18% -1.535.897	-558,21% -2.378.714	3,91%	1,22%	2,12%	18,07%	13,04%

5.8 SCENARIOS 2C Minimum standard services by cluster and National fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the cluster target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the 2018 national level.

Table 106 reports the component of the policy scenario 2C (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the cluster target, and fiscal effort at the national level setting, in the fiscal capacity models, the tax rates at the 2018 national average for each municipality.

Table 107 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 106***, and shown by the results displayed in ***Table 107***, to ensure a minimum level of services equal to the cluster average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a resource deficit of 40 million euros, initially quantified considering the historical fiscal effort (see ***Table 95***). More grants should be redistributed in favour of *Predominantly rural* municipalities and *Big cities*. At the same time fiscal capacity should also be introduced in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, almost half of the deficit can be financed by municipal funds shrinking the deficit to 24 million euros as reported in ***Table 107***. Mainly *Predominately urban* municipalities can finance the extra resources needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate resource to provide more services above the cluster average.

Table 106 POLICY SCENARIO 2C minimum standard services by cluster and national fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 cluster average (BC = 6,81, PU = 8,00, PR = 10,00, R = 8,33), % of expenditure out of pupil basket is set at the 2018 cluster average (BC = 52%, PU = 49%, PR = 48%, R = 57%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%[37].
	Social service	The composite indicator of social services and Composite indicator of social benefits are set equal to the 2018 standard number of users that takes into account the median value by cluster of the users per target population[38].
	Culture and Recreation	Number of participants by cultural centre (BC = 345, PU =61, PR =61, R =89), Number of visits by museums (BC =4522, PU =1390, PR =2103, R =9136), Number of visits by library (BC =32286, PU =8856, PR =5369, R =18745) and Number of participants in sports competitions by sport facility (BC =321, PU =108, PR =106, R =195), are set equal to the 2018 cluster median[39].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 national average (1,42%)[40].
	Property tax	Legal tax rate is set equal to the 2018 national average (0,69%).
	Land tax	Legal tax rate is set equal to the 2018 national average, Agricultural/Pond/Gardens (0,92%), Residential/Industrial/Commercial (0,86%).
Policy goal	Ensure a minimum level of services equal to the cluster average with a uniform fiscal effort equal to the average national level.	
Policy recommendation	Reform the equalisation system to redistribute more resources mainly towards the *Predominantly rural* municipalities and the *Big cities* to compensate for a resource deficit of 40 million euros evaluated considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, the deficit can be reduced to 24 million euros using municipal funds. Mainly *Predominately urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate financial resource to provide more services above the cluster average.	

[37] Teaching hours, % of graduate students and % of attending students have not been set by cluster since Education attainment cannot be differentiated over the territory.

[38] Median values have been selected in accordance with the standard level of outputs (**3.1.2 Social security**).

[39] Median values have been selected in accordance with the standard level of outputs (**3.1.3 Recreation, culture and religion**).

[40] This value corresponds to the 41° percentile of the implicit tax rate distribution that provides standard revenues close to the historical values for all municipalities.

Table 107 POLICY SCENARIO 2C minimum standard services by cluster and national fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.223.144.949	1.182.447.020	-487.093	41.185.023	40.697.930	-13.967.485	6.500.415	-7.467.070	-3,33%	1,01	0,97	7,67	8,67
Predominantly urban	516.679.746	461.538.018	-1.121.882	56.263.609	55.141.727	-18.310.851	34.513.579	16.202.727	-10,67%	1,00	0,91	5,97	6,33
Predominantly rural	954.054.420	952.889.270	-22.264.187	23.429.337	1.165.150	-185.002.012	895.162	-184.106.850	-0,12%	1,26	1,00	5,60	5,68
Resort	60.517.973	53.722.815	-317.662	7.112.821	6.795.159	-4.408.208	2.950.367	-1.457.841	-11,23%	1,12	0,90	4,90	6,50
Lithuania	2.754.397.089	2.650.597.123	-24.190.824	127.990.789	103.799.965	-221.688.556	44.859.522	-176.829.035	-3,77%	1,18	0,97	5,83	6,17
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	2,65% 71.116.193	5,60% 140.545.217	8,38% -1.870.477	-34,55% -67.558.547	-40,08% -69.429.024	10,28% -20.663.879	-52,09% -48.765.144	-64,65% -69.429.024	2,69%	0,12%	-0,09%	4,04%	10,78%
Big cities	3,09% 36.677.080	12,24% 128.984.467	nc -487.093	-69,04% -91.820.294	-69,40% -92.307.387	2386,69% -13.405.795	-92,39% -78.901.591	-108,80% -92.307.387	7,88%	7,38%	7,46%	16,16%	0,00%
Predominantly urban	8,91% 42.274.966	0,06% 263.278	-85,81% 6.781.696	167,49% 35.229.992	319,97% 42.011.688	-36,72% 10.627.298	1002,96% 31.384.390	162,78% 42.011.688	-7,90%	-8,59%	-8,52%	1,13%	8,57%
Predominantly rural	-0,90% -8.691.492	1,00% 9.410.125	54,43% -7.847.418	-30,44% -10.254.200	-93,95% -18.101.617	10,02% -16.846.711	-12,36% -1.254.907	-10,90% -18.101.617	1,88%	1,64%	1,38%	1,62%	14,29%
Resort	1,43% 855.640	3,64% 1.887.348	nc -317.662	-9,12% -714.045	10,93% -1.031.708	30,83% -1.038.671	0,24% 6.963	-242,11% -1.031.708	1,89%	0,30%	1,07%	18,07%	13,04%

5.9 SCENARIOS 2D Minimum standard services by cluster and Minimum fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the cluster target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the minimum national level.

Table 108 reports the component of the policy scenario 2D (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at the cluster target, and fiscal effort at the minimum national level setting, in the fiscal capacity models, the tax rates at the minimum level for each municipality.

Table 109 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 108***, and shown by the results displayed in ***Table 109***, to ensure a minimum level of services equal to the cluster average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a resource deficit of 40 million euros, initially quantified considering the historical fiscal effort (see ***Table 95***). More grants should be redistributed in favour of *Predominantly rural* municipalities and *Big cities*. At the same time, fiscal capacity should be included in the equalisation system to ensure a fairer redistribution of resources. Setting standard fiscal effort at the minimum national level, equalisation grants should be increased by 90 million euros, mainly in favour of *Predominantly rural* municipalities and *Big cities*, to finance a total deficit of 130 million euros.

Table 108 POLICY SCENARIO 2D minimum standard services by cluster and minimum fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 cluster average (BC = 6,81, PU = 8,00, PR = 10,00, R = 8,33), % of expenditure out of pupil basket is set at the 2018 cluster average (BC = 52%, PU = 49%, PR = 48%, R = 57%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%[41].
	Social service	The composite indicator of social services and Composite indicator of social benefits are set equal to the 2018 standard number of users that takes into account the median value by cluster of the users per target population[42].
	Culture and Recreation	Number of participants by cultural centre (BC = 345, PU =61, PR =61, R =89), Number of visits by museums (BC =4522, PU =1390, PR =2103, R =9136), Number of visits by library (BC =32286, PU =8856, PR =5369, R =18745) and Number of participants in sports competitions by sport facility (BC =321, PU =108, PR =106, R =195), are set equal to the 2018 cluster median[43].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 1st percentile of the distribution (0,43%).
	Property tax	Legal tax rate is set equal to the minimum value (0,3%).
	Land tax	Legal tax rates are set equal to the minimum value, Agricultural/Pond/Gardens (0,01%), Residential/Industrial/Commercial (0,01%).
Policy goal	Ensure a minimum level of services equal to the cluster average with a uniform fiscal effort equal to the minimum national level.	
Policy recommendation	Reform the equalisation system to redistribute more resources mainly towards the *Predominantly rural* municipalities and the *Big cities* to compensate for a resource deficit of 40 million euros, initially quantified considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. Standard fiscal effort fixed at the minimum level generates the necessity of 90 million euros of new equalisation grants (mainly towards *Predominantly rural* municipalities and *Big cities*) to finance a total deficit of 130 million euros.	

[41] Teaching hours, % of graduate students and % of attending students have not been set by cluster since Education attainment cannot be differentiated over the territory.

[42] Median values have been selected in accordance with the standard level of outputs (**3.1.2 Social security**).

[43] Median values have been selected in accordance with the standard level of outputs (**3.1.3 Recreation, culture and religion**).

Table 109 POLICY SCENARIO 2D minimum standard services by cluster and minimum fiscal effort, general results and comparison with the baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.132.235.725	1.182.447.020	-51.237.664	1.026.368	-50.211.295	-98.376.295	0	-98.376.295	4,43%	1,08	1,03	7,67	8,67
Predominantly urban	460.684.088	461.538.018	-18.843.973	17.990.042	-853.931	-51.805.033	12.012.102	-39.792.931	0,19%	1,10	0,99	5,97	6,33
Predominantly rural	904.392.349	952.889.270	-57.693.476	9.196.554	-48.496.922	-233.768.922	0	-233.768.922	5,36%	1,35	1,05	5,60	5,68
Resort	53.643.050	53.722.815	-2.043.387	1.963.622	-79.765	-8.332.765	0	-8.332.765	0,15%	1,27	0,99	4,90	6,50
Lithuania	2.550.955.211	2.650.597.123	-129.818.499	30.176.587	-99.641.912	-392.283.015	12.012.102	-380.270.912	3,91%	1,27	1,03	5,83	6,17
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	-4,93% -132.325.684	5,60% 140.545.217	481,62% -107.498.152	-84,57% -165.372.749	-157,52% -272.870.901	95,14% -191.258.338	-87,17% -81.612.564	-254,07% -272.870.901	10,36%	8,06%	6,50%	4,04%	10,78%
Big cities	-4,57% -54.232.145	12,24% 128.984.467	nc -51.237.664	-99,23% -131.978.948	-137,75% -183.216.612	17414,35% -97.814.606	-100,00% -85.402.006	-215,95% -183.216.612	15,64%	14,48%	14,27%	16,16%	0,00%
Predominantly urban	-2,89% -13.720.692	0,06% 263.278	138,42% -10.940.395	-14,47% -3.043.575	-106,50% -13.983.970	79,02% -22.866.884	283,87% 8.882.914	-54,18% -13.983.970	2,95%	0,80%	0,22%	1,13%	8,57%
Predominantly rural	-6,06% -58.353.564	1,00% 9.410.125	300,18% -43.276.707	-72,70% -24.486.982	-351,71% -67.763.689	39,02% -65.613.621	-53,99% -2.150.068	-40,82% -67.763.689	7,36%	8,76%	6,90%	1,62%	14,29%
Resort	-10,09% -6.019.283	3,64% 1.887.348	nc -2.043.387	-74,91% -5.863.244	-76,91% -7.906.631	147,30% -4.963.228	-100,00% -2.943.403	-1855,43% -7.906.631	13,27%	13,80%	11,48%	18,07%	13,04%

5.10 SCENARIOS 3B National minimum standard service and Cluster fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the national target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the 2018 cluster level.

Table 110 reports the component of the policy scenario 3B (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at a national target, and fiscal effort at the cluster level setting, in the fiscal capacity models, the tax rates at the 2018 cluster average for each municipality.

Table 111 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 110***, and shown by the results displayed in ***Table 111***, to ensure a minimum level of services equal to the national average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a deficit of 115 million euros, initially computed considering the historical fiscal effort (see ***Table 97***). More grants should be redistributed in favour of *Predominantly rural* municipalities, *Big cities* and some of the *Predominantly urban* municipalities. To ensure a fairer redistribution of resources, also fiscal capacity should be considered in the equalisation system. In particular, by setting the standard fiscal effort at the cluster average, 25 million euros of the deficit could be financed by municipal funds reducing the deficit to 90 million euros. Mainly *Predominantly urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues.

Table 110 POLICY SCENARIO 3B national minimum standard service and cluster fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 national average (8,17 sq m.), % of expenditure out of pupil basket is set at the 2018 national average (50%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%.
	Social service	The composite indicator of social services per 1000 inhabitants (1,27) and Composite indicator of social benefits per 1000 inhabitants (32,05) are set equal to the 2018 national target corresponding to the maximum standard value[44].
	Culture and Recreation	Number of participants by cultural centre (345), Number of visits by museums (9136), Number of visits by library (32286) and Number of participants in sports competitions by sport facility (321), are set equal to the 2018 national target corresponding to the maximum standard value [45].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 cluster average (BC = 0,77%, PU = 0,99%, PR = 1,78%, R = 4,14%).
	Property tax	Legal tax rate is set equal to the 2018 cluster average (BC = 0,78%, PU = 0,63%, PR = 0,70%, R = 0,64%).
	Land tax	Legal tax rate is set equal to the 2018 cluster average, Agricultural/Pond/Gardens (BC = 0,28%, PU = 0,70%, PR = 1,15%, R = 0,31%), Residential/Industrial/Commercial (BC = 0,41%, PU = 0,65%, PR = 1,05%, R = 0,34%).
Policy goal	Ensure a minimum level of services equal to the national average with a uniform fiscal effort equal to the average cluster level.	
Policy recommendation	Revise the equalisation system to redistribute more resources mainly towards *Predominantly rural* municipalities, *Big cities* and *Predominantly urban* municipalities to compensate for a resource deficit of 115 million euros, initially computed considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the cluster average, 25 million euros of the deficit can be financed by municipal funds. Mainly *Predominantly urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues.	

[44] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

[45] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

Table 111 POLICY SCENARIO 3B national minimum standard service and cluster fiscal effort, general results and comparison with the baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.199.688.668	1.225.876.090	-32.661.605	6.474.182	-26.187.423	-74.352.423	0	-74.352.423	2,18%	1,06	1,01	8,33	8,67
Predominantly urban	503.210.947	497.794.937	-22.747.665	28.163.676	5.416.011	-56.623.535	23.100.546	-33.522.989	-1,08%	1,09	0,99	6,47	6,00
Predominantly rural	965.848.108	984.497.644	-34.504.710	15.855.174	-18.649.536	-204.618.057	696.520	-203.921.536	1,93%	1,29	1,02	5,95	5,37
Resort	59.170.967	52.852.567	-85.730	6.404.130	6.318.400	-3.948.613	2.014.013	-1.934.600	-10,68%	1,11	0,89	5,30	6,50
Lithuania	2.727.918.690	2.761.021.238	-89.999.710	56.897.162	-33.102.548	-339.542.627	25.811.079	-313.731.548	1,21%	1,21	1,00	6,25	5,90
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	1,66% 44.637.794	10,00% 250.969.331	303,22% -67.679.363	-70,90% -138.652.174	-119,11% -206.331.537	68,91% -138.517.950	-72,43% -67.813.587	-192,12% -206.331.537	7,67%	3,30%	3,40%	11,41%	5,99%
Big cities	1,11% 13.220.798	16,37% 172.413.537	nc -32.661.605	-95,13% -126.531.134	-119,69% -159.192.739	13137,28% -73.790.733	-100,00% -85.402.006	-187,64% -159.192.739	13,39%	12,24%	12,25%	26,26%	0,00%
Predominantly urban	6,07% 28.806.167	7,92% 36.520.196	187,81% -14.844.087	33,90% 7.130.059	-58,75% -7.714.029	95,67% -27.685.385	638,23% 19.971.357	-29,89% -7.714.029	1,69%	0,04%	-0,03%	9,60%	2,86%
Predominantly rural	0,32% 3.102.195	4,35% 41.018.499	139,34% -20.087.941	-52,93% -17.828.362	-196,80% -37.916.303	21,68% -36.462.756	-4,22% -1.453.548	-22,84% -37.916.303	3,93%	3,44%	3,47%	7,93%	7,94%
Resort	-0,82% -491.367	1,96% 1.017.100	nc -85.730	-18,18% -1.422.736	-6,28% -1.508.466	17,19% -579.076	-31,58% -929.390	-353,99% -1.508.466	2,44%	0,14%	0,70%	27,71%	13,04%

5.11 SCENARIOS 3C National minimum standard service and National fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the national target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the 2018 national level.

Table 112 reports the component of the policy scenario 3C (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at a national target, and fiscal effort at the national level setting, in the fiscal capacity models, the tax rates at the 2018 national average for each municipality.

Table 113 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 112***, and shown by the results displayed in ***Table 113***, to ensure a minimum level of services equal to the national average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a resource deficit of 115 million euros, initially computed considering the historical fiscal effort (see ***Table 97***). More equalization grants should be redistributed mainly towards *Predominantly rural* municipalities, *Big cities* and some *Predominantly urban* municipalities. At the same time, also fiscal capacity should be introduced in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, more than 40 million euros of the total deficit can be financed by municipal funds reducing the deficit to 74 million euros. Mainly *Predominantly urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate financial resources to provide more services above the cluster average.

Table 112 POLICY SCENARIO 3C national minimum standard service and national fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 national average (8,17 sq m.), % of expenditure out of pupil basket is set at the 2018 national average (50%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%.
	Social service	The composite indicator of social services per 1000 inhabitants (1,27) and Composite indicator of social benefits per 1000 inhabitants (32,05) are set equal to the 2018 national target corresponding to the maximum standard value[46].
	Culture and Recreation	Number of participants by cultural centre (345), Number of visits by museums (9136), Number of visits by library (32286) and Number of participants in sports competitions by sport facility (321), are set equal to the 2018 national target corresponding to the maximum standard value [47].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 national average (1,42%)[48].
	Property tax	Legal tax rate is set equal to the 2018 national average (0,69%).
	Land tax	Legal tax rate is set equal to the 2018 national average, Agricultural/Pond/Gardens (0,92%), Residential/Industrial/Commercial (0,86%).
Policy goal	Ensure a minimum level of services equal to the national average with a uniform fiscal effort equal to the average national level.	
Policy recommendation	Revise the equalisation system to redistribute more resources towards most of the *Predominantly rural* municipalities, *Big cities* and *Predominantly urban* municipalities to compensate for a resource deficit of 115 million euros, initially computed considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. By setting the standard fiscal effort at the national average, 40 million of deficit can be financed by municipal funds. Mainly *Predominantly urban* municipalities can finance the extra resource needed to increase the level of services using their own fiscal revenues, generating in some circumstances also a surplus to liberate financial resources to provide more services above the cluster average.	

[46] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.
[47] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.
[48] This value corresponds to the 41° percentile of the implicit tax rate distribution that provides standard revenues close to the historical values for all municipalities.

Table 113 POLICY SCENARIO 3C national minimum standard service and national fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.223.144.949	1.225.876.090	-16.732.228	14.001.087	-2.731.141	-52.080.959	1.184.818	-50.896.141	0,22%	1,04	1,00	8,33	8,67
Predominantly urban	516.679.746	497.794.937	-14.480.694	33.365.503	18.884.809	-46.547.148	26.492.957	-20.054.191	-3,66%	1,07	0,97	6,47	6,00
Predominantly rural	954.054.420	984.497.644	-43.273.267	12.830.043	-30.443.224	-216.236.812	521.589	-215.715.224	3,19%	1,31	1,03	5,95	5,37
Resort	60.517.973	52.852.567	-183.096	7.848.503	7.665.407	-4.144.467	3.556.874	-587.593	-12,67%	1,10	0,88	5,30	6,50
Lithuania	2.754.397.089	2.761.021.238	-74.669.285	68.045.136	-6.624.149	-319.009.386	31.756.238	-287.253.149	0,24%	1,22	1,01	6,25	5,90
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	2,65% 71.116.193	10,00% 250.969.331	234,53% -52.348.938	-65,20% -127.504.200	-103,82% -179.853.138	58,69% -117.984.709	-66,08% -61.868.429	-167,46% -179.853.138	6,70%	3,74%	3,55%	11,41%	5,99%
Big cities	3,09% 36.677.080	16,37% 172.413.537	nc -16.732.228	-89,47% -119.004.229	-102,05% -135.736.457	9172,20% -51.519.269	-98,61% -84.217.188	-159,99% -135.736.457	11,43%	10,33%	10,42%	26,26%	0,00%
Predominantly urban	8,91% 42.274.966	7,92% 36.520.196	83,22% -6.577.116	58,63% 12.331.886	43,83% 5.754.770	60,85% -17.608.999	746,64% 23.363.768	22,30% 5.754.770	-0,89%	-2,25%	-2,15%	9,60%	2,86%
Predominantly rural	-0,90% -8.691.492	4,35% 41.018.499	200,16% -28.856.498	-61,91% -20.853.493	-258,01% -49.709.991	28,59% -48.081.511	-12,36% -1.628.480	-29,94% -49.709.991	5,19%	5,03%	4,72%	7,93%	7,94%
Resort	1,43% 855.640	1,96% 1.017.100	nc -183.096	0,28% 21.637	10,93% -161.460	23,00% -774.930	20,84% 613.471	-37,89% -161.460	0,45%	-0,73%	-0,30%	27,71%	13,04%

5.12 SCENARIOS 3D National minimum standard service and Minimum fiscal effort

The goal of this policy scenario is to simulate the level of resources necessary to finance a minimum level of services equal to the national target for each municipality considering the actual equalisation grants and setting the level of the municipal fiscal effort at the national minimum level.

Table 114 reports the component of the policy scenario 3D (see the summary of the policy scenarios reported in ***Table 86***). We have set the policy variables at a national target, and fiscal effort at the minimum national level setting, in the fiscal capacity models, the tax rates at the 2018 minimum levels.

Table 115 reports the detailed results of the policy scenario under evaluation. In particular, as done for the baseline scenario displayed in ***Table 87***, for all Lithuanian municipalities and each cluster, we compute the following indicators: total standard revenues (column A); total standard expenditure (column B); the level of deficit, surplus and fiscal imbalance considering and excluding the actual level of equalisation grants (columns from C to I); the fiscal gap ((column J), the horizontal fiscal imbalance considering and excluding the actual level of equalisation grants (columns K and L) and, in conclusion, we report the performance score (column M) and the overall output score (column N).

As reported at the end of ***Table 114***, and shown by the results displayed in ***Table 115***, to ensure a minimum level of services equal to the national average, the main policy recommendation of this scenario is to reform the actual equalisation system. The reform should redistribute more resources to compensate for a resource deficit of 115 million euros, initially computed considering the historical fiscal effort (see ***Table 97***). More equalisation grants should be redistributed mainly towards *Predominantly rural* municipalities, *Big cities* and some *Predominantly urban* municipalities. At the same time, also fiscal capacity should be included in the equalisation system to ensure a fairer redistribution of resources, setting the standard fiscal effort at the minimum national level. As a result, equalisation grants should be increased by 118 million euros, mainly in favour of *Predominantly rural* municipalities, *Big cities* and *Resorts* municipalities, to finance a total deficit of 232 million euros.

Table 114 POLICY SCENARIO 3D national minimum standard service and minimum fiscal effort

Policy actions and recommendation		Policy and fiscal effort variables
Scope (volume) of services, current budget expenditure	*Education*	Teaching hours per pupil is set equal to the 2018 national average per pupil (116), sq meter per pupil is set at the 2018 national target average (8,17 sq m.), % of expenditure out of pupil basket is set at the 2018 national average (50%), % of graduate students is set equal to 6% (the max value registered in 2018), % of attending students is set equal to 100%.
	Social service	The composite indicator of social services per 1000 inhabitants (1,27) and Composite indicator of social benefits per 1000 inhabitants (32,05) are set equal to the 2018 national target corresponding to the maximum standard value[49].
	Culture and Recreation	Number of participants by cultural centre (345), Number of visits by museums (9136), Number of visits by library (32286) and Number of participants in sports competitions by sport facility (321), are set equal to the 2018 national target corresponding to the maximum standard value [50].
Fiscal effort and fiscal capacity	*Fees*	Implicit tax rate is set equal to the 2018 1st percentile of the distribution (0,43%).
	Property tax	Legal tax rate is set equal to the minimum value (0,3%).
	Land tax	Legal tax rates are set equal to the minimum value, Agricultural/Pond/Gardens (0,01%), Residential/Industrial/Commercial (0,01%).
Policy goal	Ensure a minimum level of services equal to the national average with a uniform fiscal effort equal to the minimum national level.	
Policy recommendation	Revise the equalisation system to redistribute more resources mainly towards the *Predominantly rural* municipalities, *Big cities* and some *Predominantly urban* municipalities to compensate for a resource deficit of 115 million euros, initially computed considering the historical fiscal effort. Consider fiscal capacity in the equalisation system to ensure a fairer redistribution of resources. Standard fiscal effort fixed at the minimum level generates the necessity of 95 million euros of new equalisation grants (mainly towards *Predominantly rural* municipalities, *Big cities* and *Resorts*) to finance a total deficit of 232 million euros.	

[49] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

[50] Maximum standard values have been selected in order to differentiate the poly scenario from the historical situation where municipalities already provide outputs very close to national average.

Table 115 POLICY SCENARIO 3D national minimum standard service and minimum fiscal effort, general results and comparison with baseline scenario, ALL POLICY VARIABLES

	Total standard revenues (euros) (A)	Total standard expenditures (euros) (B)	Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal imbalance indicators corrected by actual equalisation grants (euros)			Fiscal Gap % of total revenues [J = (B-A)/A]	Horizontal fiscal imbalance without the inclusion of actual equalisation grants (K)	Horizontal fiscal imbalance corrected by actual equalisation grants (L)	Overall performance (1-10 index) (M)	Overall level of output (1-10 index) (N)
			Deficit (resources needed to achieve the policy target) (C)	Surplus (resources allocated to the provision of services above the policy target) (D)	Fiscal Imbalance (F = C+D)	Deficit (resources needed to achieve the policy target) (G)	Surplus (resources allocated to the provision of services above the policy target) (H)	Fiscal Imbalance (I = G+H)					
Big cities	1.132.235.725	1.225.876.090	-93.640.366	0	-93.640.366	-141.805.366	0	-141.805.366	8,27%	1,11	1,06	8,33	8,67
Predominantly urban	460.684.088	497.794.937	-50.493.802	13.382.953	-37.110.849	-85.748.181	9.698.332	-76.049.849	8,06%	1,18	1,06	6,47	6,00
Predominantly rural	904.392.349	984.497.644	-86.681.736	6.576.441	-80.105.295	-265.377.295	0	-265.377.295	8,86%	1,40	1,09	5,95	5,37
Resort	53.643.050	52.852.567	-1.908.821	2.699.304	790.483	-7.462.517	0	-7.462.517	-1,47%	1,25	0,97	5,30	6,50
Lithuania	2.550.955.211	2.761.021.238	-232.724.725	22.658.698	-210.066.026	-500.393.359	9.698.332	-490.695.026	8,23%	1,32	1,07	6,25	5,90
(% variation from the baseline scenario) (absolute variation in euros from the baseline scenario)													
Lithuania	-4,93% -132.325.684	10,00% 250.969.331	942,66% -210.404.378	-88,41% -172.890.638	-221,26% -383.295.016	148,92% -299.368.682	-89,64% -83.926.334	-356,89% -383.295.016	14,69%	11,99%	10,41%	11,41%	5,99%
Big cities	-4,57% -54.232.145	16,37% 172.413.537	nc -93.640.366	-100,00% -133.005.316	-170,40% -226.645.682	25146,21% -141.243.676	-100,00% -85.402.006	-267,14% -226.645.682	19,48%	17,65%	17,44%	26,26%	0,00%
Predominantly urban	-2,89% -13.720.692	7,92% 36.520.196	538,87% -42.590.224	-36,37% -7.650.664	-382,64% -50.240.888	196,32% -56.810.032	209,93% 6.569.143	-194,66% -50.240.888	10,82%	7,88%	7,29%	9,60%	2,86%
Predominantly rural	-6,06% -58.353.564	4,35% 41.018.499	501,26% -72.264.967	-80,48% -27.107.096	-515,77% -99.372.062	57,82% -97.221.994	-36,62% -2.150.068	-59,86% -99.372.062	10,86%	12,39%	10,44%	7,93%	7,94%
Resort	-10,09% -6.019.283	1,96% 1.017.100	nc -1.908.821	-65,51% -5.127.562	-76,91% -7.036.383	121,47% -4.092.980	-100,00% -2.943.403	-1651,21% -7.036.383	11,65%	12,65%	9,93%	27,71%	13,04%

6. DYNAMIC MICRO-SIMULATION TOOL (DASHBOARD)

According to the scope of the Action, most of the Outputs implemented for the project converge to the final dynamic tool simply named as *Dashboard*.

The Dashboard can be defined as a *Micro-simulation* tool that has been implemented to be easily accessible to all the users through Excel format.

The Dashboard provides the tools to assess municipalities' expenditure efficiency, to measure the fiscal capacity at municipal level and to evaluate the long run sustainability of the financial structure of each local government. For each local authority and available year, the Dashboard will provide a full analysis to evaluate the fiscal gap corresponding to the difference between standard expenditures and fiscal capacity.

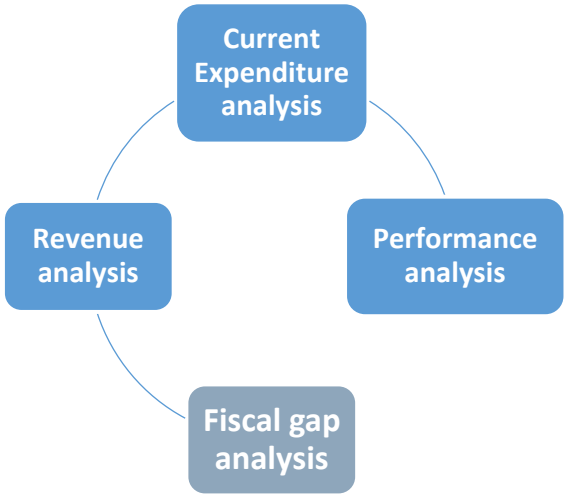
The components of the Dashboard basically concern:

- analysis of the municipalities' expenditure efficiency and productivity based on the comparison between public service current and standard costs;
- analysis of the fiscal capacity at municipal level, defining municipalities' potential revenues;
- analysis of the fiscal gap corresponding to the difference between standard expenditures and fiscal capacity.

The full set of elements included in the Dashboard can be summarized as reported in

Figure 132. The municipal fiscal imbalance analysis is the final target of the Dashboard, which needs all the single components to implement the analysis of municipalities' fiscal gap.

Figure 132 Dashboard components



The first building block refers to the analysis of current expenditures of municipal functions.

From the expenditure side, as already explained in the previous paragraphs, the functions that have been standardized can be summarized through the following list:

- General administration;
- Housing and utilities;
- Recreation, culture and religion;
- Education;
- Social security.

The second building block refers to the analysis of revenues associated to municipalities' fiscal capacity, which can be defined as municipalities' own revenue raising capacity, i.e. the potential ability of a Municipality to raise revenue. As already explained in the previous paragraphs, only some of the components of fiscal capacity have been standardized.

The identification of potential revenues (standard revenues) concerns revenues raised through the following taxes:

- Property tax;
- Fees;
- Land tax.

The third building block concerns Fiscal gap analysis that quantifies long-term fiscal sustainability which basically corresponds to the difference between expenditure needs and revenue raising capacity.

For each Municipality and for each year included in the analysis, the Dashboard provides a full set of results that covers all the previously mentioned components involved in the analysis:

- Standard expenditure for each of the standardized municipal functions;
- Potential Fiscal capacity for each standardized revenue source;
- Fiscal gap.

An additional block included in the Dashboard concerns the analysis of Performance that simultaneously takes into account the results calculated for the standardization of the level of expenditure and the standardization of the level of services provided for each municipal function as well as for the total standard expenditure.

All the blocks included in the Dashboard can be considered as sub-dashboards that analyse a specific component that contributes to the computation of the overall results. The following table (***Table 116***) reports the association between blocks of analysis and Dashboard's spreadsheets. The table also reports the dataset associated to each block of analysis.

Table 116 Dashboard blocks

DASHBOARD BLOCKS	DASHBOARD SPREADSHEET	DATASET SPREADSHEET
CURRENT EXPENDITURE ANALYSIS	GENERAL_ADMINISTRATION	DB_GENERAL_ADMINISTRATION
	HOUSING_UTILITIES	DB_HOUSING
	RECREATION	DB_RECREATION
	EDUCATION	DB_EDUCATION
	SOCIAL SECURITY	DB_SOCIAL
REVENUE ANALYSIS	PROPERTY	DB_REVENUE
	FEES	DB_FEE
	LAND	DB_LAND
FISCAL GAP ANALYSIS	FISCAL GAP	DB_REVENUE
PERFORMANCE ANALYSIS	PERFORMANCE	

The Dashboard automatically generates the results concerning the building blocks previously mentioned for each Municipality (and at a macro level, selecting total Lithuania country or Cluster benchmarks) and for each available year.

The Dashboard is also set for the inclusion of additional waves of data (2019, 2020, etc.). Most of the computations are automatically set with the exclusion of few indicators (input indicators) that need to be updated by the user. To facilitate user's intervention and the updating of the Dashboard a detailed *User guide* has been implemented with the purpose to provide all the information needed for the computation of the input variables necessary for the inclusion of additional years of analysis.

A very important and additional functionality of the Dashboard is to provide the user with the possibility to evaluate the impact of a set of policy variables (short-run and long-run policy variables).

User can select or type in a set of policy variables and the Dashboard automatically updates the results of standard expenditures, standard revenues and the corresponding fiscal gap for all municipalities. Performance scores are updated as well if policy variables are selected.

Policy variables can be set for the following building blocks included in the Dashboard:

1. Revenue analysis:
    - Property tax;
    - Land tax;
    - Fees.

2. Current expenditure analysis:
    - General administration;
    - Education;
    - Housing and utilities;
    - Recreation, culture and religion;
    - Social security.

The sub-dashboard related to standard revenues from **Property tax** (PROPERTY spreadsheet) includes just one policy variable that can be set:

- Tax rate of Immovable property tax.

The sub-dashboard related to standard revenues from **Land tax** (LAND spreadsheet) includes just one policy variable that can be set both for Agricultural land and Other land:

- Tax rate of Land tax.

The sub-dashboard related to standard revenues from **Fees** (FEES spreadsheet) includes just one policy variable that can be set:

- Implicit tax rate of Fees.

The sub-dashboard related to **General administration** function (GENERAL_ADMINISTRATION) includes just one policy variable that can be set:

- Cost of labor.

The sub-dashboard related to **Housing and utilities** (HOUSING_UTILITIES spreadsheet) function includes the following policy variables:

- Residential apartments real estate average sale price;
- Ratio of unemployed to the working age population;

The sub-dashboard related to **Recreation, culture and religion** (RECREATION spreadsheet) function includes the following policy variables:

- Cultural centers, branches and other cultural institutions;
- Number of museum buildings;
- Number of branches of public libraries
- Stadiums, swimming pools, other sport infrastructure;
- Number of participants by cultural center;
- Number of visits by museums;
- Number of visits by library;
- Number of participants in sports competitions by sport facility;

The sub-dashboard related to **Education** (EDUCATION spreadsheet) function includes the following policy variables:

- Graduate students;
- Not attending students;
- Kindergarten staff;
- Labor cost;
- Municipal expenditure out of pupil basket;
- Sqm area of school premises;
- Schools;
- Number of teaching hours.

The sub-dashboard related to **Social security** (SOCIAL spreadsheet) function includes the following policy variables:

- Unemployment rate;
- COMPOSITE INDICATOR of SERVICES PROVIDED by Target Users;
- COMPOSITE INDICATOR of OTHER SERVICES PROVIDED by Target Users.

Summarizing the Dashboard identifies a complete operational tool that has been added to the deliverables of the Action. For each municipality and for each of the benchmarks included, Lithuania and clusters, all results can be visualized through a step by step process. All details of computation are displayed in order to make the procedure more comprehensive and to facilitate presentation purposes as well. The results can be displayed for all available years with the possibility to include additional data for future analysis in accordance with the aim of the Action to guarantee the sustainability and the institutionalization of the project.

7. TRAINING

The Grant agreement that assigns to SOSE the task of the financial sustainability analysis of Lithuanian municipalities includes, among other outputs, the organization of training sessions, requested by the Lithuanian authorities to enable them to use independently both the methodology and the tools prepared by SOSE.

The goal of the training sessions, organized by SOSE, is to review all the main Outputs of the project (estimation of standard expenditure, estimation of fiscal capacity, fiscal gap analysis, infrastructure gap analysis) and for this purpose they need to be divided into two parts:

a. **Technical/Econometrics training:** the first part focused on technical/econometric training, to share the techniques used in the construction of the econometric models in order to enable the Lithuanian team to update and independently improve the main components of the project for further policy development. The econometric training should provide the skills to understand and master the individual analytical details of the econometric instruments implemented by SOSE.

b. **Policy training:** the second part focused on political training with the aim of exploiting the full potential of the instrument to support political decisions, including the equalisation exercises.

Both types of training involve not only the technical aspects of the use of the analytical tool, but also its applicability in the process of budget reviewing cycle and in taking public policy decisions on the need for and scope of public interventions in the areas analysed. This would ensure the applicability of the methodology and the tools developed, which is one of the main results and added value of the project.

Training sessions have been carried out[51] through interactive digital sessions (Webinar) using TEAMS platform (English language).

The participants to the trainings, selected by Lithuanian authorities, included among the others representative of the Ministry of Finance, Ministry of Social Security and Labour, Ministry of Education, Ministry of Culture, Ministry of Environment and Association of Local Authorities.

As to the Technical/Econometrics event, the training days have been split into 6 distinct sessions covering an overall duration of 15 hours. Each session has been divided into slots in order to differentiate the topics covered. Each slot has ended with a short discussion to leave room for questions or requests for further details.

The following table (***Table 117***) shows the complete timetable of each session.

[51] Effective date of delivery of the Technical/Econometric training: 15th, 16th and 17th July 2020.
Effective date of delivery of the Policy training: 13th November 2020.

Table 117 Technical/Econometric training

Technical/Econometric training	OUTPUT
SESSION 1 (DAY 1) INTRODUCTION **15th July 2020**	• General address (09:30 – 10:00) • General overview of the Project (10:00 – 11:30) 11:30 – 11:45 Break • Database (11:45 – 12:30)
SESSION 2 (DAY 1) **15th July 2020**	• Clustering (14:00 – 15:00) 15:00 – 15:15 Break • Life quality index (15:15 – 16:00) General discussion
SESSION 3 (DAY 2) **16th July 2020**	• PERFORMANCE ANALYSIS (09:30 – 11:00) 11:00 – 11:15 Break • FISCAL GAP (11:15 – 12:30)
SESSION 4 (DAY 2) **16th July 2020**	• Econometric Models (14:00 – 16:00) General discussion
SESSION 5 (DAY 3) **17th July 2020**	• FISCAL CAPACITY (09:30 – 10:30) 10:30 – 10:45 Break • GENERAL ADMINISTRATION & SOCIAL SECURITY (10:45 - 12:30)
SESSION 6 (DAY 3) **17th July 2020**	• OTHER FUNCTIONS: EDUCATION, RECREATION, CULTURE and RELIGION, HOUSING and UTILITIES (14:00 - 15:00) 15:00 – 15:15 Break • INFRASTRUCTURAL GAP 15:15 – 16:00 General discussion

The opening welcome address of the training also saw the participation of the CEO of SOSE to underline the importance of the event.

The first session started with a general overview of the project with a summary of the main Outputs produced by SOSE in order to give a complete picture of the Action.

The following slots of session number 1 and 2 have been focused on the details of the Database that identify the real core of the project. All families of collected variables have been showed and a deep insight to the macro variables Clustering and Life quality index has followed.

Different Clustering techniques have been illustrated together with results related to the identification of Lithuanian municipal Clusters, also explained through a working session.

The same approach has been carried out to show the results and the calculation steps needed for the computation of Life quality index.

The second day of the training has started with a complete overview of municipal Performance analysis (session number 3) and Fiscal gap analysis. During the session number 4, different econometric approaches to estimate Panel regression have been displayed. Working sessions focusing on the use of theoretical frameworks have been run to complete the second day of training.

The last day of training has involved a discussion on Fiscal capacity in the morning session (session number 5), while the last slot of the same session has been used to show details concerning the estimation of Standard expenditure needs for General administration and then Social security.

The other functions, Education and Recreation, culture and religion in particular, have been showed in the first slot of session number 6, the last one.

A general overview of the analysis of infrastructural gap has completed the technical training.

The main support tools used for the execution of the training are:

- an important number of slides prepared for each of the scheduled sessions;
- a dynamic micro-simulation tool (Dashboard) able to reproduce the results of the analysis as well as to estimate equalization scenarios according to the level of a set of policy variables.

For the use of the Dashboard (as well as for the calculation of the Life quality index) support documents (User Guides) have been prepared to facilitate understanding and use of the tools.

As to the Policy training, the event has been split into 2 distinct sessions covering an overall duration of 5 hours. Each session has been divided into slots in order to differentiate the topics covered that are reported in the following table (***Table 118***).

Table 118 Policy training

Policy training	OUTPUT

SESSION 1
 	
13th November 2020
	• General overview of the Project
	• Fiscal gap Analysis and Equalisation scenarios
	
	INSIGHTS
	• Database
	• Fiscal capacity analysis
	• Standard Expenditure Needs
	  ○ Focus on Social security function
	  ○ Focus on Education
	• Infrastructural gap analysis

SESSION 2 **13th November 2020**	• Equalisation scenarios through the Dashboard • Open discussion and questions

The opening part of the event was addressed to a general overview of the project, where high representatives of Lithuanian government took part. Subsequently the event continued focusing on the main topic of the Policy training, the analysis of the Fiscal gap and the analysis of different Equalisation scenarios. In this way it was possible to show the full potential of the developed instrument.

The following slot has focused on Database, Fiscal capacity, Standard expenditure needs (a general overview followed by an insight on Social security and Education) and finally infrastructural gap analysis.

A presentation of Equalisation results through the Micro simulation model (*Dashboard*) has characterized the second session that has been concluded with an open discussion.

The Policy training received a high level of participation and was attended by representatives of many Lithuanian institutions such as: Ministry of Finance, Prime Ministry Office, Ministry of Social security and labour, Ministry of Education, Science and Sport, Lithuanian Association of Municipalities.

At the end of the training we were finally aware of the bond created within this project by receiving satisfactory feedback in acquiring the necessary knowledge to use the simulation tool independently for further analysis.

Having achieved similar results encourages us to a possible further effort by deepening the analysis and the methodology in order to obtain a strengthening of the skills of the communities involved.

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