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ASSESSMENT OF MUNICIPAL ENVIRONMENTAL PROTECTION EXPENDITURE: CASE STUDY IN THE CZECH REPUBLIC

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Abstract

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Local authorities need simple economic tools and methodology how to evaluate public expenditure efficiency. There are a lot of ways for measuring efficiency of public expenditure however methods or economic tools which get actual information about efficiency of current public spending are rare. The paper presents new methodology for evaluating current municipal environmental protection expenditures based on a weighted assessment of multiple economic, social and environmental criteria. This methodology has issued from OECD methodology however it is a more complex tool and addresses the three pillars of sustainable development and following interdisciplinary approaches of Environmental Mainstreaming. The paper presents also case study, where is investigated environmental protection expenditure evaluation in the city of Brno, the second largest city in the Czech Republic. The results of this case study show the correct state of expenditure efficiency in the city of Brno and indicate possible improvements applicable for new investment to environmental protection and sustainable development.

efficiency, environmental protection expenditure, environmental mainstreaming municipal level, public spending

Efficiency evaluation and the methodology for evaluating efficiency have greatly improved and advanced over the past several decades. However, it remains a conceptual challenge in relation to public expenditures. According to a group of authors at the European Commission (Mandl *et al*., 2008) this issue is further complicated by the fact that public sector outcomes are often off-market, lacking relevant data, and thus cannot be quantified.

The efficiency of public expenditure on environmental protection at the municipal level needs to be seen from several points of view. This involves theoretical and practical aspects. The first theoretical level concerns understanding and discussing *efficiency as a general term*, i.e., understanding the concept of efficiency, what the concept includes, and which factors can influence efficiency and to what extent. Jollands (2006) dealt mainly with efficiency in relation to ecological economics, referring to the history of the concept of efficiency, including problems of perception, both generally and especially in relation to the environment, and stressed the relationship of efficiency and managerial decision making and planning. Hannon (2001) emphasized factors in the valuation of the environment and the relationship of these factors to effectiveness. Wätzold (2000) highlighted the influence of environmental uncertainty on efficiency. The second theoretical level includes the *concept of public spending as a whole*. As with efficiency, the concept involves what public expenditure means as it relates to the role of the public sector, which factors can affect public spending and to what extent. Public spending at the local level is a special part of public expenditure as a whole. This is mainly defined by the missions of the different levels of government and their roles and impacts on the size, scope, and effectiveness of public spending. Afonso and Fernandes (2008) assessed the efficiency of local public expenditure

(including for environmental issues) and refer to two possible approaches investigated by De Borger and Kerstens (2000). There are studies that evaluate overall efficiency, covering all or several services provided by local governments (Afonso *et al*., 2010; Burgat and Jeanrenaud, 2008; Afonso and Fernandes, 2008; Loikkanen and Susiluoto, 2005). Ring (2002) examined the relationship of the public sector's environmental and fiscal equivalence at the municipal level. These authors discuss the evaluation of efficiency and the methods and models for measuring efficiency. The effectiveness of public spending on the environment at the local level is explored in practical terms based on evaluation and measurement. The practical implementation of theoretically established methods e.g., Data Envelopment Analysis (Emrouznejad *et al*., 2008) lies in their applicability and their reliability in measuring efficiency. Numerous studies have assessed the suitability of methods, according to Afonso and Fernandes (2008, 2010). In practice, the ability to effectively manage public expenditures lies in the applicability of the manuals and practices that originated in international organizations like OECD. A number of tools have been created for public expenditure management. The handbook by Allen and Tommasi (2001) represents an example of a means to effectively manage public expenditure in general. Contemporary society prioritizes the human relationship to nature. Therefore, some handbooks and guides have been created to manage the environment and especially environmental protection costs and expenditures based on experience with the OECD methodology (Barde, 1994; OECD, 1997; Burns and Yoo, 2002 and Peszko, 2003), which is primarily focused on the economic tools of environmental protection (specifically on public expenditure in this area), as well as on the recommendations of the United Nations Organization, World Bank (EIG, 2010) and UNDP-UNEP Poverty-Environment Initiative (De Coninck *et al*., 2009).

The objective of the paper is to introduce an approach that suggests how to improve and streamline public spending on the environment at the municipal level in the European Union (EU). There are presented ten years results of research of authors focuses on key aspects of a new developed methodology for the assessment of the current municipal environmental protection expenditure efficiency (hereinafter referred to as 'the methodology'). The main goal of this paper is to present key aspects of a new methodology for the assessment of the current municipal environmental protection expenditure efficiency (hereinafter referred to as 'the methodology') created by the authors of this paper (Soukopová *et al*., 2010) and approved as a voluntary tool by the Ministry of the Environment of the Czech Republic (MŽP, 2011). Another objective is to present results of the use of the methodology in the city of Brno, the second largest city in the Czech Republic.

METHODOLOGY

Environmental protection expenditures (EPE) are all the spending on all activities aimed at both preventing pollution and protecting the environment (CEPA, 2000). One of the key criteria is that environmental protection is the primary objective of these activities. Activities that positively affect the environment but do not have protection of the environment as their primary aim are not included. This criterion is reflected in the methodology. EPE are classified according to funding sources, types of expenditure, and areas of environmental protection. In terms of funding sources, the EU-statistics divide EPE into the public sector, industrial sector, and environmental specialist manufacturers and producers of environmental services for the private and public sector (CEPA, 2000). EPE are divided into capital (investment) expenditures and current (non-investment) expenditures.

The proposed methodology is designed for the evaluation of current public EPE only. The Classification of Environmental Protection Activities (CEPA 2000) is most frequently used to determine EPE. CEPA 2000 divides EPE into nine areas of Environmental Protection (EP) (CEPA, 2000):

1. *Protection of ambient air and climate*;
2. *Wastewater management*;
3. *Waste management*;
4. *rotection and remediation of soil, groundwater and surface water*;
5. *Noise and vibration abatement* (excluding workplace protection);
6. *Protection of biodiversity and landscapes*;
7. *Protection against radiation* (excluding external safety);
8. *Research and development* and
9. *Other environmental protection activities*.

The methodology was designed for eight areas and for each area of EP separately. Area 8 of CEPA 2000, research and development, is not included because the municipalities have no such expenditures. The basic methodology ideas are:

1. *Use the concept of environmental protection, including economic and social aspects* – The methodology is based primarily on the three pillars of sustainable development following interdisciplinary approaches Environmental Mainstreaming[1] (De Coninck *et al*., 2009). Each pillar is evaluated separately. The overall rating is a weighted summary of these three pillars.

1 http://www.environmental-mainstreaming.org/

2. *Use existing methodologies and analysis* – Good practices and satisfactory evaluation indicators of existing methodologies, procedures, and methods (Barde, 1994; OECD, 1997; Allen and Tommasi, 2001; Burns and Yoo, 2002; Peszko, 2003; De Coninck *et al*., 2009 and Jílková *et al*., 2010) were incorporated in the methodology if possible and adapted to the conditions of EU municipalities.
3. *Data availability* – The authors attempt to define indicators for the evaluation that are accessible for local government authorities and also for regional and state authorities from linked open government data – ARIS[2] and ÚFIS[3] database.
4. *Weighted multi-criteria evaluation* – The weights are calculated by (1), (2), see below.
5. *Simplicity and complexity of output* – The evaluation results were proposed as an index facilitating their interpretation, publication, and communication.
6. *Quality of legislation* – Use of the methodology is strictly limited by the legislation of the country (Member state of EU) that wants to put this methodology into practice.

Algorithm for assessing efficiency

We propose to evaluate current municipal EPE in terms of the '3Es' (economy, effectiveness, and efficiency). The suggested assessment process is divided into two main levels: *basic* and *general*. The *basic assessment* is based on a municipal environmental management evaluation and a principle of appropriate budget planning (Allen and Tommasi, 2001). The general assessment is used for each EPE and proceeds in three (parallel) parts that correspond to the three pillars of sustainable development. The basic principle of the methodology is presented in structured and easy-to-survey tables, which must be completed in steps. The methodology uses both qualitative and quantitative methods of EPE assessment. The qualitative methods include a simple questionnaire for each pillar (Soukopová *et al*., 2010). The quantitative methods incorporate weighted multi-criteria analysis techniques. The methodology includes closed and open questions. Fig. 1 shows a simplified schema of the procedure for assessing the effectiveness and design of the methodology as an algorithm.

Basic assessment

To keep the evaluation simple, it was appropriate to use classification CEPA (2000) and existing and available data of the municipal EPE in the Czech Republic (ARIS, ÚFIS). The 'Municipality List' form contains only *open questions*. There is collected basic general information/data about the municipality/city, i.e., the name of the local authority, the type of local authority, population, land size, and the current EPE as planned and actual expenses.

The EPE divided by CEPA 2000 [30] are used for a basic assessment, which includes an evaluation of budget planning and the weighting of each EPE and each area of EP. The weights of each EPE and EP are set as follows:

$$w_{iO} = \frac{C_{iO}}{\sum_{i,j=1}^{n,8} C_{iO}} \tag{1}$$

$$w_O = \frac{C_O}{\sum_{O=1}^{8} C_O}, \tag{2}$$

where:

w_{iO} ..... is the weight of the i-th EPE in the O-area of EP ($i = 1, \ldots, n$, $O = 1, \ldots, 8$),
w_O ..... is the weight of the O-area of EP ($O = 1, \ldots, 8$),
C_{iO} ..... is the i-th EPE in the O-area of EP,
C_O ..... is the sum of EPE in the O-area of EP,
n ..... is the number of implemented EPE of the municipality.

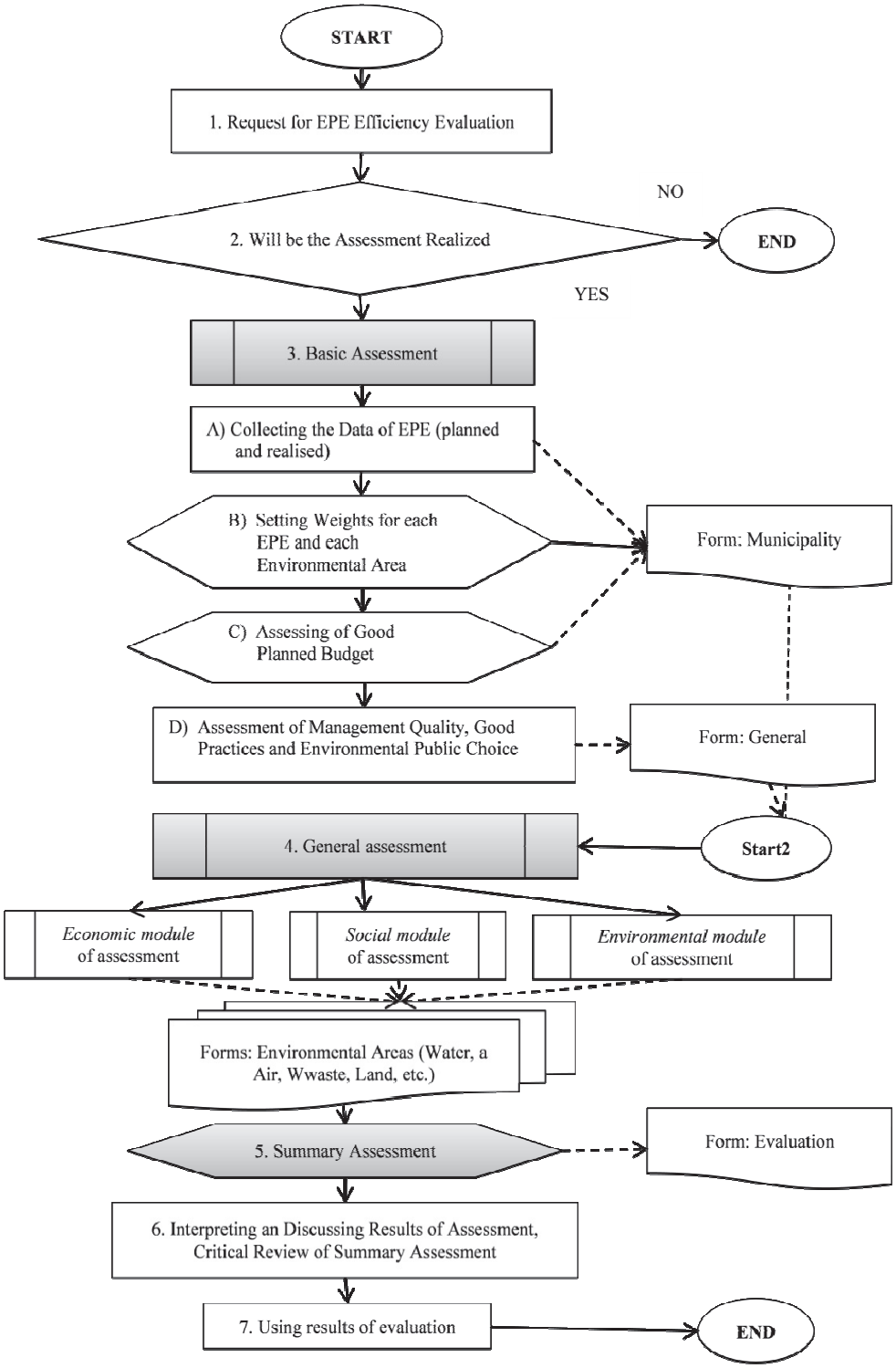
The relevance and importance of each EPE and area of EP are through the determination of weights guaranteed inclusion in the evaluation process. The second function of the basic assessment is the evaluation of the budget planning. The difference between the budgeted and actual EPE is analysed, and the results are entered into the general assessment. The 'General List' form contains closed questions relating to the tools of environmental management, good practices, and supporting the elected bodies of the municipality/city. The results of this evaluation are entered into the general assessment (Soukopová *et al*., 2010).

General assessment

The forms are divided into eight areas of EP by CEPA 2000 similar as in Basic assessment. These forms include closed questions to assess the effectiveness of the economic, social, and environmental pillars of sustainable development. The evaluation of both economic and social pillars of sustainable development is consistent for all areas of the environment.

Questions for the economic pillar are still further divided into the following areas: *legality*, *effectiveness*, *economy*, and *efficiency*. Questions for the social pillar detect how environmental protection policies create *space for the participation of stakeholders*, enhance the *quality of life*, improve *working conditions*, and more. Questions for the environmental aspects

2 http://wwwinfo.mfcr.cz/aris/
3 http://wwwinfo.mfcr.cz/ufis/



1: *Algorithm scheme of the methodology*

of the assessment are different in each area of EP and include municipal priorities in area 9 Other environmental protection activities of CEPA 2000 (9.1 General environmental administration and management).

To simplify the methodology, answers are set and assessed from 0 to 3 points: 3 – fully satisfactory, 2 – rather satisfactory, 1 – rather unsatisfactory, 0 – unsatisfactory. The methodology describes the point system in more detail [29]. The set of questions for each area and each pillar can reach up to 100 points. These points are weighted. The weights were subsequently determined by experts:

- economic pillar – weight 0.35,

- social pillar – weight 0.25,
- environmental pillar – weight 0.30,
- budget planning – weight 0.10.

The point assessment of each EPE is as follows:

$$EC_{iO} = Ec_{iO}w_{Ec} + S_{iO}w_S + En_{iO}w_{En} + GPB_{iO}w_{GPB}, \quad (3)$$

where
EC_{iO} ..... is the point evaluation of i-th EPE in the O-area of EP (0–100 points),
Ec_{iO} ..... is the point evaluation of the economic pillar (0–100 points),
S_{iO} ..... is the point evaluation of the social pillar (0–100 points),
En_{iO} ..... is the point evaluation of the environmental pillar (0–100 points),
GPB_{iO} .... is the point evaluation of the actual budget (0–100 points),
w_{Ec} ..... is the weight of the economic pillar,
w_S ..... is the weight of the social pillar,
w_{En} ..... is the weight of the environmental pillar,
w_{GPB} ..... is the weight of budget planning, where:

$$1 = w_{Ec} + w_S + w_{En} + w_{GPB}.$$

The overall rating is a sum of the weighted sums of all three pillars of sustainable development and budget planning:

$$E_{iO} = EC_{iO}w_{iO}, \quad (4)$$

$$E_O = EC_O w_O, \quad (5)$$

$$E = \sum_{i=1}^{n} EC_{iO}w_{iO}, \quad (6)$$

where
E_{iO} ..... is the efficiency of i-th EPE in the O-the area of EP,
E_O ..... is the efficiency of the O-area of EP,
E ..... is the efficiency of the sum of EPE,
w_{iO} ..... is the weight of the i-th EPE in the O-area of EP, see above (1),
w_O ..... is the weight of the O-area of EP, see above (2).

The assessment of each pillar and budget planning is constructed subsequently. The full result of the methodology is presented in a rating (see Tab. II) which contains the results of each pillar of sustainable development and an assessment of the actual municipal budget.

The Evaluation List form contains an evaluation of each EPE, each EP, a sum of EPE, each pillar and budget planning. Based on communication with local authorities, these indexes of efficiency are presented as a percentage of 100% efficiency.

RESULTS AND DISCUSSION

The case study concerns the results of a current EPE efficiency evaluation of the city of Brno, the second largest city in the Czech Republic. Brno has

I: *Summarized report with point results of pillars and overall efficiency ratings of each EPE and area of EP for the city of Brno, 2010*

Area of EP	EPE	w	Ec	S	En	EC	E
1	1.3 Measurement, control, laboratories and the like	1.000	96	63	68	77	69.53%
	$S = O_1$	0.004					69.53%
2	2.2 Sewerage networks	0.522	87	34	0	25	25.00%
	2.3 Wastewater treatment	0.095	61	100	100	100	98.00%
	2.6 Other activities	0.383	96	100	90	100	97.00%
	$S = O_2$	0.016	1	1	1	1	59.39%
3	3.1 Prevention of pollution through in-process modification	0.001	0	44	80	100	66.00%
	3.2 Collection and transport	0.427	100	88	97	100	94.00%
	3.4 Treatment and disposal of non-hazardous waste	0.559	100	50	80	100	74.00%
	3.6 Other activities	0.014	67	31	0	100	41.00%
	$S = O_3$	0.643	64	42	55	64	82.04%
4	4.5 Measurement, control, laboratories and the like	0.785	100	13	0	25	17.00%
	4.6 Other activities	0.215	0	13	0	25	11.00%
	$S = O_4$	0.002	0	0	0	0	15.71%
6	6.1 Protection and rehabilitation of species and habitats	0.198	100	81	57	81	75.00%
	6.2 Protection of natural and semi-natural landscapes	0.003	100	13	0	25	17.00%
	6.3 Measurement, control, laboratories and the like	0.001	0	78	68	88	73.00%
	6.4 Other activities	0.798	100	81	78	100	86.00%
	$S = O_5$	0.332	33	27	24	32	83.35%
9	9.2 Education, training and information	1.000	100	13	0	25	17.00%
	$S = O_8$	0.004	0	0	0	0	17.00%

Source: authors

a population of over 380,000 people in 230 square kilometres. Since 2005, the total EPE of Brno has been over half a billion CZK yearly. Tab. I and II and Fig. 2 present the results of the applied methodology in the city of Brno in 2010.

Tab. I shows the evaluation of each EPE and each area of environmental protection in the city of Brno. It does not show the EPE for 'Protection and reduction against physical factors' or 'Administration in environmental protection' because the city had no expenditures on these items. This table also does not take into account the evaluation of the pillars of sustainable development or budget planning. The results of these indexes are shown in Tab. II and Fig 2.

The results show that the economic pillar and the area 4 – Protection and remediation of soil, ground water and surface water are the least efficient in the city of Brno. A more detailed examination showed that expenditures in the area 3 – Waste management, especially in 'collection and transport' and 'treatment and disposal of non-hazardous waste' (EPE 3.2 and 3.4), had a significant impact on the results of assessment. These expenditures are inefficient in the medium-term (the 5-year period from 2007 to 2011); this was confirmed by other studies where used different tool of assessing (Soukopová and Malý, 2013, Struk and Soukopová, 2011). The results in the city of Brno are also influenced by expenditures in the area 6 – Protection of biodiversity and landscapes, in which the largest expenditure was 'other activities' (EPE 6.4) which covers mainly taking care of the appearance of the municipality and public greenery. These expenditures are less cost-effective than in other towns in the South Moravian Region of the Czech Republic where is Brno situated.

From Tables I and II and Fig. 2, it is obvious that the developed methodology provides a wide variety of information unincorporated in other well-known methodologies (OECD, 1997, Burns and Yoo, 2002; Peszko, 2003, De Coninck *et al.*, 2009). The methodology presents more information on:

- the efficiency of each EPE and each area of EP;
- an assessment of each pillar of sustainable development (economic, social and environmental) and budget planning;
- a basis for planning, decision making, negotiating, monitoring, and possibly also taking preventive measures;
- the possibility of monitoring efficiency in real time;
- the reduction of the likelihood of incorrect or inefficient allocation of resources.

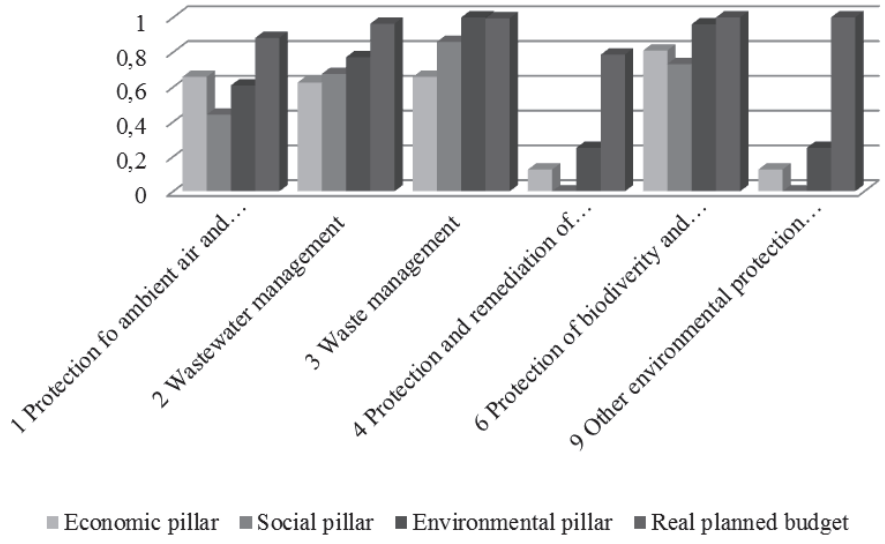
The following factors could present complications in the use of the methodology:

- lack of appropriate data;

II: *Evaluation of EPE of the city of Brno in 2010*

Set of ratings	Performance
Efficiency of the economic pillar	70.46%
Efficiency of the social pillar	80.45%
Efficiency of the environmental pillar	97.54%
Budget planning	99.40%
Efficiency of all environmental protection expenditures	86.96%

Source: authors



2: *Efficiency of each EP area and each pillar*

- false interpretation of results, even with proper data;
- the methodology does not address technical efficiency;
- the methodology depends on the management of public spending;
- the weights for the individual pillars were determined by an expert, but the methodology makes it possible to set the weights for each pillar in accordance with the priorities of the municipality[4].

It is necessary to add that the decision-making about EPE also depends on political decisions, which can significantly influence public expenditures regardless of the results of any evaluation. Even the best methodology does not address this problem, but a good methodology could contribute to general awareness for possible approaches to improve the current evaluation of public expenditures. The criterion 'actual budget' is included in the methodology assessment. The inclusion of this criterion means that municipal officers have the opportunity to adjust the environmental priorities of the municipality and then check whether these priorities are met. The authors are aware that the implementation of this methodology can be complicated, but the case study shows that implementation is possible.

CONCLUSION

The developed methodology is result of ten years research at Masaryk University, Faculty of Economics and Administration. It was designed in response to the absence of a simple methodology for the needs of local and regional municipal authorities in EU and approved in the case study of the city of Brno and many municipalities in the Czech Republic (Soukopová and Bakoš, 2013).

The methodology was also created because is not a globally unified conceptual economic tool for current EPE evaluation. Although the OECD methodologies (OECD, 1997; Peszsko, 2003) exist, they are generally used to evaluate only economics instruments. OECD methodologies also emphasize and draw attention to the institutional environment over an assessment of economic instruments. The concept of our methodology is inspired by OECD methodologies in general, (general principles are used), but apply different philosophy of UNDP-UNEP Poverty-Environment Initiative (De Coninck *et al*., 2009) than linking the environmental, economic, and social pillars of environmental protection. The methodology uses practical experiences from previous 'good practice' methodologies, i.e. (Barde, 1994; OECD, 1997; Burns and Yoo, 2002; Peszko, 2003; Jílková *et al*., 2010 and Šauer *et al*., 2009, 2011) for the management of public expenditure on environmental protection.

The methodology enables decision makers of public administration to show information for the evaluation of economic, social, and environmental efficiency and budget planning for individual spending areas as well as protection of the total expenditure on environmental protection. This makes it possible to get an overview of allocated EPE resources in relation to the level of total expenditure in all areas and activities of environmental protection. The results provide information about all four values which is graphically displayed for all the different areas of environmental protection. The evaluation of effectiveness and efficiency of public spending should support decision making in the political process. It provides information on the extent to which the environmental objectives and other objectives of an implemented municipal environmental policy have been achieved. The results should include, among other things, the opportunity to compare public spending in relation to other municipalities.

The methodology could inspire other Member States of EU and their municipalities to evaluate the effectiveness of public spending at the local level.

SUMMARY

The paper presents a methodology for evaluating the efficiency of current municipal environmental protection expenditures and using of methodology in the city of Brno. The methodology was accepted by the Ministry of the Environment of the Czech Republic and approved as a voluntary tool for municipal officials. The proposed methodological procedure for evaluating municipal environmental protection expenditures is based on a weighted assessment of multiple criteria. The procedure gives municipalities an instrument for assessing expenditure efficiency and addresses the three pillars of sustainable development: economic development, social development, and environmental protection. The methodology can be used by other countries and municipalities to evaluate the efficiency of public spending at the local level.

4 Alternatively, the methodology can be based on an evaluation of the sum of all areas and the priorities of the municipality as defined in an assessment.

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