THE POSSIBILITIES OF DETERMINING ENVIRONMENTAL IMPACTS OF ECONOMIC ACTIVITIES IN A REGION

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Abstract: *The paper deals with the increasing demand for high-quality information for management decisions about the consequences of economic activities in the territory. Emphasis is placed on monitoring the environmental externalities in focus on the aspects of the polluter and the links with the consequences of economic activity. Analyzes current approaches to the creation of administrative units and functional regions and their advantages and disadvantages are included. It discussed the possibility of creating special-purpose regions to better identify the causes and consequences mainly for the purpose of monitoring the impact of the air pollution. The paper also deals in detail with the availability of regionally structured data and indication of the pollution impact. Advantages of this process can be seen in the generally greater awareness of the spatial impact of economic activities in the administrative region of origin and the impact on the quality of the environment. The combination of qualitative and quantitative estimation of the extent analysis of the relationship of economic activities and environmental quality of the region are looking to new strategies aimed at the region as a flexible, dynamic space that emphasizes cooperation between regions and individual actors.*

Keywords: *Region, Functional region, Polluter, Environmental impacts, Negative externalities.*

JEL Classification: *Q56, R12.*

Introduction

When investigating the impact of economic activities on the environment, it is a significant problem to cope with very various symptoms of these effects in the area and the possibilities of their description using indicators which would be constructed from standard monitored information. Negative externalities caused by industrial activities are still better identified and also included into the results of the polluter's activities. This is done using different tools, both administrative and economic but in the recent years also more and more by voluntary responsibility of the polluter, such as corporate social responsibility, environmental management systems and other activities. It is also becoming a necessity for the public administration short-term as well as strategic management to know the relation between the activities within the region and their impact on the environment. Therefore, it is necessary to broaden and increase the quality of perceiving the creation and impact of negative externalities. Availability of such information enables prediction and planning of further development as well as operational intervention and control activities. This fact is connected to the increasing demand for comparison not only between regions but also their particular units which might have administrative or nonadministrative character.

The article aims to analyze the possibilities that could better identify the extent of impacts caused by a particular polluter. One such option is the creation of functional regions, for which further describes the methodology and possible usage.

1 Problem formulation

The actual need to solve these relations is supported by a whole list of documents on international as well as national level. The most important include e.g. Stiglitz – Sen – Fitoussi Report and Barca Report (Agenda for a Reformed Cohesion Policy) [23, 2]. The efforts for a reformed cohesion policy go in the direction characterized by the key term "place-based development model" (e.g. Barca Report). The execution of regional public administration should involve creation of own strategic sustainable development plans, development of region, municipality or integrated development plans of cities in accordance with particular policies and with regards to the available financial tools. This article puts emphasis on the aspect of the originator (polluter) and connection with the impact of the activity. This approach requires delimitation of the activity impacts by the polluter within the region. However accurate e.g. cartographic representation of the pollution situation cannot provide information about the polluter (e.g. maps highlighting areas exceeding pollution limits) and therefore, do not bear necessary information for decision making.

The key national strategic document is the Regional Development Strategy of the Czech Republic 2014 – 2020 [15]. It calculates with support of balanced development of regions that is with the conception of sustainable development so that the balance between the social, economic and environmental development pillars is kept. This article analyzes the problem with regards to other goals, especially pro-growth and disparity and such that prevent risks of future development. The goal is to broaden the view on regionalization of the economic performance by environmental context including the relation to the externality originator (polluter). It is a similar approach to the trend of social and environmental responsibility in the corporate sector. Responsible regional development must be based also on decision making at such situations when impact of activities outside the region needs to be reflected. The range of the impact from economic activities including transport within the region does not copy the administrative organization and so far it is not possible to delimit a theoretically defined region of economic activities impact on the environment and causing harm to the environment.

1.1 Region classification with regards to the term of functional region

Statistic classification of regions is represented by hierarchically sorted division of particular areas which sorts and divides a particular territory to individual levels where a higher grade of area unit is divided into more detailed lower. There is a hierarchical logical order of the particular superior and inferior levels of classification

The main principles of classification include stabilization of their elements in time and area which has a positive impact on comparability of indicators within time series of the regional statistics and also unification of the principles of creation and alphanumerical labeling of the regional units in the EU. The classification has a large methodical significance within the frame of outlining, collection, processing and dissemination of statistic information both at the national and European Union level. It is also connected to the preparation, realization and evaluation of various policies.

The current classification CZ-NUTS arranges regional units in the Czech Republic to the level of NUTS 3 where it is possible to differentiate administrative and nonadministrative regions.

Regional policy is connected especially to realization of programs at the level of administrative regions within the authority of the relevant institutes of executive power.

However it is not possible to exclude potential requirements of the users of the regionally structured data to characterize nonadministrative regions, or functional regions, based on statistic data. In relation to the above written facts, these requirements meet many limitations with mostly objective character.

Understanding of the definition of regions and their classification is not perceived unitedly in the literature and is accompanied by ambiguity. Administrative units are understood as such units which were created as a result of political will. They are defined with regards to the goals of the territorial community in harmony with the number of inhabitants necessary for effective and economical reaching of the goals and also with regards to historical, cultural or other factors. The literature offers a large number of various classification factors. They correspond to political, sociographic and other conditions of each country [3,4,7, 9,10,14,24,25 and other]. We recommend the used literature for details.

Administrative regions are defined for the needs of execution of the public administration and regional governments. There are two basic relations between particular levels: composition, which means that a region of a higher level consists of several units of lower levels and the relation of superiority and subordination which expresses the obligation of the norms adopted at the higher level for all subordinate regions. Certain time stability is needed. Administrative regions tend to be understood as hard, irreversible structures. Many authors [19, 24 and others] point at certain limitations given by the demarcation of regions. There might be distortions given e.g. by not respecting the historic development, socioeconomic situation etc. This problem is significant especially in the of monitoring and managing the changes in the environment quality caused by economic activities within the region. These changes can be monitored in all parts of the environment – air, water, soil, ecosystems etc. Thereby we get to so far not often explored problematic areas and their overlapping.

The Regional Development Strategy of the Czech Republic (RDS CR) says that the topic of regions and periphery areas supported by the state requires effective cooperation by the regions as this is where the problems are most often accumulated. The weakest part mentioned by the document is "poor cooperation by the regions in solving problems of the inner peripheries".

The RDS CR sets the typology of regions for the purpose of program substitution based on detailed analysis of the regional development key factors. The purpose of this typology is to reflect differentiated conditions of area development and in relation to the type of regions to define priorities, measures and direction of the funds and so increase the objectivity and efficiency of the regional policy within the development of the Czech Republic [15].

The functional regions are determined for solving concrete problems, such as solving economic underdevelopment or environmental problems. A functional region ceases to exist after solving the problem or fulfilling the purpose it was determined for. The determination of the functional region territory is not limited by the borders of administrative regions. Therefore, the determination might include grouping of regional units or regions which are on the lowest level, e.g. districts in the Czech Republic.

Based on the studies and following expert discussions of the last several year, it is possible to see the effort to define new priorities and principles of future European cooperation in the new program period 2014 – 2020. It is probable that in these conditions there will be increasing need to direct politicians in higher rate to the functional regions on the local level.

These changes are related to the development opportunities as well as to competition between regional units at all levels. This requires operational monitoring of the situation on the level of regions so that responsible organs of the decision making sphere may evaluate the growth or decrease of intensity of individual occurrences, to take – within their authority – measures and estimate development for the nearest periods. In dynamic environment the level of management quality is dependent on the system of its information support. The regional statistics at the regional level is a necessary tool for making strategic as well as operational decisions.

The theory of spatial external effects [22] can be used for the conception of creating functional regions. If the benefit from measures taken for environment protection, eventually cost for pollution, are not borne only by the inhabitants of the particular administrative region but also third subjects, we speak about positive or negative spacial external effects. The utility from the acts of other administrative unit reduce the motivation to take the cost for environment protection. The public good environment quality has different spacial dimensions; the differences are expressed in a different way (e.g. utilities from a clean lake or greenhouse gas reduction). At the given time moment the externalities are dependent especially on industry structure in the particular region.

The spacial externalities lead to the effort to create purpose (functional) regions. Such a region is determined by the area determination of the environmental problem. Today's multipurpose regions (the same regional government fulfills more tasks) are solved by one-purpose administrative units. Often the regions touched by a particular environmental problem are not equipped with corresponding competencies to solve the problem. This is being even more accented by centralization of environmental policy.

The relation between functional arrangement and administrative determination of a region is important for solving the social and economic development. Administrative regions are set up with the goal to reach their maximum balance (area, population etc.) so that administrative activities could be ensured. The most efficient areas for solving development problems are functional regions; however, the solution is processed for logical administrative reasons within the frame of administrative regions [14].

1.2 Sources of information, their limitations and problem analysis

Description of functional regions based on regional data can currently be usually described as the state of lack of data. In such cases it is necessary to take into account that the workplaces of the state statistical service are oriented especially on international requirements related to the legislation of the EU and the Czech Republic. In this context, the regional data are almost exclusively designed to be compatible with the NUTS classification (regions and areas of cohesion generally understood as local level). Other factors which form the objective limits for possibilities to create indicators in the regional level include the effort of the state statistical service workplaces to decrease administrative burden of the statistical survey respondents, especially in the enterprise sector, and also budgetary and capacity limits of their work.

Another restriction of the regionally oriented data availability is the applied method of statistic data collection. The regional accounts come from the yearly national accounts composed for the Czech Republic. In harmony with the ESA (European System of Integrated Economic Accounts) methodology the factors are inquired using enterprise method which is connected to the allocation of the indicators to regions based on the real place of activity of the units. In the majority of cases this assumes creation of functional

units by composing lower area units than a region (and also here for many indicators it is not possible to find regional estimates for some areas). In current conditions and acceptance of exceptional measures which influence above all budgetary and capacity abilities of the state, it is not possible to realize detailed estimates of all parts of the environment to determine the functional regions.

There are different information sources, databases etc. to ensure the needed data. Apart from the significant role of the Czech Statistical Office (CSO) in obtaining the information for the data from the regional area, there is also the Regional Information Service (RIS) and other component environment information systems.

The portal of regional information services was founded based on the Government Resolution 682/2000 about the Regional Development Strategy of the Czech Republic for the needs of information support for the area of individual regions of the Czech Republic. Its operations and coordination is ensured by the Center for Regional Development of the Czech Republic, a contribution organization of the Ministry of Regional Development of the Czech Republic (it methodically manages, directs the creation, construction and operations). The RIS portal maintains unified and clear information structure of regions. This open system offers information sorted by regions, cohesion regions (NUTS II), districts and municipalities with extended competencies. It makes accessible mostly regional data focused on data characterizing economic environment, the environment, social environment, administrative organization, self-governance, public administration, subsidies etc.

All regional RIS have been processed in a unified structure which enables the user easy orientation across the regions and effective access to specific information for any region of the Czech Republic. In connection to RIS, the Center for Regional Development of the Czech Republic also built Map Server RDS CR in order to display specific data on development and activities in particular regions of the Czech Republic in higher quality. It offers raster and vector maps in different scales down to the level of town plans, including vector data across the border – SABE 2004.

RIS – Source Database KROK (regional and district statistics) is taken from the Czech Statistical Office without the possibility to modify the database. Using the basic indicators from this database and their combination in the calculation enables to display a large quantity of so called determined indicators.

The source information for the category environment quality is available in more information systems. Those are especially information systems administrated by Cenia (www.cenia.cz) – Integrated pollution registry, IS OH, ISPOP, HEIS, ISSaR, http://geoportal.gov.cz/ and other map servers, (www.chmi.cz) – ISKO, (www.czso.cz) and many others. Further it is possible to use analyses prepared by the regions – especially in PZKO (Programs to reduce emissions and improve air quality regions] - including dispersion studies, administrative decisions etc. [21]), GIS run by the regions and others.

Based on above listed facts it is possible to consider the estimates for indicators of functional regions only in the form of estimates based on expert evaluation or special methods of data mining. These methods enable gross approximate estimates of the required indicators for such areas. It is not possible to expect the range of geographic-branch or sector structures to be comparable with the range provided by conventional statistics on the national level. This fact significantly reduces the information value of the regional information produced based on aggregation or disaggregation or by use of modeling.

2 Methods and suggestions

A functional region in the connection to the impacts of economic activities on the environment (region of impact of economic activity on the environment) is such a region which corresponds to the area location of the problem burdening the environment (e.g. smog situations, exceeding concentration of health harming pollutants in the air etc.).
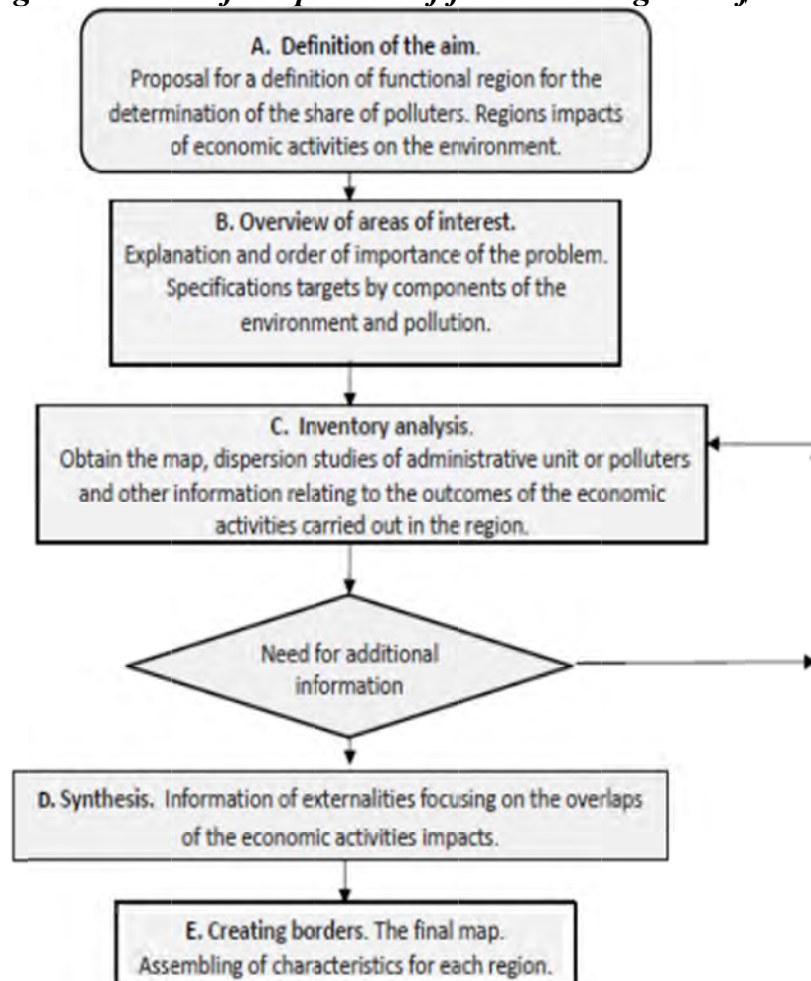
In the current situation the creation of such a region is accompanied by many problems. The recommendation is, therefore, limited only to successive steps to create the basic idea about the spacial effects of the economic activity within the region with focus on air quality.

The approach may be different based on the analysis related either to the result of the effect of individual pollutants or to the final problem. The selection of the second option will make the decision making easier (clearer relation to the inhabitants' preference, elimination of the problematic relation between emissions and imissions). The result will be material for further internalization strategies which must be environmentally and alocationally effective.

The determination of the region may be based on quantitative or qualitative evaluation. Quantitative approach forms a statistic frame for analysis selection and data classification for region creation. Qualitative approach means expert determination of selected analyses and classified data for region definition.

When defining such regions, it is necessary to take these steps (Fig.1):

Fig. 1: Scheme of the process of functional region definition

A. Definition of the aim.
Proposal for a definition of functional region for the determination of the share of polluters. Regions impacts of economic activities on the environment.

B. Overview of areas of interest.
Explanation and order of importance of the problem. Specifications targets by components of the environment and pollution.

C. Inventory analysis.
Obtain the map, dispersion studies of administrative unit or polluters and other information relating to the outcomes of the economic activities carried out in the region.

Need for additional information

D. Synthesis. Information of externalities focusing on the overlaps of the economic activities impacts.

E. Creating borders. The final map.
Assembling of characteristics for each region.

Source: Authors

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Processing inventarisation analysis of influences on the environment assumes to classify to groups based on impact (caused problems). These problems are classified as potential start of acidification (SO_2, NO_x), harming health of inhabitants (such as PM_{10}, $PM_{2.5}$, VOC and others), climate changes (greenhouse gases), potential creation of ground-level ozone (precursors O_3).

Collection of the maps, description and collection of data, identification of future region characteristics (map revision – they concern only a very narrow problem and might lead to misinterpretation). Although the relative significance of environmental characteristic remains constant, the described quality of information used on the map for the area of spread of the region, it often changes and may request changes in the drawing. The level of data generalization differs among the different maps of the same scale, but also in individual maps. The evaluation of the current air pollution in the region needs to be based on the tabular and map overviews published by CHMU [6].

The maps for area representation of the imission characteristics and atmosphere deposition are created based on the connection and integration of the GIS system, relation database of measured imissions and chemical composition of atmospheric precipitation ISKO and model calculations based mostly on emissions. An important role is also played by adding and correcting the objective calculations on the basis of expert estimate [6]. These maps of imissions with exceeding imission limits do not inform about the polluter, therefore, it is necessary to analyze cause separation in the area (of economic activity) which should be characterized by these described functional regions.

The method which will be used for modeling of the economy activities impact on air quality will be especially dispersion studies (reference methods for processing studies SYMOS 97, ATEM a AEOLIUS). The content requirements for dispersion studies are defined by appendix 15 to the Decree 415/2012 Coll. [18], as well as the Journal of the Ministry of the Environment CR XIII, August 2012, part 8.

In order to recognize the impact of the economic activities from neighboring regions it is necessary to monitor the frontier areas. The main source for finding the range of economic activity impact is represented especially by the dispersion studies. These have a long tradition in the Czech Republic; they have been prepared for various situations, stationary as well as linear sources, area sources and also for some cities and regions of the Czech Republic (Programs for decreasing emissions and increasing air quality)[21]. The method has some limitations. The evaluation of polluted air impact uses especially dispersion studies which are a model calculation, not measured values. Based on the Decree of the Ministry of Environment 330/ 2012 Coll., [17] the methodology of dispersion studies is applicable for air pollution calculation for urban agglomeration above the level of building roofs and country areas. Another restriction is the range of calculation area limited to 100 km from the source of pollution. The dispersion studies exist for other regions, e.g. in the interest area of the Pardubice Region, also in the Liberec Region, Hradec Kralove, Vysocina, South Moravian and Vysocina regions. Unfortunately, the studies are not compatible [21]. They were prepared using the SYMOS and ATEM methodology.

They were also created for different pollutants. This limits their further use. The most important are the identifications of overlapping to other regions. Unfortunately, this cannot be read from the existing dispersion studies – in most times the published data are limited only within the borders of the particular region. Also the graphical outputs and choice of pollutants differ among the studies (apart from the main emitted substances). The time

compatibility is not ensured, too. It would be very beneficial to publish binding instructions for study elaboration, with regards to the time restrictions and funds requested. In further details to dispersion studies and air pollution in the Czech Republic we refer to the currently running public order for the Ministry of Environment. The procedure for measuring and imission limits is included in the appendix to the Law 201/2012 Coll. on air protection [5].

3 Discussion

The estimate of region of economic activity impact on the environment, border definition and their description are not discrete, it needs to be counted with the transition zones – fuzzy borders. The draft of the functional region borders is defined based on expert evaluation.

This procedure has certain logic in obtaining the information about the causal relation between economic activity and spatial representation of impact from product pollution. At the current state of cognition, especially available information, the spatial delimitation cannot be accurately identified but the borders can be set using expert estimate.

One of the supporting program tools for purpose region creation may be geographic information systems. Their utilization is further only drafted as they were not used within the project due to limited data sources. The problem is their insufficient compatibility and partly limited accessibility for the general public. The data are owned by various institutions and available in different scales and formats.

Conclusion

The advantage of this approach can be seen in the generally higher awareness of spatial impact of economic activities on the area of an administrative region and the origin of the impacts on the environment quality. The combination of qualitative estimate of the extent and quantitative analysis of the relation between economic activities and environment quality are a new approach focused on regional strategies. In accordance with the current theories of regionalistics the concept of region as flexible and dynamic space is accented which puts emphasis on cooperation between regions and the particular actors. Responsibility of the regional strategy is understood in the meaning of extended responsibility of corporate activities.

The form of a purpose region is essentially virtual and enables to better describe the root cause of the problem and solve it more flexibly. However, some information needs for successful definition of purpose regions remain unfulfilled in the details. They concern especially excessive administration workload in searching both, dispersion of emitted substances in the area as well as indicators of economic performance monitored in the structure of administrative regions.

Similar procedures regarding region classification, approaches to regions definition etc. are devoted mostly to economic and social parameters; a deeper analysis of environment quality is not included.

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