The System Approach to Revenues of the Czech Municipalities and Decision Making Process in Distribution of Grants

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Abstract: This paper deals with the system approach to grant and tax revenues of the Czech municipalities and shows a use of multiple criteria decision making method in order to a distribution regional grants. Firstly it focuses on public administration system, describing of tax revenues, grants, and situation in the Czech Republic and shows a process of grant realization and creation of design of grant criteria objectification model. The part of this paper contents also an application of AHP method in defined problem.

Key-words: system, system approach, public administration, revenues, AHP, decision making

1 Introduction

Public Administration can be broadly described as the development, implementation and study of branches of government policy. Public Administration is linked to pursuing the public good by enhancing civil society and social justice. By [16] it is government in action – the management of public affairs or the implementation of policies and there we can find various definitions. Generally it is possible to say, the public administration presents people and activities that are part of organization process.

Systems theory [16, 19] views an organization as a complex set of dynamically intertwined and interconnected elements, including its inputs, processes, outputs, feedback loops, and the environment in which it operates and with which it continuously interacts. Any change in any element of the system causes changes in other elements. The interconnections tend to be complex, dynamic, and often unknown. Thus, when management makes decisions involving one organizational element, unanticipated impacts usually occur throughout the organizational systems. The Fig.1 shows the public administration as the system.

This system is divided into three distinct parts [19]: inputs, processes and outputs. They are surrounded by an environment and include a feedback mechanism (for example control of an observance of the rules, term, fulfillment of obligations, payment of taxes, measurements of citizens' satisfaction etc.). In addition, human decision-makers are considered part of this

system. Incomes and revenues, laws and regulations, knowledge and experiences of workers, various data and information and other sources are inputs there. Processes are realized on the basis of various tools, activities, procedures and decisions. In public administration many processes related to economical, legislative and social areas are under way. Performances, consequences of decisions, protection of public interest and security of the necessities of life of citizens etc. are outputs of this public administration system.
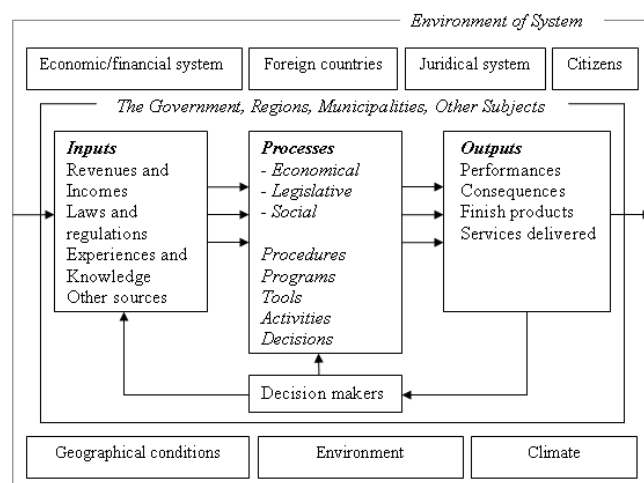

Fig. 1 System of the public administration, modified by [19]

Because organizations are adaptive systems that are integral parts of their environments, they must adjust to change in their environment if they are to survive.

Norbert Wiener's model of an organization as an adaptive system epitomizes the basic theoretical perspectives of the systems perspective. The basic concept behind cybernetics is self-regulation, biological, social, or technological systems that can identify problems, do something about them, and then receive feedback to adjust themselves automatically [16]. This model is in the Fig. 2.
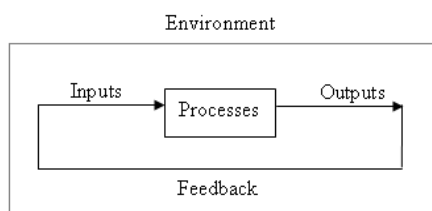

Fig. 2 Norbert Wiener's model of an organization as an adaptive system [16]

Public administration system has not elements of self-regulation. The regulation is at least secured by tools, decisions of decision markers at the various levels of public administration and influence of environment.

Every organization has its structure that defines elements, their roles, functions and operating principles. The public administration is comprised state administration bodies, territorial self-government bodies and their relations. The state administration is directly or mediately regulated by the central government. Characteristic features of this state administration are the restricted decision making autonomy, vertical hierarchical structure and subordination of lower state administration bodies to higher bodies. The territorial self-government is a spatially defined function unit with power to make decisions. Municipalities and regions are an example of this government. At the territorial self-government level in the Czech Republic is a hybrid model. The state government and territorial self-government (both governments) at the level of municipalities and regions are realized under the one territorially administrative unit. If the self-government bodies perform the state government it is concerned about the transfer state administration. The Czech municipalities differ in range of the state administration execution in transfer competency. The structure of the public administration in the Czech Republic is in the Fig. 3, more about Czech municipalities, regions and public administration for example in [17, 22, 23].
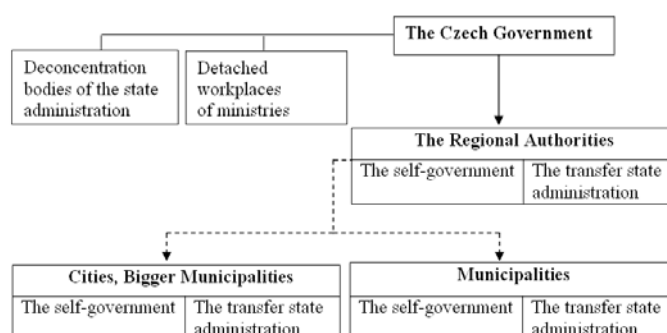

Fig. 3 The public administration structure in the Czech Republic, modified by [14]

Goals of this paper are:

- To describe the two types of the municipalities' revenues used in the Czech Republic. It means to focus to grants and tax revenues;
- On the basis of system approach to describe grant system of the Czech municipalities;
- To create a design of grant criteria objectification model.

2 The Revenues of the Municipalities

Transfers and grants $P1$, tax revenues $P2$ and non-tax revenues $P3$, credits and loans $P4$ are the basic groups of the municipalities' revenues. We can note revenues as a set P_M containing these groups of above-mentioned revenues $P_M = \{P1, P2, P3, P4\}$, more about financing of public administration in Czech Republic, public service financing and financial system is for example in [5, 13, 14] .
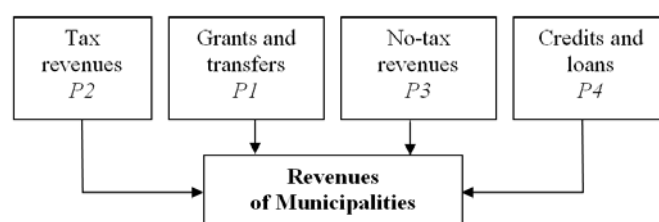

Fig. 4 Basic groups of the municipalities' revenues

Tax revenues $P2$ are one of the most important revenues of Czech municipalities. They consist of shared and entrusted taxes and influence the financial stability of municipalities.

The shared taxes decrease a fiscal unbalance among the territorial (local) self-governments. The municipality or region makes decision about their usage. The state and local self-government share the same tax base.

A tax calculation is statewide determined on the base of the related tax Acts and territorial self-governments can not influence it. The Act determines the share of municipalities on statewide collected taxes (the municipalities – 21.4 %, regions 8.92 %). By calculation of percentage s_1 that determines share of e Czech municipalities of national gross yield (NGY) of tax it is considered four big municipalities o_d for $d = 1, 2, 3, 4$ (there are Prag o_1, Plzen o_2, Ostrava o_3 and Brno o_4) and the rest of municipalities o_d for $d = 5, 6, …, e$. This percentage s_1 for the rest municipalities is calculated by [25] by following formulas and criteria:

$$s_1 = \left(\frac{KV_d}{\sum_{d=1}^{e} KV_d} 100 \right) 0.03 + \left(\frac{PO_d}{\sum_{d=1}^{e} PO_d} 100 \right) 0.03 + \left(\left(\frac{\alpha_{ld}}{\sum_{d=1}^{e} y_{ld}} 100 \right) 0.94 \right) ts, \qquad (1)$$

where KV_d is cadastral area of municipality o_d for $d = 1, 2, …, e$ (criterion 1), PO_d is number of inhabitants in municipality o_d for $d = 1, 2, …, e$ (criterion 2), α_{ld} is multiple of gradation for municipality o_d for $l = 1, 2, 3, 4$ taken values by [25] and $i = 5, 6, …, e$ (criterion 3), ts is total percentage with that the rest of municipalities participates on the part of the NGY. It is possible to determine by the following formulas:

$$ts = \frac{\beta_5 \sum_{d=5}^{e} PO_d}{\beta_1 PO_1 + \beta_2 PO_2 + \beta_3 PO_3 + \beta_4 PO_4 + \beta_5 \sum_{d=5}^{e} PO_d}, \qquad (2)$$

$$ts = \frac{\beta_5 \sum_{d=5}^{e} PO_d}{\sum_{x=1}^{5} \sum_{d=1}^{e} \beta_x PO_d}, \qquad (3)$$

where β_5 is rate for conversion for the rest of municipalities and β_q for $q = 1, 2, 3, 4$ are values of rates for conversion for big municipalities (Praha o_1, Plzeň o_2, Ostrava o_3 a Brno o_4) by [25].

The percentage s_2, that determines share of big municipalities Prag o_1, Plzen o_2, Ostrava o_3 a Brno o_4 to proportional part of the NGY of tax it is possible to calculate by this following formula:

$$s_2 = \left(\frac{KV_d}{\sum_{d=1}^{4} KV_d} 100 \right) 0.03 + \left(\frac{PO_d}{\sum_{d=1}^{4} PO_d} 100 \right) 0.03 + \left(\frac{\beta_q PO_d}{\sum_{q=1}^{5} \sum_{d=1}^{e} \beta_q PO_d} 100 \right) 0.94 \qquad (4)$$

where b_q for $q = 1, 2, 3, 4, 5$ rate for conversion for municipalities o_d, KV_d for $d = 1, 2, 3, 4$ is cadastral area for the big municipalities o_1, o_2, o_3 and o_4, and PO_d for $d = 1, 2, 3, 4$ is number of inhabitants in municipality o_d, more in [24, 25, 26]. This share is their revenue.

There are two types of the share taxes allocation [14]: derivational and no derivational types. The second type is typical for the Czech Republic. The share is determined from total revenues of tax and divides by a criterion or criterions, for example number of people lived in municipality or cadastral area of the municipality.

For example personal income tax and value added tax (VAT) belong to the share taxes in the Czech Republic.
Because about their usage self-governments (municipalities and regions) decide, they support decentralization and an increase of responsibility relative to their usage.

In accordance of their usage the shared taxes have form of a general (unconditional) grant but the difference is that in case of worse economic process the level of share on tax yield has not to be filled.

In some countries they are known as transfers and are not part of tax revenues of the territorial self-governments.

By [14] it is possible to find different opinions what are transfers (grants) and what are tax revenues. Grants to the municipalities and regions are internal transfers.

Unclearness is in case of the share tax. If the territorial self-government can influence either a tax rate or the tax base of the tax it is the tax revenue. If higher level of the government has influence and control the tax rate or tax base and collected revenues are only relocated (the shared taxes) or allocated it is transfer.

Grant transfer spending power form one government to another. Grants can reduce the problems created by fiscal disparity, and reduced special problems associated with regional economic decline etc. Basic types of grants are for example categorical and bloc grants.
Categorical grants finance specific and narrowly defined programs, usually limited to spending for certain activities. In [9] are these types of categorical grants:

- Formula (in which aid is distributed according to a legislatively or administratively determined formula. Formula elements may include: population, population in certain demographic categories, per capita income, unemployment, housing categories, energy use, highway lane miles etc.;
- Project (in which aid is distributed at the discretion of the administrator for particular project. These grants are usually awarded on a competitive basis from applications made to support a particular proposal from a local government or other entity);
- Project/formula (in which aid is distributed at the discretion of the administrator within constraints set by a formula that limits amounts awarded in an area.

Projects are evaluated on the specific factors and criteria, such as the creativity on novelty of the project approach or the possibility that results may be used elsewhere. Selection criteria and weighting among factors is usually published with program announcements. In [9] we can find particular difficulties of this categorical grant system.

Block grants are usually distributed to general-purpose government according to a statutory formula to finance activities in a broad function area. Recipients have considerable discretion in how to spend the money. Among the features of these grants are that [9] "aid is authorized of a wide range of activities within a broadly defined function area; recipients have substantial discretion to identify problems, design programs, and allocate resources; administrative, fiscal reporting, planning, and other imposed requirements are limited to those necessary to ensure that national goals are being accomplished; aid is distributed on the basis of statutory formula with few, if any, matching requirements and, historically, spending has been capped".

3 The Grant System of the Czech Municipalities

Typology of grants that is typical for the Czech Republic we can see for example in [13, 14].

There is dividing of categorical (purpose) grant into grant with and without a financial participation.

This grant with the financial participation forces the territorial self-governments to be more responsible for their expenditures and to increase their own incomes. Furthermore we can divide grant by the way of a grants acquisition and in practice clerks works with capital (for investment) and common grants, too. Elements of decentralization respect more block grants. However, for their usage we need transparent and stable system of criteria (for allocation of grants).
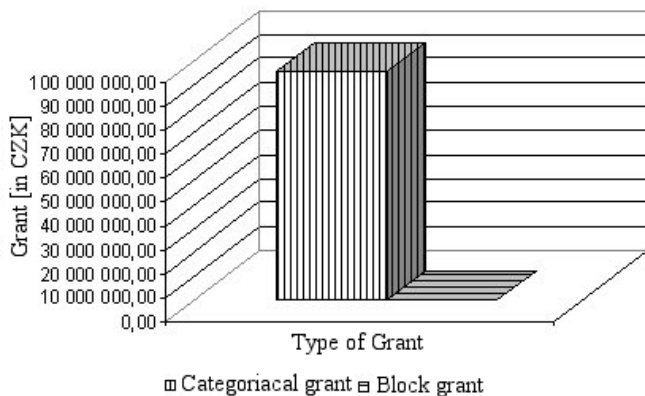
Fig. 5 Grants in 2007 in the municipality

However, nowadays in the Czech Republic categorical grants are poured into municipalities. For example we can see it in the Fig. 5. (There are the categorical grants 82 060 548 CZK and block grants 305 000 CZK in one of the Czech municipalities in 2007. About 100 000 inhabitants live there). Most of categorical grants finances repeated expenditures that are connected with a delegacy of providing some services only partially. These grants cover only the social security benefit expenditures. It motivates the municipalities to an expenditure good management; on the other hand this type of grants (for example per inhabitant) does not motivate municipalities to an idle capacity accumulation [14]. The providing grant system is in the Fig. 6 and Fig. 7. Ing the Fig. 6 we can see process of realization grant on the basis of provider grant financial resources.

There are four elements: provider b_1 (donor) of grant (for example European Union, region, the state), the municipality b_2 (the Fig. 6), measurement b_3 and comparison b_4. Provider b_1 is the controller and municipality b_2 is controlled element of system. Elements b_3 and b_4 represent activities in the grant process.
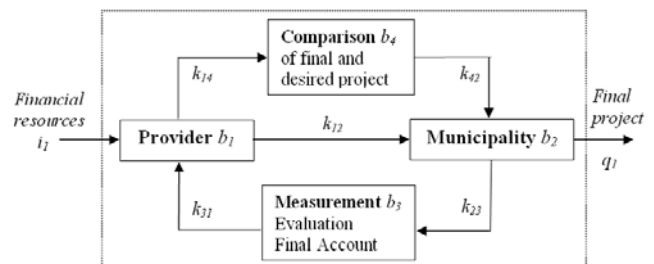
Fig. 6 Process of grant realization

By the system approach [1,19] it is possible to define this system S_1 as a set containing inputs I, outputs Q, elements B and set of relations $K=\{ k_{12}, k_{23}, k_{31}, k_{14}, k_{42}\}$ between them $S_1=\{I, B, K, Q\}$, where I is set of inputs $I = \{i_1\}$, B is set of elements $B = \{b_1, b_2, b_3, b_4\}$, and Q is set of system outputs $Q = \{q_1\}$.

If the municipality want to get grant it is necessary to fulfill needed criteria, e. g. Municipality's strategic plan, a size of a debt service.
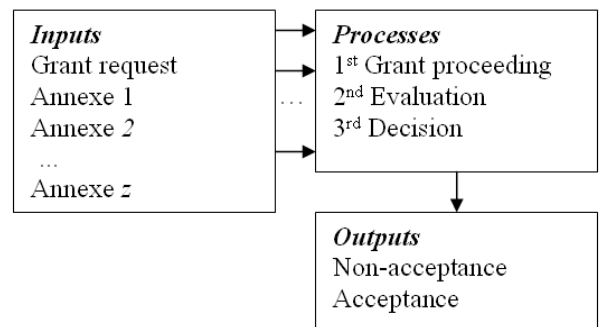
Fig. 7 The system of providing

If the municipality completes required criteria it can ask for grant. The municipality makes request with annexes to provider. In second step is grant proceeding. Result is an acceptance or non-acceptance of grant request. On the basis of positive result contract between the municipality and provider is made. The contract contents contractors, subject of the contract, financial conditions, consequences of non-performance of the contract and final provision. Afterwards it is possible to use of financial resources and to realize the project. The last steps are an evaluation of project and final account.

Disadvantage of this type of grant is necessity to use financial resources only to exactly defined aim. Under-used grant municipality can not use otherwise.
In the Czech Republic the situation in the grant system (regarding both types of grant: block and categorical) is not too transparent.

In European Union countries is trend to use block grants. Necessary of public services indicators and standards for grant providing is underlined.

By the system approach [19] it is possible to define this system S_2 as a set containing inputs I, outputs Q, processes P and relations K between them $S_2 = \{I, PR, K, Q\}$, where I is set of inputs $I = \{i_1, i_2, ..., i_z\}$ and where i_1 is grant request, i_2 to i_r are annexes related with input i_1; P is set of processes $PR = \{p_1, p_2, p_3\}$, where p_1 is grant proceeding, p_2 is evaluation of grant proceeding, and p_3 is decision on the basis of previous processes; Q is set of system outputs $Q = \{q_1, q_2\}$, where q_1 is acceptance and q_2 is non-acceptance of the grant request. System output is depended on a result of decision making process.

5 Design of Grant Criteria Objectification Model

Therefore it is inevitable to define in this area a set of generalized criteria. Design of model to collection and objectification that will be realized is in the Fig. 8.

In this model we can see these eight steps. Firstly it is necessary to realize status quo analysis (present conditions of development). It contents study of many material about financing of municipalities, Acts and rules, financial reports, reports of Ministry of finance, state budget, budgets of municipalities etc.). Study of measurement of phenomena in public administration is part of this step, too. On the basis of the first step it is possible to create list of criteria and formulas. In order to data collection it is appropriate to create the questionnaire and realize a survey. Much information about creation good questionnaire and surveys and analysis of result including various methods we can find for example in [10, 21]. The survey will be focused to

selected Czech municipalities (number of Czech municipalities was 6249 in year 2006) and to applied criteria in this grant system. The results of survey will be evaluated and together other information will be fundament to create grant criteria objectification model. In this step will be used selected statistical methods and methods of computational intelligence, e.g. hierarchical cluster methods, neural networks, fuzzy inference systems, correlation analysis). Applications of these selected methods we can find for example in [3, 4, 6, 8, 20, 21]. The output of this model is design of applicable criteria in grant system of municipalities.
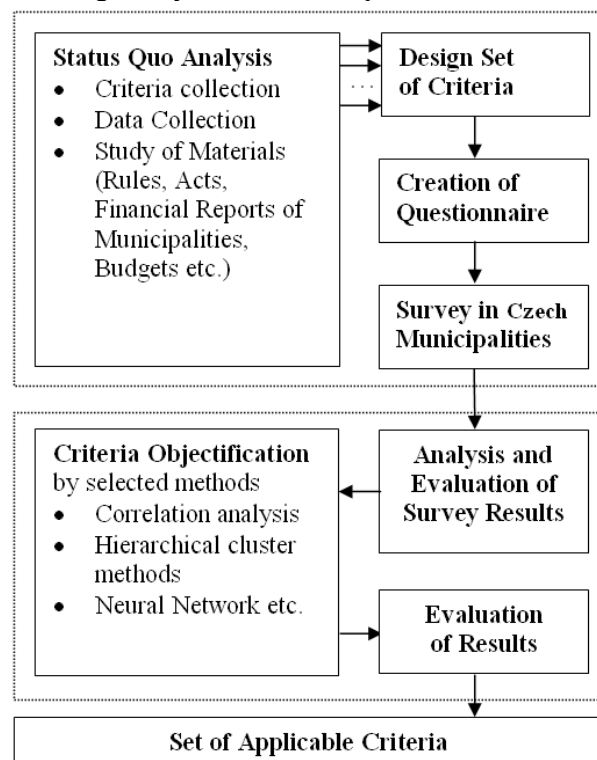
Fig. 8 Design of model

6 Case Study: AHP Method in Distribution of Grants

This case study shows a usage of AHP method in process of distribution of grants in the Pardubice region in the Czech Republic in order to an increase of a transparency in decision making process of officers.

6. 1 Decision Making

Decision making (DM) [2, 19] is a process undertaken by an individual and organization. The intent of this process is to improve the future position of the individual or organization in terms of one or more criteria. Most scholars of DM define this process as one that culminated in an irrevocable allocation of resources to affect some chosen change or the continuance of the status quo. Money is the most

commonly allocated resource. Goods and services, and the time and energy of talented people are also other scarce resources. [2]

Multiple criteria decision making (MCDM) refers to making decisions in the presence of multiple objectives. Multiple criteria decision problems pervade almost all decision situations ranging form common household decision to complex strategic and policy level decisions in corporations and governments. Analytic hierarchy process (AHP) [2] belongs to the multiple criteria decision making methods.

6.1.1 AHP Method

The AHP method points out to an effective decision under difficult situations. It is the method of analysis of difficult unstructured situation which separates the problem hierarchically into several different groups (also called levels, clusters, stratums) with easy elements so called hierarchy structure. Hierarchy is a particular type of system, which is based on the assumption that the entities, which we have identified, can be grouped into disjointed sets, with the entities of one group influencing the entities of only one other group and being influenced by the entities of only one other group [2]. The AHP [15] is possible applied to the easiest type of hierarchy structure of MCDM. We wish to find their weights of influence: the vector $w = \{w_1, w_2, \dots, w_m\}$ and the matrix $V = \{v_{11}, v_{12}, \dots, v_{1n}; v_{21}, v_{22}, \dots, v_{2n}; \dots; v_{m1}, v_{m2}, \dots, w_{mn}\}$ on some $A = \{a_1, a_2, \dots, a_n\}$; $C = \{c_1, c_2, \dots, c_m\}$. Basic problems of the method are [2, 7, 15]:

- Subjective evaluation of the pair wise comparison of the criteria, which assigns to individual components a numerical value. It expresses relative importance individual criteria by weights w_j and v_{ij}, where $i = 1, 2, \dots, n$ and $j = 1, 2, \dots, m$;
- Determine the judgment of the selection of alternative a_i with the highest priority on the basis of the multiplication i-row of the matrix V and the vector w: $a_i = \{v_{1i}, v_{2i}, \dots, v_{mi}\} \cdot \{w_1, w_2, \dots, w_m\}^T$.

The algorithm of AHP consists of following steps:

The 1st step: Define of the hierarchy structure HS of system by the following way: $HS = \{L_k\}, k = 1, 2, 3,$ where: $L_1 = \{g\}$ is the global goal of decision; $L_2 = \{c_1, c_2, \dots, c_m\}$ are criteria and $L_3 = \{a_1, a_2, \dots, a_n\}$ are alternatives (low level of the hierarchy structure).

The 2nd step: Define the Saaty's matrix $S(m \times m)$ of the pair wise comparison of the criteria. This matrix S is positive and reciprocal:

$$S = \begin{vmatrix} s_{11} & s_{12} & \dots & s_{1m} \\ s_{12} & s_{22} & \dots & s_{2m} \\ \dots & \dots & \dots & \dots \\ s_{m1} & s_{m2} & \dots & s_{mm} \end{vmatrix} \qquad (5)$$

Any set S is a binary relation, which satisfies the reflexive, anti-symmetric and transitive law. The matrix has elements s_{ij}, where:

$$s_{ij} = w_i / w_j, s_{ji} = 1 / s_{ij}, s_{ii} = s_{jj} = 1. \qquad (6)$$

Saaty's scale of relative importance was used for assigning the values of matrix elements s_{ij} (Table 1).

Table 1 Saaty's scale of relative importance

Number ≈ Intensity of relative importance definition
1 ≈ Equal importance
3 ≈ Weak importance (of one over the other)
5 ≈ Strong importance
7 ≈ Demonstrated importance (of one over the other)
9 ≈ Absolute importance
2, 4, 6 and 8 ≈ Intermediate values between 1, 3, 5, 7 and 9

The 3rd step: Calculate the largest eigenvalue λ_{max} and eigenvector $\sigma = \{\sigma_1, \sigma_2, \dots, \sigma_m\}$, $\sigma_i \geq 0$ of the matrix S and vector of weights $w = \{w_1, w_2, \dots, w_m\}$ on the basis of formula:

$$S \cdot \sigma = \lambda_{max} \cdot \sigma \quad \text{and} \quad w_i = \sigma_i / \sum_{j=1}^{m} \sigma_j. \qquad (7)$$

We take the consistency index (CI) as our indicator of „closeness to consistency" by the following way: $CI = (\lambda_{max} - m)/(m-1)$. Generally, if this number is less than 0.1, we may be satisfied with our judgment.

The 4th step: Create new values $*r_{ij}$ for maximum or minimum criteria C by the following way:

$$^*r_{ij} = r_{ij} / \sum_{i=1}^{n} r_{ij} \quad \text{or} \quad ^*r_{ij} = (1/r_{ij})/(1/\sum_{i=1}^{n} r_{ij}) \cdot \qquad (8)$$

The 5th step: On the basis of principle of hierarchy composition compute v_{ij} as element of the matrix V. We have to define of the Saaty's matrix $S_i(n \times n)$, where $i = 1, 2, \dots, m$ for the pair wise comparison of the values of "normalization" criteria and alternatives A. Calculate the largest eigenvalue λ_{max} and eigenvector $\sigma = \{\sigma_1, \sigma_2, \dots, \sigma_m\}$, $\sigma_i \geq 0$ of the matrix S_i and vector of weights v_{ij} on the basis of formula (5) and CI_j.

The 6th step: Compose weights for alternatives a_i in the hierarchy H and CI_H of the hierarchy by the following way:

$$^*a = max\{a_i\} = max\{\sum_{j=1}^{m} v_{ij} \cdot w_j\}, i = 1, 2, \dots, n$$

$$\text{and } CI_H = max\{CI, \sum_{j=1}^{m} w_j \cdot CI_j\}. \qquad (9)$$

6. 2 Grants of the Pardubice Region

Pardubice region (Pr) has an area 4 519 km^2, more than 505 thousand inhabitants live over here and an average

population density is 112 inhabitants per 1 km^2. There are 451 municipalities in the region.

Grants are financial resources provided as categorical grants from the budget of Pr. They are provided on the basis of programs announced by the council of Pr (CPr). Departments of the Regional authority suggest a content of programs under the budget process [11]. They result from:

- needs of regions and subjects in the regions;
- possible legislative adjustments and restrictions;
- possibilities of the budget of Pr in given calendar year.

Within an administration of programs "Principles for distribution of grants from the regional budget" (principles) were created. They content basic rules for an enunciator and applicant. Programs and principles are recently stable.

6. 3 Support of Development Projects Realization in Problem Micro-regions of the Pardubice Region

The goal of the program with title *Support of development projects realization in problem micro-regions of the Pardubice region* (program Nr. 5) is to support a common disparities reduction in development of micro-regions in the Pardubice region. Program is focused on favorable conditions creation for an enterprise and an employment increase by construction of infrastructure. The financial resources can be used to an acquisition of a long-term tangible property or intangible property, reconstruction and modernization of property.   It contents [12]:

- a reconstruction or modernization of buildings and their use to an enterprise;
- a construction of buildings and their use to an enterprise;
- a construction and reconstruction of a technical infrastructure useful to an enterprise and a use of areas (after an investment) to an enterprise;
- an establishment of premises for trading and also other services.

Minimal size of support per one grant request is 20 000 CZK and maximal is 1 000 000 CZK. These financial resources may not be greater than 50 % of total acceptable costs of project.

Within the frame of the first phase of this grant program an applicant can get support for more projects (but he has to state a priority of individual grant requests; preferentially the applicant gets financial resources there, where is grant request with priority 1). Local authority of Pr decides about grant request on the basis of proposal

from the CPr (this proposal CPr makes by recommendation of commission established by CPr).

Information about decision is only delivered to successful applicants [12].

By the Fig. 7 a decision making process is based on principles, criteria, binding limits, knowledge and experiences of decision makers.

6. 3. 1 Criteria

Criteria for support of development project realization in problem micro-regions of Pr it is possible to write down as a set of criteria *C* (there are *basic criteria*; if one of this criterion is not completed, project is eliminated (criterion „priority" is an exception); and *specific criteria* (by them it is solved an allocation of financial resources (grant project) to applicant and a size of these resources.

After an assessment (an evaluation) of basic criteria projects are rated by the values of specific criteria. Basic and specific criteria are in [12]. Decision making process about projects by the specific criteria is based on a subjective assessment (approach to an evaluation) of decision makers.

6. 3. 2 Alternatives

In a set of alternatives *A* (variant, elements) can be various elements that it is possible to compare. In our case municipalities are applicants. The set $A = \{a_1, a_2, a_3, a_4, a_5, a_6\}$ contents 6 alternatives (in the Table 2). Many applicants asked the support in the year 2007 in terms of program nr. 5, but only 6 applicants it was choose. Desired size of financial resources (6 projects) was 3 708 000 CZK.

Table 2 Applicants (municipalities), modified by [11]

Alt.	Applicant	Project	G1 in [CZK]	G2 in [CZK]	G3
a_1	Červená Voda	T_1	968 000	484 000	1
a_2	Červená Voda	T_2	968 000	484 000	2
a_3	Bystré	T_3	1 886 417	940 000	1
a_4	Borová	T_4	2 257 379	1 000 000	1
a_5	Mladějov na Moravě	T_5	400 000	200 000	1
a_6	Brněnec	T_6	1 200 000	600 000	1

Note: where T_1 is an establishment of offices for accounting and consulting firms and firm for a housing stock administration in Červená Voda nr. 268; T_2 is an establishment of snack bar including of reconstruction of building nr. 421 in Červená Voda; T_3 is a reconstruction of building nr. 340; T_4 is a construction work of building nr. 60, Borová; T_5 is a public lighting extension in municipality

Mladějov na Moravě to firm KERAMS-PAL, Limited; T_6 is a access path reconstruction to lumbering company in Brněnec; G1 are expected total costs of project in CZK; G2 is desired size of grant in CZK, G3 is priority of grant request.

6. 3. 3 Decision Making of Commission About Distribution of Grant

By decision making of the commission (1 chairman of commission and 6 members) decision making methods are not used and criteria are not evaluated by points. Decision making process is realized in several steps.

Firstly:
- one member describes strong and weak points of project on the basis of criteria and mistakes;
- he indicates projects to disqualification.

Secondly the commission deals with all projects (grant request) and suggests the size of financial resources. Basis for decision is a subjective assessment, knowledge of area and previous experience with an applicant. Optimal applicants obtain 100 % desired grant mostly; in some cases it is possible grant cutting (reduction) e.g. to 60 %. It results from a size of budget to this program (nr. 5). The reduction of size of desired grant is no more than   to minimal desired financial resources.

An approval of a selection procedure result is the next step in this process. It is necessary the approval of an absolute majority of attendees in commission. A proceeding (it is recommendation to CPr) is made. It is part of a report to the CPr. The CPr on the basis of this proceeding files proposal to the allocation of financial resources in term of grant request to Local authority of Pr. Decision of the commission is in the Fig. 9.
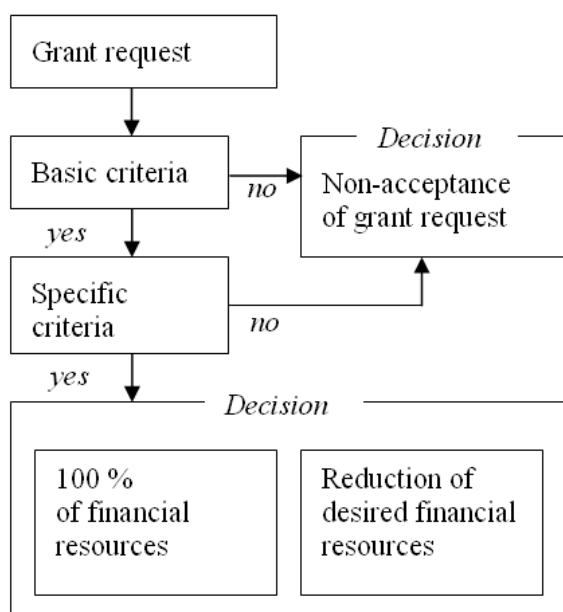

Fig. 9 Decision of commission

6. 3. 4 Proposal of the Solution

We can say, today a way of decision making about allocation financial resources in terms of regional grants is not too transparent. Therefore it is appropriate to use decision making methods in this process in order to better transparency in distribution of grants.

Table 3 Decision table

Alternative a	Criterion c								
	c_1	c_2	c_3	c_4	c_5	c_6	c_7	c_8	c_9
a_1	10	6	9	3200	7	6	10	2	4
a_2	6	3	8	3200	7	3	9	3	3
a_3	7	5	9	1700	7	4	10	2	4
a_4	8	7	10	1000	8	5	10	2	4
a_5	8	8	10	500	7	3	10	3	4
a_6	7	3	7	1400	4	3	8	3	4

In our case (in our proposal) the decision table (Table 3) is the basis. It is created from values that were assigned by the set of criteria $C = \{c_1, c_2, c_3, c_4, c_5, c_6, c_7, c_8, c_9\}$ to applicants in the year 2007 (they fulfilled basic criteria). The contents of criteria are following: where c_1 is an interconnection and applicability proposed activities, quality of project; c_2 is a demonstrable interest of a private sector about activity in constructed premises and pieces of land; c_3 is a meaning (importance) of project by a standpoint of positive modification of some indicators on the basis of them a region was included in to regions with a concentrated support; c_4 is a size of target touch group of people that it will be to relate to project realization; c_5 is a feasibility and readiness of project; c_6 is a micro-regional and regional impact of project; c_7 is a sustainability of projects (prospective financing of project after an expiration of grant); c_8 is a use of an existing building; c_9 is the priority of the project. The set of criteria C contents all specific criteria $c_1, ..., c_8$ and one of basic criteria c_9.

Criteria c_1, c_2, c_3, c_5, c_6 a $c_7,$ can take values from 1 to 10 (it means, if the value is bigger, it is better; the applicant fulfilled the criterion better; the best value is 10 and the worst value of criterion is 1). A rounded-off value to hundreds is by criterion c_4. The criterion c_8 can take values from 1 to 3, where value 1 is an existing building is not used, value 2 it is not much used and value 3 is an existing building is fully used or it is not a building. The criterion c_9 is value 5 minus a number of priority of the project (e. g. priority is 1, than value of criterion c_9 is 5 – 1 is 4).

Model of the decision making process is in the Fig. 10.

Alternatives
$A = \{a_1, a_2, a_3, a_4, a_5, a_6\}$ *Grant requests*

...

Criterion
$C = \{c_1, c_2, c_3, c_4, c_5, c_6, c_7, c_8, c_9\}$

...

Methods
AHP method and Expert evaluation
(Subjective evaluation based on experiences, knowledge and other factors)

Desired goal
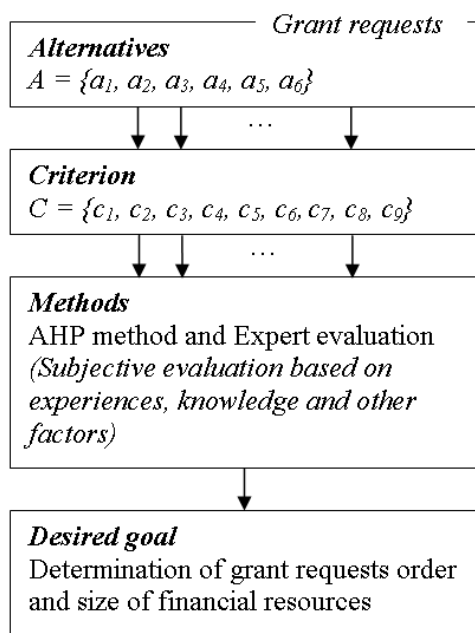Determination of grant requests order and size of financial resources

Fig. 10 Model of decision making process

Solution by the AHP method: On the basis of steps in the chapter 6. 1. 1, we have these resulting values of variants (Table 4 and the Fig. 12).

To calculation of weights of criteria it was used the exact procedure (method) based on the calculation of matrix eigenvector of relevant importance.

In the Fig. 11, we can see the criterion c_1 with value 0.31. This one achieved the biggest weight by calculation of the distribution of grants. On the contrary criteria c_8 and c_9 have the fractional influence.

Table 4 Values of alternatives

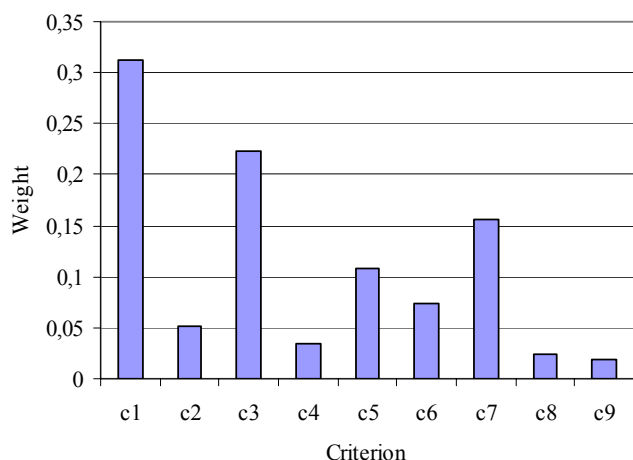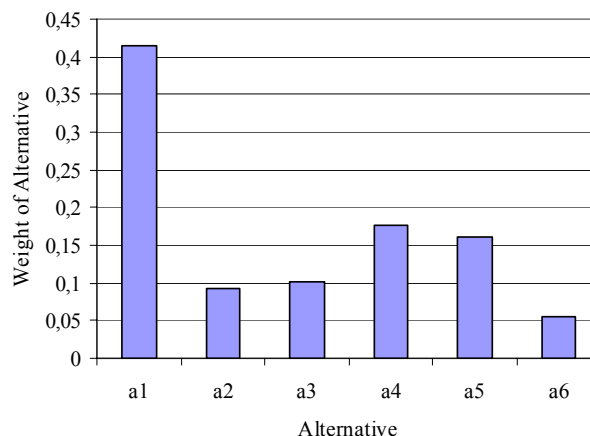| a_1	a_2	a_3	a_4	a_5	a_6
0.4142	0.0932	0.1004	0.1761	0.1615	0.0547

Fig.11. Weights of criteria

Fig. 12 Values of alternatives

The alternative with the biggest weight was selected as the best. In the Fig. 12, we can see the alternative a_1 (Červená Voda) complies used criteria by use of the AHP method best (weight is 0.41). Alternative a_4 (Borová) is second (weight is 0.18). The weight (0.06) of the alternative a_6 (Brněnec) is the worst. Output The resulting order of all alternatives is the following: a_1, a_4, a_5, a_3, a_2 and a_6.

The proposal of the distribution of grants on the basis of the AHP method is following:

- All applicants obtain 100 % of desired financial resources (minimally 20 000 CZK and at the most 1 000 000 CZK), it may not be greater than 50 % of total acceptable costs of project.

- If total sum of desired financial resources is greater than a given limit specified for the program Nr. 5 (in the year 2007 it was 2 200 000 CZK) then to give 100 % of desired financial resources to the applicant that is the first in the resulting order achieved by the calculation based on the method AHP (in our case it is a_1 Červená Voda).
  Then to give 100% size next applicant in the order (in our case it is a_4 Borová) and to divide financial resources (grants) until total sum (2 200 000 CZK) will be exhausted. It means, the last applicant (in our case it is a_3 Bystré) does not obtain 100 % of desired financial resources with a high probability but he can not get less than is minimal desired financial resources. Results are in the Table 5.

- If some grant request is overvalued it is possible to reduce desired financial resources from 100 % to less but only with a valid reasons; financial resources after reduction may not be less then minimal desired financial resources.

Recommendation to an increase of the transparency:
- to give information to all applicants, it means not only to successful applicants and

- to inform about a reason why they have not obtained grant (in the case of future grant request applicants can correct mistakes and opacities).

Table 5 Draft of distribution of financial resources

Alt. a	Project	G4 in [%]	G5 in [CZK]	G6 in [CZK]	G7 in [%]
a_1	T_1	50	445 000	484 000	100
a_2	T_2	50	428 000	0	0
a_3	T_3	50	500 000	516 000	54.89
a_4	T_4	44	1 000 000	1 000 000	100
a_5	T_5	50	150 000	200 000	100
a_6	T_6	50	500 000	0	0
Sum				2 200 000	

Note: G4 is a desired size of grant request (%), max. 50 %; G5 is a minimal desired size of grant request; G6 is an approved grant request in CZK; G7 is an approved grant request (% from desired grant request).

7 Conclusions

The regions have restricted competency in decision making and have to respect decisions of government and use grants by the strictly determined aim. Nowadays is pursuit of an increase of block grants usage and approximate to European Union. The goal is to strengthen competency in decision making of the territorial self-government regarding to way of block grant usage.

Decision making is a process leading to the selection among several alternatives and every decision making process produces a final choice. Many decision makers are interested in methods, methodologies and models of decision making in order to a simplification of decision making process.
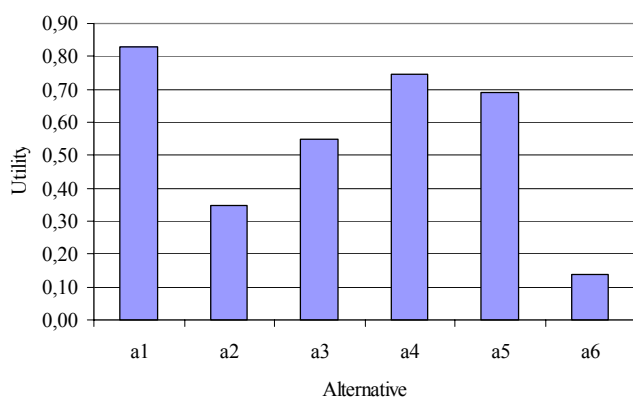

Fig. 13 Utility of alternatives, modified by [18]

In this case study the distribution of grants (in terms of grant program Nr. 5) was solved. The AHP method

was applied. In the Fig. 12, we can see, the alternative a_1 (Červená Voda) is the best by values of specific criteria and also the alternative a_4 (Borová). The alternative a_6 (Brněnec) is the worst by given set of specific criteria. In order to a comparison a weighted sum method was used (the Fig. 13). It was achieved an identical position (order) of alternatives [18].

8 Acknowledgement

References:

[1]   Dorf, R. C., *Modern Control Systems,* Addison-Wesley Publishing, 1990.

[2]   Gass, S.I., Harris, C.M., *Encyclopedia of operations research and management science,*Kluwer Academic Publishers, 2004.

[3]   Han, J., Kamber, M. *Data Mining: Concepts and Techniques*, Morgan Kaufmann Press, 2001.

[4]   Jirava, P., Křupka, J., Classification Model based on Rough and Fuzzy Sets Theory, *WSEAS Computational Intelligence, Man-Machine Systems and Cybernetic,* 2007, pp. 199-203.

[5]   Kašparová, M., Prediction Models Analysis of Financing of Basic Transport Services. *WSEAS Transactions on Systems*, vol. 5, no. 1, 2006, pp. 211 - 218.

[6]   Kašparová, M., Křupka, J., Classification and Prediction Models for Internal Population Migration in Distrists. *WSEAS Transaction on Systems*, Vol.5, WSEAS Press, Athens New York, 2006, pp.1540-1547.

[7]   Křupka, J., Olej, V., *Analytic Hierarchy and Fuzzy Analytic Hierarchy Process Application in Military Systems*, Proc. of the 8th International Mendel Conference on Genetic Algorithms, Optimization Problems, Fuzzy Logic, Neural Networks, Rough Sets, MENDEL 2002, Brno, 2002, pp. 239-243.

[8]   Křupka, J., Olej. V, Obršálová, I., Multiple Criteria Decision Making in Environmental System. *WSEAS Transaction of Systems,* vol.5, no.1, 2006, pp.148-155.

[9]   Mikesell, J., *Fiscal Administration: Analysis and Applications in the Public Sector,* Thomson Wadsworth Publishing, 2007.

[10] O' Sullivan, E., Rassel, G.R., Berner, M., *Research Methods for Public Administration,* Pearson Longman, 2008.

[11] *Pardubický kraj.* [on-line], URL <http://www.pardubickykraj.cz> [cit. 2008-02-26].

[12] *Pardubický kraj. Program č. 5 - Podpora realizace rozvojových projektů obcí v problémových mikroregionech Pardubického kraje* [on-line], URL<http://www.pardubickykraj.cz/ dbOther.asp?category=633&thema=2703&item=3 8128> [cit. 2008-02-15].

[13] Peková, J., *Hospodaření a finance územní samosprávy,* Management Press, 2004.

[14] Provazníková, R., *Financování měst, obcí a regionů: teorie a praxe,* Grada, 2007.

[15] Saaty, T. L., *The Analytic Hierarchy Process,* McGraw-Hill Int. Book Company, New York, 1980.

[16] Shafritz, J. M., Russell, E.W, Borick, Ch. P., *Introducing Public Administration,* PEARSON Longman, 2008.

[17] Skulová, S., *Základy správní vědy,* Masarykova univerzita, 1998.

[18] Sockelová, I. *Modelování rozhodovacích procesů přidělování dotací v rámci územní samosprávy.* [thesis], UPa, Pardubice, 2008.

[19] Turban, E. et al., *Decision Support Systems and Inteligent Systems,* Prentice Hall, 2005.

[20] Witten, I. H., Frank, E., *Data Mining: Practical Machina Learning Tools and Techniques,* Morgan Kaufman, 2005.

[21] Yang, K., Miller, J. G., *Handbook of Research Methods in Public Administration,* CRC Press, 2007.

[22] *Zákon č. 129/2000 Sb., o krajích (krajské zřízení).*

[23] *Zákon č. 128/2000 Sb., o obcích (obecní zřízení).*

[24] *Zákon č. 218/2000 Sb., o rozpočtových pravidlech a o změně některých souvisejících zákonů (rozpočtová pravidla).*

[25] *Zákon č. 243/2000 Sb., o rozpočtovém určení daní.*

[26] *Zákon č. 250/2000 Sb., o rozpočtových pravidlech územních rozpočtů.*