A Research Proposal on the Parametric City Governance

Magdalena Wagner

Abstract The issue of spatial management and governance is currently one of major challenges of modern urban planning. Discourse on new ways of urban management gains new meaning and is in fact a discussion about the contemporary urban planners' skills and tools. The paper presents a concept and an initial phase of the research whose main objective is to develop methods that could aid local-level spatial planning and support rational choices. The research presented in the paper examines whether, and to what extent, methods derived from econometrics, operational research, and mathematics could be incorporated into spatial decision-making process. The potential of parametric governance is investigated in order to improve the effectiveness of decision-making in the area of city governance. The reflections presented in this study are, among others, focused on building a system that reflects the internal relations between decisions and projects in urban governance, which are a specific expression of the process of city management. Methods and techniques that would be used to assist the decision-making process in spatial planning should make the process more transparent, objective, and rational as the need to build a new and comprehensive system of urban management is (and will be) a particularly significant challenge in the coming years. The paper discusses the initial outcomes of the presented research and indicates challenges that will be addressed in the further work.

Keywords PROMETHEE · Multi-criteria decision analysis · Urban policy making · City governance

1 Introduction

The paper presents a research concept whose aim is to support spatial planning with innovative and comprehensive tools for the decision-making process. Therefore, the main objective is to develop methods that could aid the local-level spatial planning

M. Wagner (✉)
Wroclaw University of Technology, Wrocław, Poland
e-mail: magdalena.wagner@pwr.edu.pl

A. Bisello et al. (eds.), *Smart and Sustainable Planning for Cities and Regions*, Green Energy and Technology, DOI 10.1007/978-3-319-44899-2_12

and support rational choices. The issue of spatial decision-making has been raised in a number of scientific works, however, it seems fair to say that this matter has not been thoroughly investigated and resolved yet. Researchers usually pay attention to the conditions and environment of the decision-making process, but no comprehensive solutions have been proposed so far. The research would be checking whether, and to what extent, methods derived from econometrics, operational research, and mathematics could be incorporated into the spatial decision-making process. Problems and obstacles in the policy-making process should be identified and several solutions should constitute a new approach to the urban policy-making procedure. The paper presents the conceptual frame, discusses initial outcomes, and indicates future challenges for the research.

2 Research Questions

The issue of spatial management and governance is currently one of major challenges of modern urban planning. Discourse on new ways of urban management gains new meaning and is, in fact, a discussion about the contemporary urban planners' skills and tools. It also touches the issue of contemporary urban doctrine and its model. The term doctrine can be understood as values or objectives that we want to achieve while shaping space, as well as ways to achieve these goals (Lorens 2010). One of the key challenges is to define the modern urban doctrine so that it covers both the form and the manner of its formulation and decision-making. Lack of such a coherent approach weakens the position of urban planners and has a noticeable negative impact on spatial planning itself. During the 2nd Congress of Polish Town Planning in 2006, the participants stressed that the new doctrine "should consist of determining demands for the city form, ways of building that city (or, more broadly—manufacturing space), and ways of discussion and decision making on the guidelines and forms of urban development" (Lorens 2010). Understanding, improving, and modernizing the last component—ways of discussion and decision making—is the essence of the research. The need to build a new and comprehensive system of urban management is (and will be) a particularly significant challenge in the coming years.

A literature review and my own observations of planning practices indicate a lack of comprehensive and advanced tools that could support spatial decision making at the local level. The procedure of prioritizing spatial projects in a big city was described by Ossowicz (2003) who also paid attention to the use of mathematical analysis in urban policy making. He suggested that numerical models and analyses can and should be used when choosing urban activities pursuing strategy goals. However, to compare other approaches see Markowski (1999), Brol (2004), and Pęski (1999). Urban planners usually conduct complex spatial analyses, however, as Zeleny noticed (2011): "Decision making takes place only when multiple criteria *and* trade-offs are present. All the rest (single criteria, aggregates or utilities) are simply analysis, measurement and search, not decision making".

Therefore, it is crucial to adjust and apply comprehensive decision-support methods in the process of city policy formulation, as such an approach is currently missing.

There are several questions that have arisen during the research. The starting point is an evaluation of the policy-making procedure at the local level. What are the weaknesses of planning procedure and how the process could be improved? City authorities make efforts to choose the best options and goals, however, they may face difficulties when dealing with big data, limited resources, and conflicting actions. The role and importance of city governance in the light of growing uncertainty and fast changes are essential prerequisites to taking up this issue. Methods, which may help answering the question "what, where, and when should be built?", could significantly improve the quality of the decision-making process at the local level, and thereby positively affect the functioning of the entire city and its community.

Therefore, the second issue that should be addressed is an examination of potential solutions. An assumption was made that spatial governance could be supported by sophisticated mathematical formulas. The question is how it should be done? Which methods shall be used (and which shall be avoided)? Is multi-criteria decision analysis (MCDA) a good solution for urban planners? Answering these questions would enable the selection of the most suitable and accurate techniques for improving spatial decision making.

Another task of the research is to produce solutions that are applicable and repeatable. Could the selected methods be applied in real-world situations? Is it feasible to incorporate these tools into policy making? Would city authorities benefit from the research outcomes? It seems fair to say that addressing these issues is crucial for the work. The research shall make the decision-making process easier (for the decision makers) and more rational, and, therefore, approachable and convenient tools should be developed. Several methods should be studied in detail, then selection of the most adequate ones should be done, and finally these methods should be adjusted to the needs of spatial planning at the local level. A comprehensive set of tools and an advanced approach to solving decision problems in spatial planning could be a useful and original guidance for actors involved in urban policy making. The methods developed during the research would be transformed and presented as computer tools (a sort of matrices and decision trees, where mathematical formulas are hidden and the interface is user-friendly). It is a technical challenge to build a comprehensive set of spatial decision- support tools that would be user-friendly and complex at the same time.

The reflections presented in this study are, among others, focused on building a system that reflects the internal relations between decisions and projects in urban governance, which are a specific expression of the process of city management. Methods and techniques that would be used to assist the decision-making process in spatial planning should make the process more transparent, objective, and rational. Urban policy makers should make decisions responsibly with respect to:

- long-term local policy at the municipal level,
- resources available for development,

- forecasting market conditions in a given period of time,
- policies at national and regional levels and policies of neighbouring municipalities,
- attitude of the society to planned projects (Ossowicz 2003).

Finally, it seems fair to say that developing a comprehensive approach to deal with the complex spatial decision-making process could be a useful contribution in the, still not well-investigated, area of decision-making models in spatial planning.

3 Research Design and Methods

The decision-making process in spatial planning at the local level covers a broad spectrum of issues that are objectives of urban development policy. This challenge involves the need to consider such diverse and complex issues as, among others, housing, transportation, cultural heritage, environmental protection, quality of public spaces, economic activity, or safety. Moreover, it seems fair to say that there is a need to develop new solutions that will provide support for coordinated, rational, and transparent decision making under conditions of risk and uncertainty. Given these requirements, the structure of the research consists of three main parts.

The first part is the structure of spatial decision making at the local level (in Poland). Examination of existing decision-making procedures at the local level would be followed by a general evaluation of the process. References to theoretical and practical aspects would be made. Each step of city policy making would be described and investigated. Weaknesses and "gaps" would be identified as spaces for new solutions which shall be developed in the research. In the process of urban policy making, several steps can be distinguished: complex analyses are followed by formulation of a vision, mission, and main objectives; then operational tasks are identified; and finally projects/activities pursuing these goals are recognized. This procedure is connected with constructing the balance of resources and time schedule of urban projects (Ossowicz 2003). Between these elements several complex interrelationships, feedbacks, and correlations could be identified. Attention should be paid to a relatively large number of bodies, institutions, and groups involved in the decision-making process and the fact that the interests of these parties may sometimes be in conflict. This part of the research would focus, in particular, on:

- the essence of city governance: definitions (city management, city governance, spatial policy, urban policy, etc.), features of governing, city governance in the light of organization and management theory, uncertainty and risk in spatial planning;
- local government: its role and tasks, structure, features, and management instruments;

- urban planning: actors, features and attributes of the local-level spatial planning, models of integrated planning in cities, and models of strategic planning (including models taking into account the specificities of public organizations management);
- city finances;
- controlling and monitoring.

The second part of the research would be a catalogue of possible solutions. Examination of decision-making tools would be followed by an evaluation of their potential for use in the area of spatial planning, regarding the "gaps" identified in the previous chapter. References to other disciplines would be made (i.e., economics, econometrics, mathematics, future studies, and decision theory). Within this subchapter, as a starting point, the decision theory and decision-making models are addressed and presented:

- the rational/classical model: assumes that an individual is always capable of saying which alternative he or she prefers. These preferences are assumed to be complete (a person can always say which of two alternatives he or she considers preferable or that neither is preferred to the other) and transitive (if option A is preferred over option B and option B is preferred over option C, then A is preferred over C). The rational decision maker takes into account available information, probabilities of events, and potential costs and benefits in determining preferences; he or she acts consistently (Tyszka 2004);
- the bounded rationality model: this model does not assume individual rationality in the decision process. Instead, it assumes that people, while they look for the best solution, normally settle for much less, because the decisions they confront typically demand greater information, time, processing capabilities than they possess. They settle for bounded rationality or limited rationality in decisions (Simon 1972);
- other methods and models: Pugh Matrix (also known as decision grid), multiple-step decision models, Vroom-Jago model, recognition-primed decision-making model (model of how people make quick, effective decisions when faced with complex situations), retrospective decision-making model (this model focuses on how decision makers attempt to rationalise their choices after they have been made and try to justify their decisions).

This subchapter would provide information about various approaches to the decision-making process. Given the data, it would be possible to develop framework for making the most rational, logical, and sensible choices in spatial governance with use of new tools (described in the next subchapters).

The second part of the "catalogue" would be devoted to multi-criteria decision analysis (MCDA). This issue is the main interest of the research. MCDA (multi-criteria decision analysis) or MCDM (multi-criteria decision making) is a sub-discipline of operational research and was developed in 1960s in the business sector. MCDA is used in the situation of having multiple, usually conflicting, criteria. Such situations we approach in everyday life, e.g. when choosing a car we take into account price, size, fuel consumption, safety, comfort, etc. Instead of following intuition, the decision-making process could be made more rational with use of the MCDA methods. The development of MCDA is related to computer development, which enabled decision makers to conduct complex analyses of multi-criteria problems. MCDA addresses mainly discrete ill-defined problems (no optimal solution) with not very large sets of alternatives. It can be used to conduct the following operations: choice, ranking, or sorting (Xu and Yang 2001). Therefore, it can be used to choose (e.g. the new location for an investment, a team of workers, an investment plan), rank (e.g. cities, regions, universities, students), or sort (e.g. research projects, cities). MCDA problems could be described with the use of a decision matrix with a set of alternatives a_i, i = {1,…m} and criteria g_j, j = {1,…n}. Three types of tasks/systems can be distinguished: deterministic, stochastic, and fuzzy. In the deterministic system, there is a finite set of possible discrete controls, and $v_j(a_i)$ is a performance value of alternative a_i on criterion g_j. In the case of the stochastic system, the transition function relies on conditional probabilities of accessing some state and is a matrix of probabilities (Stańczak 2005). In the fuzzy system, the performance value of an alternative is expressed by a triangular fuzzy number (Trzaskalik 2014). This subchapter compares several MCDA methods: their potential, scope, fields of application, data needed as input, number of decision makers, and the nature of criteria and alternatives. The research discusses methods based on estimating a value function and methods based on outranking relations. The first group consists of methods such as SAW (Simple Additive Weighting), Fuzzy SAW, AHP, ANP, MAUT, Goal Programming, etc. A value function can be used to derive preferences for the alternatives. To give an insight into these methods, just a few of them are described next:

- The Analytic Hierarchy Process (AHP) is based on mathematics and psychology. It is widely used to help decision-makers in the fields of business, transportation, and education. The most important feature is the group decision making, where each decision maker can have different priorities and values. The problem is decomposed into sub-problems. The pairwise comparison of various aspects of the problem and pairwise comparison of criteria are conducted independently. The decision makers can either provide concrete data or just use their individual and subjective judgement. Those evaluations are computed in order to obtain a comprehensive evaluation of the decision problem. The capability to compare incommensurable elements distinguishes the AHP from other MCDA methods (Saaty and Peniwati 2008). On the other hand, Ronen and Coman (2009) describe how the "valuable discipline of MCDM was abused by the Analytical-Hierarchy-Process (AHP)", and use MCDM as an example of analytical overdose—a "cumbersome and time-consuming process" (Zeleny 2011).
- The Analytic Network Process (ANP) is a generalization of the Analytic Hierarchy Process (AHP). The basic structure is an influence network of clusters and elements. Not all decision problems can be structured hierarchically because they involve the interaction and interdependence of elements. The ANP method

takes into account not only that the importance of the criteria determines the importance of the alternatives as in a hierarchy, but also the importance of the alternatives themselves determines the importance of the criteria (Saaty 2008).
- Multi-Attribute Utility Theory (MAUT) is an evaluation scheme which can be used to reconcile many interest groups.
- Goal Programming is a branch of multi-objective optimization. It is similar to linear programming but, instead of having one objective, goal programs can have several objectives; therefore it can be used if there is more than one objective to be achieved (e.g. minimizing cost, maximizing real-estate surface).

The second group (methods based on outranking relations) is widely known mostly for two approaches, i.e. ELECTRE and PROMETHEE. Outranking methods were first developed in France in the late sixties following difficulties experienced with the value function approach in dealing with practical problems. As in the value function approach, outranking methods build a preference relation among alternatives evaluated on several criteria. It is a binary relation S on the set X of alternatives such that xSy (x is at least as good as y), if there are enough arguments to declare that x is at least as good as y, while there is no essential reason to refute that statement. In most outranking methods, the outranking relation is built through a series of pairwise comparisons of the alternatives (Bouyssou 2001). ELECTRE I is the first outranking method, and it gives a good notion of the ideas behind outranking. Other outranking methods are more advanced as they accept differences in the strength of the decision maker's preferences as well as the possibility of the decision maker being indifferent with respect to two alternatives (de Boer et al. 1998). Another outranking method is PROMETHEE (and its descriptive complement geometrical analysis for interactive aid which is better known as GAIA). The fields of application are similar as in the aforementioned AHP technique. The main advantage of the PROMETHEE method is the clear reasoning which helps decision makers build well-structured framework for the decision problem. It is useful for solving complex problems with several criteria that need to be evaluated. The method could be applied to: choosing the best location for an investment, ranking action projects or investment plans, or allocating resources. The information requested by PROMETHEE and GAIA is particularly clear and easy to define for both decision makers and analysts. It is based on a preference function associated to each criterion as well as weights describing their relative importance. Usually there is no alternative optimising all the criteria at the same time, therefore a compromise solution should be selected (Brans and De Smet 2015). To give a better understanding of outranking methods, an example of using PROMETHEE II method is presented below.

If we consider buying a building plot, we take into account several attributes. For instance, we may consider the following criteria:

- f1—utilities/services (water, electricity, etc.)—if yes, then value 1; if not, then value 0;
- f2—price of a plot (thousands, PLN—Polish Zloty)
- f3—ground surface (square metres)

- f4—number of shops within d = 300 m
- f5—distance from city centre (kilometres)

PROMETHEE (as all outranking methods) can deal simultaneously with qualitative and quantitative criteria. Criteria scores can be expressed in their own units. We assume that the price of a plot and distance from city centre should be minimized and that the ground surface and number of shops should be maximized. In this example, we consider four alternatives ai, i = {1, 2, 3, 4}. The starting point is an evaluation matrix, which presents the performance of each alternative in relation to each criterion. Weights giving the relative importance of the criteria are given in the last row of the table (Table 1). Decision makers are required to weigh criteria and to choose a preference function. PROMETHEE does not provide specific guidelines for determining weights for criteria, but assumes that the decision maker is able to weigh the criteria appropriately, at least when the number of criteria is not too large (Macharis et al. 2004). For the purpose of this example, we use method PROMETHEE II for obtaining a complete ranking of alternatives.

Using the data contained in the evaluation matrix, the alternatives are compared pairwise with respect to every single criterion. The results are then calculated and expressed by the preference functions, which are calculated for each pair of options and can range from 0 to 1, where 0 means that there is no difference between the pair of options (indifference), 1 indicates a strong preference, and value between 0 and 1 indicates weak preference:

$$\mathrm{P_j(a, b) = F_j[d_j(a, b)]\ \forall a, b \in A}$$

where:

$$\mathrm{d_j(a, b) = g_j(a) - g_j(b)}$$

For criteria to be minimised, the preference function should be reversed or alternatively given by:

$$\mathrm{P_j(a, b) = F_j[-d_j(a, b)]}$$

In order to facilitate the identification of preferences, six types of particular preference functions have been proposed (see Fig. 1). In each case, 0, 1 or 2 parameters have to be defined, their significance is as follows:

Table 1 Evaluation table

Alternatives	Criteria				
	f_1	f_2	f_3	f_4	f_5
a^1	0	249	830	1	21.5
a^2	1	386	966	8	7
a^3	1	366	873	11	12
a^4	0	340	640	4	8
W_k	0.2	0.3	0.25	0.1	0.15

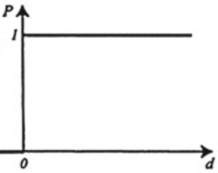
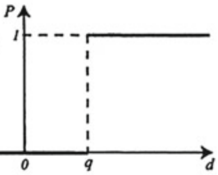
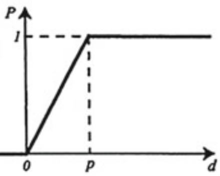
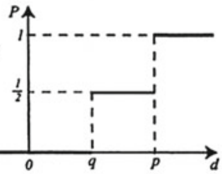
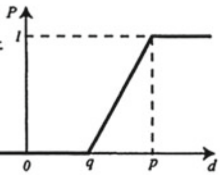
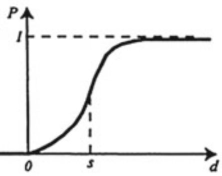
Generalised criterion	Definition	Parameters to fix
Type 1: Usual Criterion 	$P(d) = \begin{cases} 0 & d \leq 0 \\ 1 & d > 0 \end{cases}$	–
Type 2: U-shape Criterion 	$P(d) = \begin{cases} 0 & d \leq q \\ 1 & d > q \end{cases}$	q
Type 3: V-shape Criterion 	$P(d) = \begin{cases} 0 & d \leq 0 \\ \frac{d}{p} & 0 \leq d \leq p \\ 1 & d > p \end{cases}$	p
Type 4: Level Criterion 	$P(d) = \begin{cases} 0 & d \leq q \\ \frac{1}{2} & q < d \leq p \\ 1 & d > p \end{cases}$	p, q
Type 5: V-shape with indifference Criterion 	$P(d) = \begin{cases} 0 & d \leq q \\ \frac{d-q}{p-q} & q < d \leq p \\ 1 & d > p \end{cases}$	p, q
Type 6: Gaussian Criterion 	$P(d) = \begin{cases} 0 & d \leq 0 \\ 1 - e^{-\frac{d^2}{2s^2}} & d > 0 \end{cases}$	s

Fig. 1 Six types of preference function. *Source* http://brasil.cel.agh.edu.pl/~13sustrojny/promethee/#

- q is a threshold of indifference;
- p is a threshold of strict preference (Pj(a, b) = 1);
- s is an intermediate value between q and p.

In the example with the building plot, we use type 1 for the first criterion, namely f_1, and type 5 (with indifference threshold and preference threshold) for the rest. The preference degrees for each pair of alternatives on each criteria are presented below (Tables 2, 3, 4, 5 and 6).

Tables 2, 3, 4, 5 and 6 Preference degrees for every pair of alternatives

$$\pi(a_{x1}, a_{x2}) = \sum_{j=1}^{k} w_j P_j(a_{x1}, a_{x2})$$

Table 2 Preference degree for every pair of alternatives with respect to criterion 1

$G_1(d_1)$	a^1	a^2	a^3	a^4
a^1	0	0	0	0
a^2	1	0	0	1
a^3	1	0	0	1
a^4	0	0	0	0

Table 3 Preference degree for every pair of alternatives with respect to criterion 2; indifference threshold and preference threshold

$G_2(d_2)$	a^1	a^2	a^3	a^4	q_k	p_k
a^1	0	1	1	1	5	50
a^2	0	0	0	0		
a^3	0	0.333333	0	0		
a^4	0	1	0.822222	0		

Table 4 Preference degree for every pair of alternatives with respect to criterion 3; indifference threshold and preference threshold

$G_3(d_3)$	a^1	a^2	a^3	a^4	q_k	p_k
a^1	0	0	0	1	10	100
a^2	0.7	0	0.444444	1		
a^3	0.144444	0	0	1		
a^4	0	0	0	0		

Table 5 Preference degree for every pair of alternatives with respect to criterion 4; indifference threshold and preference threshold

$G_4(d_4)$	a^1	a^2	a^3	a^4	q_k	p_k
$a^{\mathbf{1}}$	0	0	0	0	2	6
$a^{\mathbf{2}}$	1	0	0	0.5		
$a^{\mathbf{3}}$	1	0.25	0	1		
$a^{\mathbf{4}}$	0.25	0	0	0		

Table 6 Preference degree for every pair of alternatives with respect to criterion 5; indifference threshold and preference threshold

$G_5(d_5)$	a^1	a^2	a^3	a^4	q_k	p_k
a^1	0	0	0	0	0.5	2
a^2	1	0	1	0.166667		
a^3	1	0	0	0		
a^4	1	0	1	0		

Next, global preference degrees are calculated for each pair of alternatives:

Finally, positive, negative, and net flow scores are calculated in order to obtain a complete ranking of alternatives. In the matrix of global preferences, the sum of the row expresses the strength of an alternative (dominance). The sum of the column expresses how much an alternative is dominated by the other ones (subdominance). A linear ranking is obtained by subtracting the subdominance-value from the dominance-value (Tables 7 and 8).

To sum up the procedure, we may distinguish three main steps:

- Step 1: compute unicriterion preference degree for every pair of alternatives;
- Step 2: compute global preference degree for every pair of alternatives;
- Step 3: compute positive, negative, and net flow scores.

In the example presented above, the best solution, according to the given criteria and their weights, is alternative a^2, followed by a^3, then a^1, and last one is a^4. The PROMETHEE methods (or outranking methods in general) could be used in various multi-criteria problems, such as ranking of investment plots (for various activities) or ranking of city development objectives/goals in the process of strategy making. The scope of the paper is to indicate possible applications of the selected methodologies. These techniques will be thoroughly investigated during further research; PROMETHEE is chosen and presented as an example, just to show its possible application and capabilities in the field of urban planning. It may not be the most suitable solution—it is too early to decide at this stage of the research, however, if the example presented above indicates that it may be a promising and helpful technique.

Other methods that may prove to be useful are those related to problem structuring, for instance the DEMATEL method. Decision Making Trial and Evaluation Laboratory (DEMATEL) is a robust analysis tool used for identification of cause-effect relationships (Fontela and Gabus 1974). It can be used for both tangible and intangible factors. The method is used to illustrate the interrelations among criteria and to find the central criteria to represent the effectiveness of

Table 7 Global preference degree

$\pi(a^i, a^j)$	a^1	a^2	a^3	a^4
a^1	0	0.300	0.300	0.55
a^2	0.625	0	0.261111	0.525
a^3	0.486111	0.125	0	0.55
a^4	0.175	0.300	0.397	0

Table 8 Final ranking (net outranking flows)

	φ^+	φ^-	φ
a^1	0.383	0.429	−0.045
a^2	0.470	0.242	0.229
a^3	0.387	0.319	0.068
a^4	0.291	0.542	−0.251

factors/aspects. In the field of spatial planning, it could be used to show relations between various urban activities/developments (compare with Ogrodnik 2015).

The third subchapter of the "catalogue" would be devoted to methods derived from econophysics, econometrics, mathematics, and other disciplines. Several methods and approaches would be examined to check whether (and to what extent) they could be useful in spatial planning:

- game theory is used to study economic behaviours, including behaviours of firms, markets, and consumers; it could be also used when looking for consensus between stakeholders or city policy goals;
- the Monte Carlo method, as in finances, could be used to value and analyse investments by simulating the various sources of uncertainty affecting their value, and then determining their average value over the range of outcomes (Jaeckel 2002);
- graph theory (mathematical structures used to model pairwise relations between objects; used to model many types of relations and processes);
- critical path analysis (CPM and PERT; for scheduling a set of project activities);
- Markov chains (for representing the decision-making process);
- decision trees (used to structure a strategy towards a goal);
- backcasting (derived from future studies, used to produce scenarios);
- correlation (Pearson, Kendall, Spearman);
- input-output model (for representing interdependencies between different branches of a city economy);
- numerical taxonomy (classification system that deals with the grouping by numerical methods);
- SWOT analysis (used to evaluate the strengths, weaknesses, opportunities and threats);
- several techniques used in business sector (e.g., cost-benefit analysis, Pareto principle and Pareto analysis, ABC classification, Eisenhower's matrix, NPV, ROI, etc.).

Given an evaluation of a city policy-making procedure and a collection of possible solutions (with respect to this procedure), an attempt could be made to develop comprehensive tool(s) for supporting the spatial decision-making process at the local level. If possible, each step of the planning procedure could be "equipped" with new and innovative tools supporting the decision-making process, therefore, traditional spatial governance would be mixed with computer-based methods and algorithms. The research would stress the most promising solutions that could be incorporated at each stage of spatial development, also with respect to spatial policy making at other levels. A general evaluation of the proposed set of tools could be conducted in order to identify strengths, weaknesses, and limitations that could be addressed in further research.

Analysis of the aforementioned issues would enable drawing conclusions about the possibilities of improving the decision-making process at the local level.

4 Expected Outcomes and Conclusions

The main outcome of the research would be a set of comprehensive and complex tools for supporting city policy making. A "parametric city-governance model", comprising innovative, computer-based methods with already existing spatial procedures, could be produced. The research aims at developing this issue. The vast catalogue of techniques and methods derived from various disciplines would be subjected to critical analysis with respect to their implementation in spatial-planning practice. The methods which would be discussed are subjects of interest of many researchers from such fields and disciplines as mathematics, operational research, economics, and econophysics. The scientific works from these disciplines describe in detail the proposed methods and techniques in terms of their theoretical fundamentals and possible applications. However, it seems that there is no work which combines spatial planning at the municipal level with these methods. In this respect, the research project has the ambition to present the possibility of using these methods in the city policy-making process.

Furthermore, the research would provide identification of strengths and weaknesses of traditional city governance, as the policy-making procedure would be examined in detail and step by step. Deliberations undertaken during the work would include the structure of creating local urban policies: formulating development goals, giving them certain weights, recognizing criteria for selection of priority axes, as well as relations between these objectives and criteria. A large number of decision makers involved in urban policy making and complex nature of the decision-making process make it difficult to avoid shortcomings or omissions in some areas. The research aims to identify and (where possible) to eliminate such "gaps".

Also, an evaluation of the offered solutions in terms of spatial planning may probably enrich the discourse about these techniques. The research would also raise a question (and an answer, to some extent) of how to combine and mix methods from various fields and disciplines. The research would also contribute to answering the question of whether selected techniques derived from other disciplines may be included in spatial-planning procedures. It seems fair to say that, while urban planners rarely decide to look far outside their own academic discipline in search of new tools, however, it may prove to be an effective and efficient solution that would not only improve the planning practice, but also have a rather positive impact on the discipline of architecture and urban planning. A comprehensive overview of methods and techniques supporting the decision-making process and derived from other disciplines should enrich the discussion on their capabilities and potential areas of application.

It seems fair to point out that most of city authorities can influence and determine urban development only to a limited extent, i.e. they establish a framework for other entities, but cannot guarantee that the proposed directions and instructions would be obeyed. Modern cities are built by many independent actors (both public and private) and public authorities face the challenge to appoint them reasonable and attractive conditions for activities and implementation of their projects. There is no doubt that reasonable city governance under uncertainty is particularly significant, which is another important premise justifying undertaking the research.

Finally, a question of what is new in the research and how it can be distinguished from already-existing methods should be addressed. Therefore, it might be essential to briefly stress differences between research objective and already-existing decision models. Decision Support Systems (DSS) are computer-based tools designed to support management decisions (Eom 2001). Spatial Decision Support Systems (SDSS) are interactive, computer-based systems designed to assist in decision making while solving a semi-structured spatial problem (Sprague 1982). In other worlds, SDSS comprises DSS and GIS. However, many of (S)DSS are in fact various models used to better describe data or visualise a system without addressing specific decision problems or helping decision makers in making inevitable trade-offs (Giove et al. 2009). The aim of the research is not to improve already-existing decision support systems. Also simulation models or land-use models such as cellular automata (CA) or Agent Based Models (ABM) are not within the scope of the research. The objective of the research, as it was already mentioned, is to offer a comprehensive set of tools supporting the decision-making process in city policy making under uncertainty, when dealing with several conflicting criteria and taking into account various stakeholders' needs. Therefore, the research focus is not on providing a GIS (or GIS-related) model, DSS, or simulation model. The research also does not decide on goals of a city policy. The author has no right, nor ambition to decide for the city authorities on the best goals for their city. The purpose is to equip planners and city authorities with methods and tools supporting decision making at the local level in order to make more rational and objective choices.

To sum up, the research would offer a set of methods and techniques that would support the urban policy-making process. Likely, an action scheme in which each step of strategic and spatial decision making receives support in the form of advanced tools would be developed. These methods would take the form of convenient and approachable computer tools, and therefore, would have a fairly high probability of being included in the everyday work of urban planners. In 1971, Beaujeu-Garnier and Chabot pointed out that "the city changes, adapts to a particular form of civilization, whose expression they are, and therefore, its definition cannot be the same for all ages and all countries". This statement indicates that cities are hallmarks of civilization—its level and condition. Thus, improving city governance could be perceived as an important issue that may have prominent and positive impact on the development of civilization.

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