

The Optimization of the Local Public Policies' Development Process Through Modeling And Simulation

Minodora URSĂCESCU¹
Cleopatra ȘENDROIU²
Ioan RADU³

ABSTRACT

The local public policies development in Romania represents an empirically realized measure, the strategic management practices in this domain not being based on a scientific instrument capable to anticipate and evaluate the results of implementing a local public policy in a logic of needs-policies-effects type. Beginning from this motivation, the purpose of the paper resides in the reconceptualization of the public policies process on functioning principles of the dynamic systems with inverse connection, by means of mathematical modeling and techniques simulation. Therefore, the research is oriented in the direction of developing an optimization method for the local public policies development process, using as instruments the mathematical modeling and the techniques simulation. The research's main results are on the one side constituted by generating a new process concept of the local public policies, and on the other side by proposing the conceptual model of a complex software product which will permit the parameterized modeling in a virtual environment of these policies development process. The informatic product's finality resides in modeling and simulating each local public policy type, taking into account the respective policy's characteristics, but also the value of their appliance environment parameters in a certain moment.

KEYWORDS: *dynamic systems with inverse connection, expert simulator of local public policies, expert system, knowledge base, working memory.*

JEL CLASSIFICATION: H83

INTRODUCTION

The problem of developing some concepts, principles and methods that should lead to the efficiency of the public policies process is of permanent actuality, even if the preoccupations in this sense appeared once with the administrative science. Nevertheless, the research existing in Romania, regarding the parameterized modeling of the local public policies development process, with the purpose of simulating their effects depending on the economic and social context represents a still low explored domain. The previous two decades registered at worldwide level important progresses both in the plan of discovering mathematical models for modeling decisional processes afferent to the public policies and in the one of developing complex informatic solutions for simulating the public policies' options, based on economical-financial, social and environmental solutions. Despite these

¹ The Bucharest University of Economic Studies, E-mail: minoursa@ase.ro,

² The Bucharest University of Economic Studies, E-mail: cleosendroi@gmail.com

³ The Bucharest University of Economic Studies, E-mail: iradu@man.ase.ro

approaches' heterogeneity, the stake of the researches in this domain represents the identification of some new mechanisms for viable and sustainable public policies, based on complex informatic and communication technologies. In such a context, the research we propose through this paper intends to develop an optimization method of the local public policies elaboration process, using as instruments the mathematical modeling and the simulation techniques. The scope of this method consists in formulating the best options of local public policies through a simultaneous approach of the needs that generate these policies and of their possible effects. Beginning from the reconceptualization need of the local public policies process, based on an unitary vision of needs-policies-effects type, the reasoning which represents the basis of our research measure is in essence the following:

- Extending the adoption cycle of the local public policies through estimating the effects these ones intend to produce, before their effective application in the real environment, by appealing to simulation techniques.
- Evaluating, based on these potential effects, the degree in which the respective public policies respond to the needs which lead to their conception.
- Adopting the passing decision to the appliance of the respective local public policy, if considered that the estimated effects correspond to the expectations or restrictions imposed by the environment, or resuming the substantiation and conception cycle through a new simulation process, otherwise.

It is important to mention that such a reasoning also permits in the same time a qualitative evaluation of the local public policies adoption cycle, but also the application simulation of some of their versions projects, so that, based on an optimum criteria system, the proper local public policy version might be selected in a certain moment. The local public policies types' diversity, as well as the dynamic of the environment in which they are conceived and applied exceeds the framework of only one model, universally valid that might be transposed in a simple software application. The computerized modeling and simulation of the local public policies process permits the elaboration of a high number of possible scenarios for solving the existent social problems, through the characteristics parameterization of each policy type and of the environment's variables in which this one will be applied.

Although the public policies formulation has a priority place, at the level of the central administration, where usually exists a strong political determination, the reality proves that the economic and social viability of the public policies is best demonstrated at the level of the local public administration, where these ones can respond to a great variety of needs, expressed in specific economical, social, political and cultural contexts. At the moment, in Romania the researches area focused on the study of the public policies process is relative restrained, these ones being mainly registered in the academic environment and at the level of the central administration. In this context, the present research is developed in the perimeter of the local administration and targets the realization of a study, structured on two main directions: firstly, it is proposed to elaborate a new process concept of the local public policies, based on the functioning principles of the parametric systems with inverse connection, which should ensure the needs-effects feedback. Secondly, the conceptual model of a complex software product (expert simulator of local public policies) is presented, which will permit the modeling and simulation of the diverse local public policy types, depending on the each own characteristics and on the environment's parameters in which it will be applied. Such a software product will be realized within a future research and it will be substantiated on an architecture specific for the expert system, which will permanently take scenarios and models, thus improving its knowledge basis.

1. THEORETICAL BACKGROUND

The problematic regarding the public policies represents a subject of interests and of actuality in the scientific literature, in the academic environment, but also at governmental level or the one of the international organisms. As Muller (2000) mentions the notion of public policy in mainly of Anglo-Saxon origin, but knowing an important development in the United States too, stating with the '50s. The distinction must be realized between what the Anglo-Saxons understand through the term of "policy", namely the action initiated by the government and by the administration as an action program and what it is understood through the term "politics", as a stage in the politic competition for gaining the power.

In a simplified manner, the public policy may be defined as the public authorities' action, in this case everything what the governments decide or not to do (Massardier, 2003). Similarly, Friedrich (1984) affirms that the public policy represents an ensemble of governmental decisions which includes everything that should be realized or not, in a certain space-temporal context. According to Horbert-Papazian (2008) a public policy is a coherent sequence of decisions adopted by public actors, operationalized by public and private actors, who aim the orientation of a target group's behavior on behalf the general interest.

We do also retain the definition of Lemieux (1994) who appreciates the public policies from the perspective of the situations' regulation that generates a public problem, within a collectivity or among these ones. The term of collectivity is used by the author, either in large sense or in the one of political collectivity formed by the State, or in the sense of politic sub-collectivities (province, municipality, region etc). A specific public policy approach has been emerging for some years now, which it is known as the cognitive approach. According to Muller & Surel (1998) this approach attempts to understand public policies as cognitive and normative matrices constituting systems of interpretations of reality, within which the different public and private actors can register their actions.

A complex definition results from the authors' Knoepfel et al., (2001) work: a public policy represents a chain of coherent decisions and/or activities, taken by different public and sometimes private actors, whose resources, institutional affiliations and interests vary, with the purpose of solving a problem, defined from the political perspective as being collective. Anderson (2010) formulates a definition which focuses more on the public policy making, affirming that this one represents a sequential activities' or functions' succession, which has as objective the solving of a problem of general interest.

The apparition of a public policy implies the existence of an effective politic agenda, defined at the level of the state, government or local administration, capable to mobilize the public action in the direction of adapting the society to change and evolution. From this point of view, the approach of the public policies process takes place in a sequential manner, which includes five stages (Jones, 1970): a) identifying the problem which needs the public policy's elaboration; b) developing the political-administrative program which efficiently treats the problem; c) implementing the program; d) evaluating the program from the perspective of the expected effects; e) adjusting the entire cycle as a consequence of the previous evaluation.

In many cases, the appliance of this linear logic in conceiving the public policy is replaced by a parallel sequences ensemble which interact one in report to another, by changing continuously. Monnier (1992) affirms that this parallel approach involves two aspects: on the one side, it permanently obliges the actors to reformulate the problem which generates the public policy, depending on the available resources and on the other side, it imposes an evaluation of its effects, which often leads to the reconsideration of the initial assumptions, as

a consequence of the variables' evolution in the real economic, social or politic environment. We observe a relative new approach at international level, regarding the elaboration of public policies on the principles of the dynamic systems and of the simulation models used to anticipate their effects. Atle (2001) presents a model for the impact's evaluation of the public policies through a fuzzy analysis, with the purpose of creating a connection between the choice of the public policy instruments and the technological innovation.

At European level the public action effectuated in developing and orienting the public policies process aims a collective mobilization and the constitution of transnational networks, so that this process might be multi-level and multi-stratifies (Jachtenfuchs, 2001). This new approach type generated a series of debates regarding the moment and modalities through which the European institutions, the states' administrations and the local authorities will become more active, more transparent, more flexible and more efficient in the complex process of making public policies imposed by the new context of the globalization.

The success of a public policy registers in a general action framework which permits its delimitation from simple isolated measures and mainly depends on more important factors (Bouriche, 2005): a) realizing a rigorous diagnosis, elaborated by potential actors and sometimes, even by the beneficiaries of the public actions, with the purpose of rigorously defining the problem which will need the public policy making; b) the hierarchy and prioritization of the public actions; c) the optimal inscription of the public policy in the national and international policies, the juridical and financial context. The success of a public policy is also conditioned by the a priori evaluation of its effects, in order to see in what measure the hypotheses of its initial actions are valid. This anticipative measure is practically facilitated by the use of the mathematical modeling in the parameterization of the public policies process, as well as of the simulation techniques of their effects depending on the environment's real conditions.

2. STUDY REGARDING THE DEVELOPMENT OF AN OPTIMIZATION METHOD OF THE LOCAL PUBLIC POLICIES PROCESS

In the modern management of the public administration, one of the success factors in making local public policies is represented by the adoption of some methods and techniques that should aim the perfecting of their conception process' quality, as well as the effectiveness of their operationalization. The study we are proposing for the development of such a method is inscribed in this context.

2.1. The study's objective

The acceptance of a public policy and its introduction in the decisional process of the institution which wants to promote is conditioned by the deviation's size between the policy's estimated effect and the desired one from the social and/or economical point of view. The quantification of this deviation is possible through the association of a standard indicators system to each policy, that will highlight the desired effects, as well as of these indicators' values, estimated through the simulation process. In this approach, the present research proposes the development of an optimization method for the reconceptualization of the local public policies through a systemic *needs-policies-effects* approach. The possibility is thus created to integrate the conception process of the local public policies with the anticipation of their effects, using therefore the mathematical modeling and the simulation techniques.

2.2. The research methodology

This study begins from the classical cycle of the public policies, structured according to the theoretical approaches in some specific stages (Bondar, 2009). It is known that each local public policy type presents certain characteristics and its appliance environment is subordinated to some often random and uncertain variables. As a consequence, this traditional approach of linear type of the public policy's making process does not permit an evaluation of its effects, only at the end of the cycle, after it's launching in the real environment. That is why, the effectiveness of the local public policies process is considerably improved by building new mathematical models that should surprise specific parameters for each public policy type and in the same time by simulating its effects in a virtual environment, previous to its implementation stage, by adopting normative acts. Thus, for the realization of an optimization method for the local public policies process, the research's methodology is based on elements specific for the system's theory, in this case on the functioning principles of the dynamic systems with inverse connection, according to Forrester's model (Forrester, 1979). Also, for the concept's definition of the future software product – expert simulator of local public policies – with informatic instrument role by means of which the proposed optimization method will be made operational, the research's methodology focuses on the own structure of the expert systems (Balmisse, 2002). For a more complex approach of the study, the research is developed on the following levels:

Level 1. Defining a new concept of local public policy process, based on the functioning principles of the dynamic systems with inverse connection

A public policy reunites a processes ensemble, cultural and technical models, resources, constraints and diverse actors' categories, which function interdependently based on some causality relationships for reaching an objective and having a well defined finality (social, economic, politic, civic, regulatory, persuasive etc). Being given that, the objectives and the finality determine that the stages of the public policies' elaboration cycle do not always develop linearly, successively, it is useful to reconsider this cycle from the perspective of an transversal approach and of a dynamic interaction between the stages. Under this aspect, we appreciate that the development of an optimization method for the local public policies' cycle should start with its redefinition as a cybernetic system. Thus, the new concept of the local public policies process we are proposing at this first level of the research is built on the feedback relations between the stages, as well as on the self-regulation capacity of the entire process. Through this approach the possibility is created of going through an iterative process in identifying and formulating the diverse variants of local public policies, based on the parameterization of the variables and initial conditions which describe these variants.

Level 2. Choosing the dynamic behavior type of the local public policies process

According to Forrester (1979) there are many categories of a system's dynamic behavior, which devolve from its answer types, to the manifestation variations in time. The more exact knowledge of the dynamic behavior manner of the process which describes the elaboration of a public policy type is necessary in this stage for building the models that parameterize the state variables which characterize the respective policy: inputs, needs, action's results (outputs), policy's effects (outcome), influence factors, performance indicators etc. Beginning from the particularities of the local public policies cycle, we appreciate that the dynamic system which best surprises its behavior in time is the one with negative inverse connection. This one because the elaboration process of the local public policies has a structure in the shape of a closed loop, according to which, the respective process is influenced by its behavior in the past. In other words, in a certain moment, within the public policies cycle are used the results of a passed action, in order to command a future action that might be for example the re-discussing of the public agenda, the reformulation of the public policy option or the re-evaluation of its effects. In this manner, the system regulates itself through successive adjustments, determined by the quantity, quality and nature of the information in the system, depending on the aimed purpose.

Level 3. Defining the mathematical models system destined for the formalization of the priority local public policies.

The presence of this level in developing the research is linked to the necessity of abstracting through mathematical modeling of the public policies process, for the ulterior development of the software product that will simulate their effects on the environment. The mathematical models we propose to define are divided in two classes: a) general mathematical models, specific for the representative local public policies through which the state variables capable to highlight the common characteristics of their main categories will be identified; b) particular mathematical models, for the parameterization and personalization of the mathematical models' general system. The passing from the implicit form of the models system to the explicit one, for each priority local public policy will be realized by taking into account the specific variables which define its state.

Level 4. Projecting the functional architecture of the software product – expert simulator of local public policies.

The functional architecture of the software is an Expert System architecture, backed by a simulation component, which holds the modeling algorithms. The basic system decomposition is: 1. User Interface; 2. Inference Engine; 3. Knowledge Base; 4. Algorithm Engine; 5. Knowledge base and data layer. The system will be based on standard technology platforms, using JAVA programming language. The future system functional architecture is presented in the figure 1.

Using an Expert System like model, the specifications will be structured under three domains:

- Reasoning domain knowledge (RDK). This is the domain knowledge encoded by the domain expert in the expert system proper. Typically, it includes terminological knowledge, instance knowledge, and rules.
- Communication domain knowledge (CDK). This is knowledge about the domain which is needed for communication about the domain.
- Domain communication knowledge (DCK). This is knowledge about how to communicate in the domain.

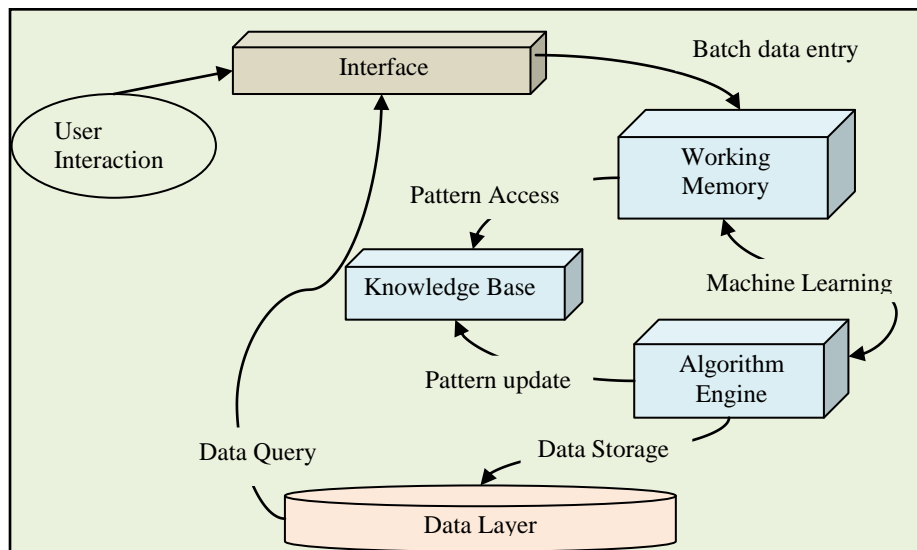


Figure 1. The system functional architecture

Source: adapted from Reix (2005), p. 155

Main system components will be:

- Interface – standard user interface, based on a JAVA platform. After the algorithms will be developed and the main system core defined in terms of business rules and business requirements and model, a specific platform will be chosen. More than likely, a web based system will be chosen, since the web platforms existing now, offer a great support for complex operations.
- Working Memory – expert system component. Will be custom built to handle the implemented algorithms. This concept will be implemented due to the batch task specific data that needs to be gathered from the system.
- Knowledge Base – will hold the factual and heuristic knowledge. Practically, it will hold the patterns that will be applied for processing system.
- Algorithm Engine – same as the Inference Engine. Is the logical contained for the implemented algorithms in the system.
- Data layer – standard database which will be covered by existing relational databases on the market (open source or component-of-the-shelf, based on the researched and developed algorithms).

The proposed technical development approach will offer the best value for the given project, by using the latest existing technologies in process modeling, but also support the development process, by choosing open technologies, continuously developed. There is also the fact that a cheap and fully functional technical solution, in the market is very weakly represented (strong solutions are more than likely very expensive but very weak since they are built to model commercial phenomena). This approach will offer a complex low-cost alternative to existing market solutions that is specialized in social outcome cases. The proposed application implementation of a business rule modeler and library will be a pinnacle implementation and a totally different approach, in using existing technologies in modeling behavior.

3. THE RESEARCH'S ESTIMATED RESULTS

Through the research we have realized we intended to develop an optimization method of the local public policies elaboration process, substantiated on mathematical modeling and simulation techniques. This method focuses on the stages described in the previous section, starting from the proposal of the new concept of the local public policies' process, based on the functioning systems of the dynamic systems with inverse connection, going through the defining of the models system used for the formalization of the priority public policies and finalizing with the presentation of the functional architecture concept on which the complex software product, named expert simulator of local public policies, will be built. We appreciate that this research, directed both on the quality of the conception process and on the effectiveness of its operationalization, might bring in theoretical and in practical plan some results, as it follows:

- Issuing a new theory regarding the approach of the complex elaboration process of the local public policies, from a perspective with many criteria scope-decision-effectiveness-efficiency.
- Optimizing the classical cycle of elaborating local public policies by using a complex mathematical and informatic device with the purpose of a synergetic approach of the economic, political and social phenomena specific for the local communities.

- Creating a strategic management instrument for realizing the forecast, quantitative and qualitative analysis of the possible effects which result from the implementation of the local public policies.
- Defining the functional architecture of the future software product which will simulate the elaboration process of the public policies, ensuring the correlation needs-policies-effects.

4. IMPLICATION OF THE RESEARCH

The present research invites to a new perspective over the public policies' analysis, a domain which renews continuously in the context of the actual economic, politic and social system. We consider that the major impact of the undertaken research measure is registered in theoretical plan but equally in the practical one too. From the point of view of the theoretical sphere, we appreciate that the research opens a direction low explored in Romania, namely the one referring to the parameterized modeling of the elaboration process of local public policies, in accordance with their possible effects simulation. Also, beginning from the functional specifications we are proposing for the future development of the expert simulator of local public policies, we appreciate that the generation of a knowledge basis will permit the accumulation of some best practices sets in the analyzed domain, which will ensure for the software product the perfecting through self-teaching, this one thus tending to an intelligent product.

Under the aspect of the practical implications of the research, these ones will be mainly registered at the level of the administrative-politic component where the public action takes place, but also at the level of the community which will benefit of public policies, whose effects have been a priori evaluated, thanks to the simulation techniques. The method proposed for the optimization of the local public policies cycle represents a transition measure from a traditional approach based on a successive logic of the stages to their transversal approach which implies reciprocal interactions, continuous modification, and sometimes the reconsideration of the assumptions. In this way, the entire elaboration process of public policies is substantiated on a cybernetic system, which regulates itself depending on the feedback existing among its components.

CONCLUSION AND LIMITATION

The ration of the public policies elaboration fundamentally resides in their capacity to propose viable solutions for the society's real problems, intending in equal measure that these solutions should be applied and their effects over the community should be maximal. In this context, the proposed research intends to realize a new approach of the public policies process, which should considerably diminish the deviations that exist in practice between the estimated effects of the policy and the desired ones from social and/or economic point of view. In conclusion, we appreciate that the realization of this desideratum is a direct consequence of applying the optimization method proposed in the study, a method that is focused on using a complex mathematical device and modern informatic technologies. Also, it should be remarked that for this measure to become an useful instrument at hand for each local public administration there are necessary a series of changes in the mentality of the decision factors, that should eliminate the arbitrary regarding the exercise of the decision act at the local community's level. Regarding the realization of the expert simulator of local public policies, the conclusion we have reached after the projecting stage of its functional architecture resides in the need to constitute a

multidisciplinary researchers team, that should value its members expertise in domains like: modeling, management, public and social policies, statistics, managerial informatics etc.

We must also mention some limits of the proposed research, some of them being possible to be exceeded within a future research. Firstly, taking into account the diversity of the public policies problematic, the research has been oriented only at the level of the local ones that were considered to be representative from the point of view of the coverage area and of the social impact. We also consider that the research direction opened through this paper will be permanently supposed to some new limits, generated both by the implementation of the change management in the local public policies process, and by the accelerated evolution of the ICT sector, whose products and services strongly condition the simulation techniques' operationalization of these policies' effects.

REFERENCES

- Anderson, J. (2010). *Public policymaking: An introduction*, 7th edition. Wadsworth: Cengage Learnig.
- Atle, C. C. (2001). Technological Change and the Role of Public Policy: An Analytical Framework for Dynamic Efficiency Assessments. *Fridtjof Nansen Institute (FNI) Reports*, issue 4, Lysaker, Norway.
- Balmisse, G. (2002). *Gestion des connaissances. Outils et applications du knowledge management*. Paris: Vuibert.
- Bondar, F. (2009). Cum să formulezi corect recomandari de politica publica. Ghid practic destinat organizațiilor neguvernamentale. *Report of Public Policies Institut, Bucharest*. Retrieved from http://www.ipp.ro/library/Ghid%20Politici%20Publice_ONG%20_2_.pdf
- Bouriche, R. (2005). Réussir une politique publique: un programme du gouvernement performant. *Le Quotidien d'Oran*, 3166, 9-10.
- Forrester, J.W. (1979). *Principles of systems*. Bucharest: Technical Publishing House, 14-57.
- Friedrich, C. J. (1984). Public policy and The Nature of Administrative Responsibility. In Rourke, Francis E. (Ed.), *Bureaucracy Power In National Politics*, 3^{ed}, (pp. 318), Boston, Toronto: Little, Brown and Company.
- Horbert-Papazian, K. (2008). Culture et Pratique de l'Evaluation des Politiques Publiques: Quels Enjeux et Défis pour le Sénégal? *Communication donnée lors des Journées Sénégalaises de l'Evaluation*.
- Jachtenfuchs, M. (2001). The Governance Approach to European Integration. *Journal of Common Market Studies*, 39(2), 245-264.
- Jones, Ch. O. (1970). *An introduction to the study of public policy*. Belmont: Duxbury Press, 230-233.
- Knoepfel, P. et al. (2001). *Environmental policies 1982-2000*. Helbing & Lichtenhahn.
- Lemieux, V. (1994). Les Politiques Publiques et les Alliances d'Acteurs. In Les Presses de l'Université Laval (Ed.), *Le système de santé au Québec. Organisations, acteurs et enjeux.*, (pp. 107-128) Québec.
- Massardier, G. (2003). *Politiques et action publiques*. Paris: Editions Dalloz.
- Monnier, E. (1992). *Evaluations de l'action des pouvoirs publics*. Paris: Economica.
- Muller, P. & Surel, Y. (1998). *L'analyse des politique publiques*. Paris: Montchrestien, 47-48.
- Muller, P. (2000). *Les politiques publiques*, 4^{ème} édition. Paris: Presses Universitaires de France, 4-5.

Reix, R. (2005). *Systèmes d'information et management des organisations*. Editions Vuibert, 154-163.