

A Cognitive Mapping Approach for Policy Evaluation and Prospective

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Abstract

This paper presents the methodology used in a research program in progress which aim is to evaluate current policies for creation of economic activity in rural and coastal lagging regions and use these results to think about ex ante evaluation of future policies in new contexts. The results of the analysis of the current situation (causal theories of institutions, effects of policies, description of the local system) will be derived into cognitive maps based on the identification of causal linkages (direction and magnitude) between concepts. The properties of these maps offer the possibility to describe the different paths which connect the concepts and to calculate their total effect, which will be mostly useful for the evaluation of the interrelated effects of current policies and for simulation purposes.

This work takes place in an European research project¹ which objectives are to evaluate public policies² for rural development in lagging regions, to propose “guidelines” for the implementation of diversification policies in marginal communities and to forecast the impact of future policies under various scenarios and in different contexts. The structure of the research is (BUSSELOT, A., 1994): (1) to describe the institutional context dealing with rural development and its functioning (2) to inventory the different policies implemented with their area, target groups and potential recipients³ (3) to understand what is the decision making process of the institutions, id est., on which beliefs do they base their policy-making decisions (4) to evaluate these policies characterising their impacts on the local employ system in a process or comprehensive evaluation (5) to describe and analyse the local system with a focus on economic dynamics (6) to simulate possible future policies or events.

The general context of our research is the one of the study of an hyper-complex system constituted by complex systems which are the institutions, the enterprises and farms, the policies or programmes. The policies or programmes under focus are most often negotiated by several organisations as they may depend on co-fundings (e.g. EU Programmes 5b), or simply

¹ The project AIR3 - CT94 - 1545 is co-ordinated by Gordon Clark (Lancaster University), and the participants are TEAGASC (Dublin), Scottish Agricultural College (Aberdeen), CERVIR (University of Caen), Cemagref (Clermont Ferrand) and the Universities of Valencia (Spain) and Patras (Greece).

² In this document we will use mainly the word “policy”. In reality, in our case we will mainly work on programmes constituted by different actions. As these programmes may be very heterogeneous in terms of actions operated, we had in our research to focus on actions and even sometimes subactions. Nevertheless, the word policy has been used for reasons of facility.

³ This part is very important considering the great number of actions operated, which may often be complementary

be implemented by several institutions. This situation brought us to privilege an entrance by the actors, thus giving a responsive dimension to our work.

The data used are coming from documents (presentation of budget decisions, evaluations...), business and institutional interviews. The first ones will give information on the different policies operated by the various institutions, their reasons for operating them, their problems of choice in the drawing up of the budget, and the point of view of institutions on the evaluation of policies. The second ones will give us more accurate information on who benefited from the policies, on the internal impact of the projects helped in the business in terms of outcomes, employ, satisfaction of the entrepreneurs, impact on the economic environment,... The guide for institutional (semi-directed) interviews (Busselot, A., 1995) - which are central as their will have inputs in all our research questions -, is structured on main subjects, which are (1) the rural development policies or programmes operated which reveals the beliefs system or causal theory of the institution connected with rural development (2) the evaluation as seen by the institution of its policies or programmes (3) the opinion of the institution on other policies or programmes operated in the region⁴ (4) the opinion of the expert interviewed inside the institution⁵ on the constitution of the local system, the main processes in action, ... (5) his vision of the plausible or desirable futures of the region. In this process the interviewee is considered first as an actor of the system and then as an expert of it.

But the main question is the one of how to analyse, interpret the information and account for the results in a form permitting to easily simulate new situations. The approach we propose has been developed and used by several researchers both in the domains of decision making analysis (e.g. Axelrod, 1976; Bonham and Shapiro, 1976; Roberts, 1976) and prospective (e.g. Godet 1985, 1991), with different points of views: cognitive mapping or direct construction of valency (or impact) matrix. But their aim is always to represent the different elements constituting a system and the relationships between them from the assertions of an individual or of a group and to use the theory of directed graphs and the properties of matricial calculus to analyse them. The cognitive map is a particular way of representing complex systems as a person's [or a group's] assertions about some limited domain such as a policy problem (Axelrod, 1976) or a local system and may be derived from documents as for example transcripts of statements of individuals or institutions (e.g. Bonham and Shapiro, 1976) or groups of experts (e.g. Roberts, 1976). In the first case the problem is one of encoding every causal relation present in the document, this being made either by a structural or syntactical analysis of the written assertions (the grammatical construction Subject/ Verb/ Object corresponding to the basic structure of the cognitive map Cause Concept/ Linkage/ Effect Concept) or by content analysis when the basic structure does not clearly appear. Wrightson (1976) has widely developed the rules which govern this coding work and insists on the fact that "these rules [...] provide the code with guidelines which, if conscientiously followed, will result in outcomes meeting social scientific standards of comparative validity and reliability". In the second case, the process generally used (e.g. Roberts, 1976; Godet, 1985 and 1991; de Jouvenel et Roque, 1994; Kayser et alii, 1994) is (1) the identification of all pertinent variables or concepts by using collective intelligence tools (Delphi techniques for example) (2) limitation of the number of variables by selection of key variables, classification

⁴ In our case most policies or programmes are the results of negotiations and several actors are involved in their implementation, each of them with their own rules and objectives, so the opinion of the institution on this process and its satisfaction/dissatisfaction are important to take into consideration

⁵ The status of the interviewee is more ambiguous here than in the previous subjects, as he is considered as an expert here and not only as a representative of the opinion of the institution, but we assume that the vision of the expert is influenced by the institution he works for.

of the variables in sub-systems,... (3) definition of the direction of the relations between each pair of variables⁶ and (4) definition of the linkage (positive, negative, neutral, or its magnitude). In any case the result is the derivation of the cognitive map of an individual (or an institution) or of the group consensus, which can be represented either as a graph or a square valency (or impact) matrix⁷ or the direct construction of this matrix.

How to use these cognitive maps? Axelrod (1976) define the mathematics of cognitive maps as “Relationships that are in sequence form paths, and paths transmit indirect effects [...] the operation of combining direct effects of relationships that are in sequence into indirect effects of a path is multiplication [...] when two or more paths start with the same point and end with the same point, their effects can be added into a total effect of the first point to the second one”. Bousset has developed for the purpose of our research a software⁸ which uses the matrixes derived from the cognitive maps and offer the possibilities (1) to define the direct and total indirect outdegree⁹ and indegree¹⁰ of any concept (2) to recognise and describe every paths between two concepts and calculate their total effect. These outcomes will be used for the structural analysis of the map or matrix and for simulation purposes such as the search for antecedents, consequences, or alternatives paths leading to a chosen objective.

In our case, we will first derive cognitive maps for each institution (from the documents and institutional interviews) related to their causal theory concerning their establishment of policies. In terms of policy evaluation, these maps will represent the explicit or implicit hypothesis (which in fact are ex ante evaluations) which are the basis of their policy choices and constitute a corpus of hypothesis to be verified. Then, the analysis of the current impacts of some policies, based on existing evaluations and on the results of the entrepreneurs survey as well as on the ex-post evaluation made by the institutions will give us some elements for discussing these ex ante causal theories. Cognitive maps, connected with each policy and not, as before, with each actor, may be integrated in a more general cognitive map which aim is to describe the local system, or, more exactly, a sub-system concerning employment and economic activity. As the policies are part of this cognitive map, the search of antecedent paths will let us identify which are the different policies having an action on one concept and discuss the relative effects of these different policies.

A last aspect of our research is the management of a multi-actors or pluralist system. If many important policies - as the result of a negotiation between the main actors of the institutional system - announce some common objectives contributing to the regional utility, it is still true that each institution may have specific objectives and preferences in terms of objectives, which is important for its participation in future policies. This has to be taken into consideration for our prospective purposes. Bousset has particularly worked on the problem of multi-actors contexts and proposes a software¹¹ which offers the possibility to study the possible alliances or conflicts of the actors (by comparing their positions and salience) and to

⁶ The authors insist on the importance of considering systematically all cross impact which should avoid omissions, and especially of feedback loops.

⁷ Matrix which each line and column represent one of the concepts (or variables) of the corresponding cognitive map and the value of each cell is the magnitude (or -1, 0, +1) of the direct causal linkage of one in-line concept on each in-column concept

⁸ Software Futurhis, Jean Paul Bousset, Cemagref Clermont Ferrand, Division Production et Economie Agricoles, 1995

⁹ id est. the number of concepts perceived to be affected directly or indirectly by this concept

¹⁰ id est. the number of concepts perceived to affect directly or indirectly this concept

¹¹ Software Concert, Jean Paul Bousset, Cemagref Clermont Ferrand, 1995

simulate negotiation processes as well as changes in the position or salience of one or several actors towards one or several goals.

Should we distinguish state and process variables? Should we or should we not introduce the actors in the maps? In fact, as we want to be able to try to quantify the causal relations between the concepts, these have to be variables, id est. they must be measurable. Thus the map will only contain state variables, actors' utility, actions implemented by actors... Should we consider other types of relations than causal relations? Axelrod (1976) underlines that "causation is vital in the process of evaluating alternatives"¹² and, we assume that with our definition of concepts as variables, linkages should mainly be causal ones. Nevertheless, other type of relationships will surely appear, in particular between actors. So, we propose to complete our study of the actors by the construction of graphs showing clearly the position of actors with regard to some specific processes which are the implementation of policies, and the type of relationships between actors in terms of hierarchy, influence, type of negotiation. At this stage, this analysis remains mostly qualitative, but will be very useful both in policy evaluation and simulation.

How to define the magnitude of the causal relations? Axelrod (1976) proposed first to use only neutral, positive or negative relations between concepts. Then he proposed to detail the causal relations by using a collection of eight values or, more exactly, combinations of positive, negative and neutral¹³ which does not solve the problem of the cases of irresolution when calculating the total effect of different paths of these signed digraphs. Using the actual positive or negative figure in constructing weighted digraphs can solve this. Two main problems appear here. The first one is that the actual numbers are very difficult to evaluate and it is often only possible to determine the sign of the relations in the analysis of documents or open interviews. The second one is that introducing one Figure is supposing that the relation between the two concepts in cause is linear which is obviously not always the case. One possibility to solve this is to define as much concepts as necessary to take in account only linear relations. At least, another possibility is the introduction of a specific function for each relationship, which would not only be difficult to determine but difficult to analyse. In fact, authors use mainly signed digraphs (NPN¹⁴ maps) for they are easier to construct and to analyse. But the evaluation of the policies or programs will let us specify the magnitude of some relations. And the use of software will let us easily examine several hypothesis related to magnitude of linkages.

Still remains the problem of the consideration of time, which is a difficult one in evaluation (Monnier, 1992) as well as in prospective (Gonot and Loinger, 1994). The first aspect of this problem is that the causal theory of the actors may vary with time and with the context, and the hierarchy of the objectives of the policy makers may change because their cognition changes, or because new events appear with new social problems to be solved¹⁵. The second one is that we deal with non synchronous phenomena which duration and speed are different, and, when comparing policies or programmes we have to consider the value of long term impacts compared to short term ones. Of course the achievement and critical analysis of our field work will give us more arguments to discuss the interest and possibilities of

¹² People do evaluate complex policy alternatives in terms of the consequences a particular choice would cause and ultimately of what the sum of all these effects would be (Axelrod, 1976)

¹³ id est. :positive, negative, zero, non negative {0,+}, non positive {0,-}, non zero {+,-}, universal {+,-,0} and ambivalent (the empty set).

¹⁴ Neutral Positive Negative.

¹⁵ Especially in periods with sharp budgetary constraints, when choices are more severe !

implementation of cognitive mapping approaches for the study of institutional behaviour), for policy evaluation (by the clarification of ex ante causal theories and the study of the interrelations between policies) and for prospective (by the description of the paths and the calculation of their total effects). More, the use of cognitive mapping should lead to a better consideration of conflict in evaluation¹⁶ and in prospective (by the identification of the cognitive map of each actor and the possibility to manage them altogether).

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¹⁶ As wished by Monnier (1992)