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METHODS FOR TERRITORIAL INTELLIGENCE

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Besançon cedex

Summary : Quantitative methods which are used by social sciences for thirty years can provide tools to help territorial actors better managing their territories. This short paper outlines an inventory of the kinds of methods that are usable within this framework.

Résumé : Les méthodes quantitatives utilisées dans les sciences sociales depuis trente ans peuvent fournir des outils pour aider les acteurs territoriaux à mieux gérer leurs territoires. Ce bref article esquisse un inventaire des types de méthodes utilisables dans ce cadre.

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This paper presents a draft of state of the art which was written thanks to contributions from members of the WP4M (J.C. FOLTETE, C. TANNIER, S. ORMAUX…). The paper is organized in relation with two objectives: analysing and simulating.

1. METHODS TO ANALYSE

Within the methods to analyse, territories are mostly analysed by using spatial frameworks where space is divided into discreet spatial units. Social, demographic, economic or environmental data are aggregated into these units. Then, statistical methods are used to analyse the territorial content which is defined by the variables.

Two main families of statistical methods are usually distinguished: exploratory methods and inferential ones.

1.1 Exploratory methods

The exploration of territorial data is usually based on factors analyses which allow identifying their main structure. Such structure is sum up by factorial axes that are computed and interpreted to "compress the most important part of the information that is contained in the data table". Two main methods can be used: main component analysis (PCA) in the case of quantitative data and multiple correspondence analyses (MCA) in the case of quantitative data. Another way to analyse consists in defining a typology of spatial units. This approach can be applied to raw data or can be considered as a step following a factor analysis. The objective is to summarize the information, by describing spatial units with a simple set of categories. Afterwards, this approach focuses on the observation of spatial units and spatial zoning, more than on processes and relationships between variables. The main methods which are used are "k-means" and "hierarchical classification".

A territorial typology is a genuine communication tool which leads to show a single map which interpretation does not need specific knowledge.

1.2 Inferential methods

The second kind of analysis method belongs to the inferential methods, where the analysis is focused on a precise character that one tries to explain thanks to others characters. In a more simple vision, two kinds of methods are available. The first one is the regression one that is used if the interesting character is quantitative. The second kind of method is the discrimination one, if it is a qualitative character. This approach leads to compute estimated values of the variable of interest and to extract residual values by comparing the model and reality. These residues are extremely important because they show the local specificities of each spatial unit.

If these residues constitute spatial aggregates, it means there is a geographical effect, for example a structural opposition either between two different cultural regions, or between two different physical contexts.

Both kinds of methods are not strictly separated and can be jointly used. A classical combination consists in firstly exploring a structure through factor analysis in order to define the main structural features and to precise the assumptions, and secondly in studying a more detailed subject, what implies to use an inferential method.

2. METHODS FOR SIMULATION

For thirty years, the research activity in social sciences has been interested in elaborating tools which allow simulating the territories spatial dynamics. These simulation tools were developed thanks to the computer sciences progress. The design of spatial simulation tools implies the modelling of the phenomena which are analysed.

A model can be defined as a summarized representation of an object, in order to work on it.

Considering the case of spatial simulation modelling, there are two requirements:

- The model should integrate the spatial dimension: material distance, social distance, perceived distance, topological distance. The spatial dimension can also appears through the places attributes or through indicators which describe the places: indicators of satisfaction, indicators of attractiveness.

- The spatial simulation model should allow testing many scenarios according to different assumptions.
Such an approach is very different from traditional approaches which generally consider three

scenarios: continuation of the trend, optimistic scenario and pessimistic one.

Indeed, the interest of the spatial simulation is not genuinely its prediction ability, but it is its ability to test many factors combinations, many types of interactions which are too complex to be analysed without any simulation tool. Consequently a simulation model can be used to develop the knowledge, but also to help the decision-making in the field of the territorial management.

There are different kinds of simulation models, static ones, dynamic ones.... Most of the researchers consider that three types of spatial models can be used to support participative approaches:

- The first models that were developed have a mathematical nature. They come from physic and chemistry and deal with self-organizing processes.

- Another type of models belongs to the distributed artificial intelligence field. Such models focus on emerging properties of complex systems (cellular automata, multi-agent system…).

- The third type of model is based on the fractal geometry use. Here the fractal geometry gives the basic principles that determine a system spatial growth.

Conclusion

All these methods appear to be well-adapted to design tools that are usable by territorial actors. But the transformation of the generic methods into territorial management tools requires a genuine transposition process. It also requires taking into account the available data and the action temporalities.

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