Application of Prospective Structural Analysis to Rural Development Strategy

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1. INTRODUCTION

After the approval of the Council Regulation (EC) 1698/2005 on 20th September 2005, it started to be developed the fourth programme of Rural Development Aid for the period 2007-2013. On 20th February 2006 it was approved the Decision of the Council related to Communitarian Strategies Directives for Rural Development for the same period following article nine of the above mention regulation. The new rural programme has the next main characteristics:

- A unique financial and planning instrument, Rural Development Agricultural European Fund.

- A genuine communitarian strategy of rural development making greater emphasis on European Union priorities.

- Control, evaluation and reports elaboration reinforcement. Audit system of account liquidation will be enlarged to all rural development sectors.

- A consolidating rising focus (bottom- up). State members, regions and local action groups will have more strength when adjusting programs to local necessities.

Andalusia, a region situated in the south of Spain, is affected by the application of the communitarian regulation. Following European normative, the regional Government gave instructions to elaborate the Andalusia New Rural Strategy (ANRS) for the new period. The authors of this paper have contributed to the elaboration of that strategy as technical advisors. We suggest a general methodology for the whole strategy process. Particularly, we argue the need to use a concrete method to analyse the collective reflection process carried out in the 51 rural areas in which the region has been divided with their correspondent Local Action Groups.

2. OBJECTIVES

The main aim is to know the behaviour and influence of the most important socioeconomic variables that define past, present and future of any rural area. We believe that by applying the Prospective Structural Analysis (PSA) method it will be possible to observe the interrelation and influence among different variables which will let us classify them in order to understand the most relevant ones for the development of a specific rural area.

3. METHODOLOGY

We distinguish two levels. The first one corresponds to the global project. The object of this level is to show the methodology of the global project in a summarize way. In the second level, we present the specific methodology, Prospective Structural Analysis (PAS), applied to the rural development strategy.

3.1. ANRS project

ANRS project has been an initiative which has promoted participation of rural society and social, economic and political agents in the debate and analysis of actual situation in Andalusia rural zones. In fact, ANRS project is a complementary strategy to the new Andalusia economic policy within European Union framework and an ambitious wager for sustainable development of rural zones. It is in the Andalusia Rural Development programme for 2007-2013. Contributions in this project could be sum up in two.

- The elaboration of fifty-one strategic local plans, eight strategic provincial plans and a strategic regional plan.

- A new methodology, part of which is shown in this paper.

As it is represented in the following scheme (Figure 1), this project has been developed in a bottom-up way with the starting point on rural development groups in Andalusia to reach a global diagnosis of the region. We have obtained primary and secondary information related to Andalusia region using usual techniques such as interviews, questionnaires (Delphi method) and round-table discussion.

Figure 1
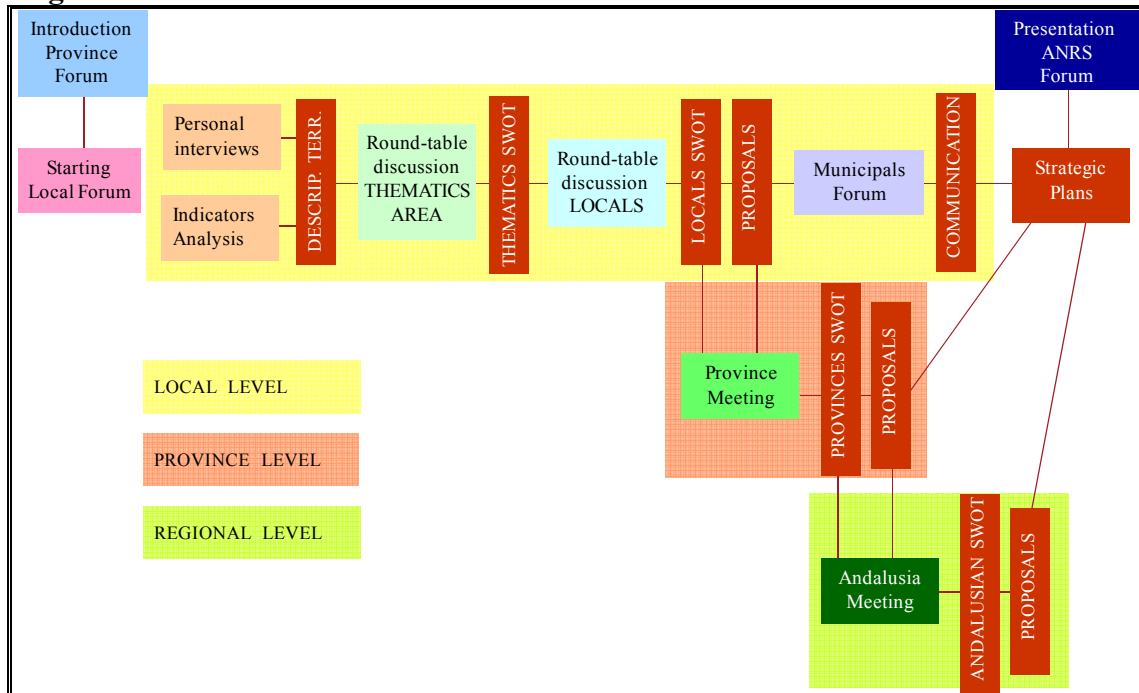
In order to maintain primary information homogeneity it was designed, in common accordance with different agents, standardized models of questionnaires to get information. To facilitate the analysis of territory data it was proposed a design and development of a database according to conventional data relational model. This database was enclosed to final documents and some necessary statistical and spatial analysis were made.

Before proceeding to show resultant information of the diagnosis, ETEA investigation team made a preliminary analysis of each region applying the prospective structural analysis technique (PEA) adapting it to the reality of rural zones for its study. This method (a fundamental contribution of this paper) will be conveniently explained as well as some findings in the following section.

3.2. Rural Prospective Analysis

The study of rural zones, as systemic, evolutionary and complex realities, require tools that allow considering in an integrative way, all the elements, their interrelations and their dynamic nature and also the impacts that any change in them provoke in the whole system.

Assuming that a rural region is a social construction, the interpretation made by local agents about potential restriction and incentives for change in the communities should be the main input to build rural territory as an object of study.

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Prospective techniques analysis is grounded on the bases that future cannot be extrapolated from the past and it is not predetermined but, on the contrary, it can be built. This paper shows how these techniques can describe real situation and they are also useful to design the sceneries encouraging and structuring processes of collective reflection to generate a future vision for rural territories and show the necessary action to reach it (Godet 2001; Gavigan and Scapolo, 2001).

In order to analyze the complexity of elements, the factors and present interactions in rural territories, as well as to understand variables for their present and future situation we have used the technique of Prospective Structural Analysis (PSA).

This method is based on the elaboration future scenery through the inference of historic tendencies of the system (Godet, 1985, 1994, 2001). The main objective is to reduce the future uncertainty elaborating viable sceneries and proposing necessary actions to reach them.

PSA technique helps to describe a system identifying the influence relation (instead of cause-effect relations) among the integrated elements of the system, through a process of collective reflection in which a double entrance matrix is filled in. Through the application of the properties of Markov chains, this tool can show the classifications of the elements according to motivity and dependency properties.

The method points out the relationship between the variables of the system and it shows which variables are essential for the system evolution. The structure of relations is represented through variables hierarchies according to the influence that an element plays on the rest of them (motivity) and the influence that elements receives from the rest (dependency).

Taking into account that all systems contain feedback, this method makes an additional influence between direct and indirect influences. The importance of a variable should be considered not only for its direct relation with other variables but for the millions of indirect variables (Godet, 1994). The countless indirect influences that come to and fro an element make an invisible structure of relations between the elements of a system and give a very close image of the system functioning.

In this paper, PSA has been adapted to rural zones reality for its study. It has been divided in three phases:

Phase 1. List of macro-variables.

The first stage is to elaborate a series of areas in which macro-variables are included to explain them. Five areas were considered: National Resources and Environment, Population and Society, Framework, Economy, and Public Administration.

Table 1. List of macro-variables

Accessibility & mobility	Food industry	Others industry
Agriculture	Heritage & Culture	Population basic services
Basic supplying nets	Human capital	Population setlement ways
Building	Income & its distribution	Resources situation
Cattle-Raising	Income tax & Public expenditure	Services & Commerce
CIT	Labour market	Social capital
Competences	Legal frame	Social conciliation
Cooperation & nets business	Local identity	Socio-cutural & demographic frame
Disposition territory	Macroecnomics situation	Sport &leisure
Financing source	Management & Resources use	Technologic frame
Fish	Natural resources	Tourism

The system is form by macro-variables that can be either internal or external. That list should not contain more than 70-80 macro-variables and each one should be clearly defined, including the evolution tendency followed in the past and predicted for the future. The macro-variables list was consented which the Local Action Groups and is shown in Table 1.

Phase 2. Description of the relationship among variables

The main object of this stage is to fill in a double entrance matrix. Each element (a_{ij}) in this matrix represents the value of influences exerted by variables in rows (i) over variables in columns (j). It is a fundamental step in the technique.

A deep reflection on the nature of the relationship among elements is needed (Figure 2) to identify clearly if influences exerted by i over j are direct (a), or they are affected by a third variable k (b) or even if that relation is influenced by a third variable effect m (c).

Figura 2
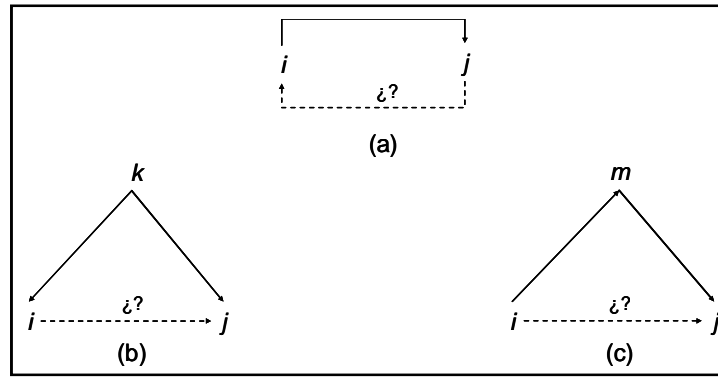
Each element of the matrix (a_{ij}) can oscillate between 0 and 3 (0 meaning no direct influence between two variables, 1 means a weak direct influence, 2 means medium influence and 3 is a strong influence). It is possible to assign a P value (potential) to those direct influences that can be relevant in the future in case that certain circumstances should be modified. This tool does not consider the influences sign.

The filling in of the influences matrix has been done by local actors in prospective workshops. The effectiveness of this technique is grounded on the basis of the implication and commitment made by local actors. The achievement of any desired change in rural zones is based not only on the local knowledge and experience but specially, on the commitment in the changing process ant the capacity to lead it.

Phase 3. Identification of the key variables using MICMAC.

This software applies the properties of Booleans matrixes to order variables according to the paths number and intensity. It also considers the motivity influence (given feedback) and the dependency influence (received feedback) exerted by each variable (Godet, 1994; Godet & Bourse, 1989).

Direct influences between variables *i* and *j* belong to relationship 1, because any element makes influence between both elements ($i \rightarrow j$). These relationships are collected in the Direct Influences Matrix (DIM) the result of phase 1.

In order to incorporate indirect influences (for example, $i \rightarrow k \rightarrow j$, order relation 2 between i and j), the successive DIM raising to *second, third, fourth, ...n* power leads to classify matrix elements according to the aggregated sum of exerted or received influences in successive iterations. From a determined power, any additional keeping stable and giving place to Indirect Influences Matrix (IIM).

MICMAC method can represent elements of a system in motivity-dependence plane form pairs of values associated to each element, by motivity and dependence. Macro-variables classification in Motivity-Dependence plane is set above two criteria.

The first criterion responds to the entrance exit logic of the territorial system. We can distinguish four types of macro-variables:

a) Determinant. Determinant macro-variables of the territorial system functioning (those which have had are having a high incidence in its dynamics) and those in which it is believe that other elements of the system have had a little incidence.

b) Environment. Macro-variables that have medium incidence over territorial dynamics and those in which other elements of the system have had a little incidence.

c) Objectives. Macro-variables considered desires evident or territorial system goals. It is believe that the rest of elements have had high incidence on them although its influence on territorial dynamics is medium.

d) Result. They are macro-variables considered descriptive indicators of the territorial system evolution. They show a limited motivity (their incidence over territorial dynamics is very low) and they have a high dependency. That is why we consider them rigid factors and evident system debilities.

The second criterion is connected to a *strategic logic* and the capacity to provoke of multiplying effects, depending on the position a macro-variable in the strategic diagonal plane DM (diagonal which is all along the plane from its origin to the opposite extreme). This capacity to generate

multiplying effects will be higher in more distant variables from the plane origin and lower in the nearest macro-variables to the origin.

Figure 3. Ideal representation of macro-variables type in Motivity-Dependence plane
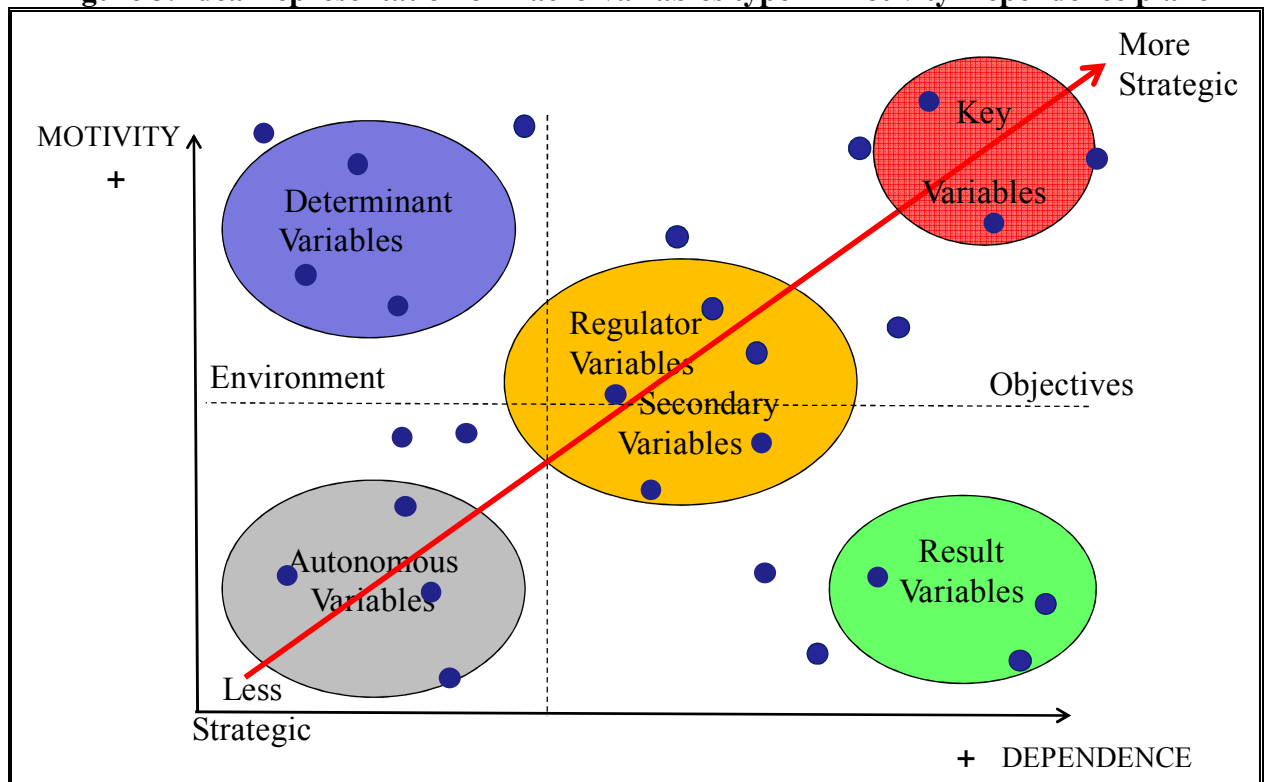
We can distinguish four types of strategic macro-variables:

a) Key. These macro-variables are considered to have had or be having a high incidence on territorial dynamics and the rest of system elements have a high incidence on them.

b) Regulator. These macro-variables have medium incidence on territorial dynamics and the rest of system elements have medium incidence on them.

c) Secondary. These macro-variables have or have had low-medium influence on territorial dynamics and the rest of system elements have medium incidence on them. Secondary and regulator macro-variables are called *squad variables* of the system.

d) Autonomous. They have a low impact to generate changes in territorial system. The rest of system elements have or have had a low or inexistent incidence.

The image obtained in this plane is a product of the participants' interpretation of direct influences over the system elements. For that reason this plane should be consider specially

relevant to understand which restrictions, opportunities and stir into action of the change are perceived bay local actors and, consequently, to tackle their rural territory.

4. RESULTS AND DISCUSSION

Results correspond to information obtained by Jerez LAG, in Cadiz province belonging to Andalusia autonomous community in the South of Spain. This information was recorded in a double entrance matrix (Influences Matrix) after several working sessions in the so called round-table discussion local. The matrix was formed by 33 rows and 33 columns according to the 33 macro-variables. The percentage of (DIM) filled in was 61%[2]. For that reason we opted for not making any changes in the original matrix. MICMAC method was applied to that matrix.

In order to classify macro-variables we based on the motivity-dependency plane (DM plane) resultant of DIM and we followed all the steps explained in the methodology section although some modifications in the values will be necessary. The steps are the following:

(i) Calculate macro-variables "strategic value". These are calculated with the sum of direct influences proportions and for direct dependency.

(ii) Discriminate "squad macro-variables". To discriminate these macro-variables (regulatory and secondary) we get "strategic values" average calculated in the previous step "squad macro-variables" will be those whose strategic value in in the interval defined by following limits:

- Upper limit, 115% of strategic values average

- Low limit, 85% of strategic values average

(iii) To discriminate "regulatory and secondary macro-variables". Considering DIM results, we will use direct influence proportions:

a) Average value will be obtained from direct influence proportion of all macro-variables

b) Values to be compared will be obtained from direct influence proportions.

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[2] Direct influences matrix filling rate is calculated as the percentage of values different to 0 over the total cells of the matrix (excluding diagonal values). A normal filling rate should not exceed 25%, although rates around 50-60% can also be acceptable.

After being identified regulatory and secondary variables motivity-dependence results are shown in Figure 4.

Figure 4. Motivity-Dependance plane Jerez local
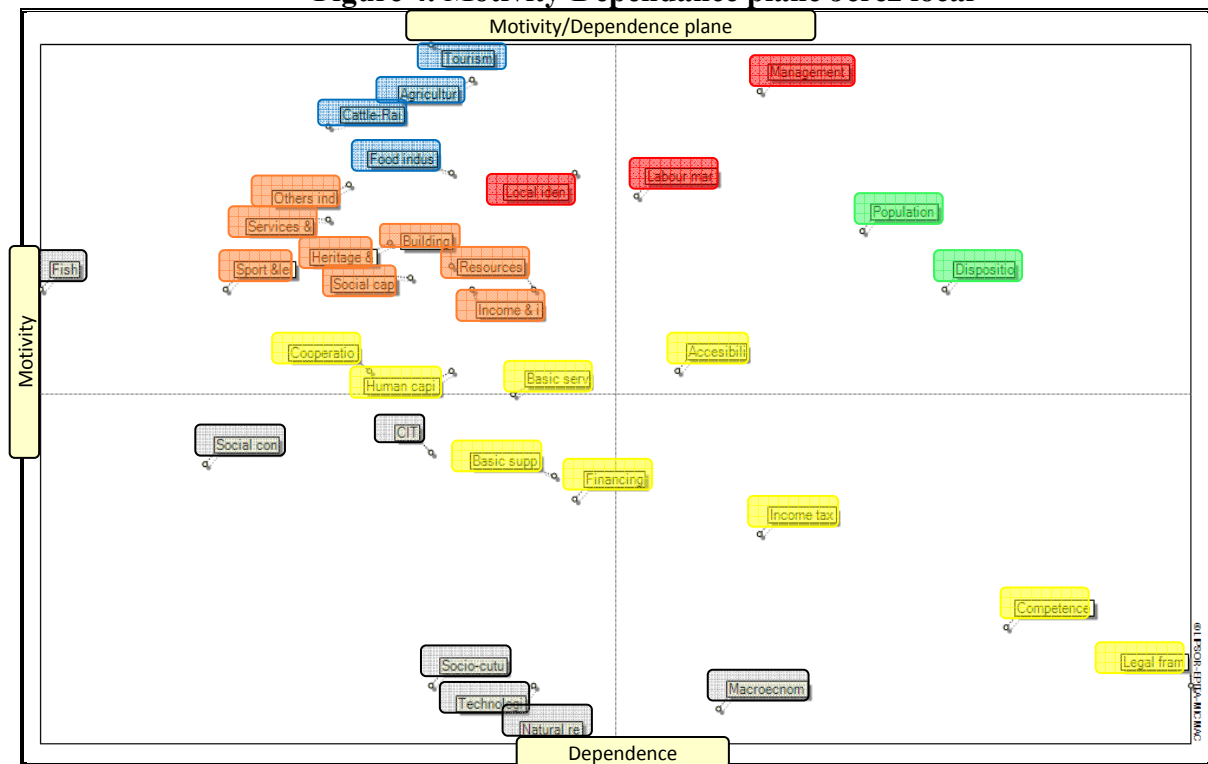
Leyend: **Blue**: Determinant. **Green**: Objetive. **Red:** Key. **Orange:** Regulator. **Yellow:** Secondary. **Grey:** Autonomous.

We present (Table 2) the results classified in every type of strategic macro-variables.

Determinants and desires (entrance-exit logic)

Territorial dynamics in Jerez are conditioned by four macro-variables in the Economic area. Territorial process in this rural area determined by activities associated to agriculture and cattle-raising from where food industry comes. Tourism also has a great importance in this local area contributing greatly to production. These macro-variables are perceived as extern factors. They can have some local territorial incidence as they are relatively close to dependency average value.

We identify two aims or desires: territorial disposition and settlement population ways. Related to variables that form these macro-variables, we suggest that settlement of the population offers difficulties to the population basic services benefits. In fact, Jerez town hall is one of the largest

ones in Spain with more than twenty entities (seven small village and sixteen rural suburbs) which are situated between four and twenty kilometers away from town center.

Demands connected with territory disposition show the necessity to promote new urban projects due to the raising need of edification land.

Table 2. Macro-variables classification in Jerez LAG

DETERMINANT	OBJETIVE
Agriculture	Territorial Disposition
Cattle-raising	Setlement population ways
Food industry	
Tourism	
KEY	**REGULATORS**
Labour market	Building
Management & Resources use	Competencies
Local identity	Heritage & Culture
	Income and its distribution
	Legal frame
	Others industry
	Resources situation
	Services & commerce
	Social capital
	Sports & leissure
SECONDARY	**AUTONOMOUS**
Accessibility, maintenance & mobility	Fish
Basic services to population	Information & Communication Technologies
Basic supplying nets	Macroeconomic Situation
Cooperation & nets business	Natural resources
Financing sources	Social conciliation
Human capital	Socio-cultural & demographic frame
Income tax & public expenditure	Technologic frame

Strategic elements (strategic logic)

Strategic macro-variables have relatively close levels of motivity and dependence which show the capacity to generate multiplier effects (higher in key macro-variables and lower in autonomic ones).

According to perceptions obtained by local action group, macro-variables with higher multiplier (key) in Jerez are: Labour market, Management & Resources use, Local identity. Territorial processes are greatly slanted for the exploitation of natural resources and food industry. In a territory with the agrarian sector as determinant macro-variable will probably be a modernized

agricultural activity, highly conditioned by natural environment situation but with a strong component of technologic innovation (in case of being a territory necessity or desire it will be considered an objective).

Labour market is also in this group due not only to technologic innovation but to CAP application which has negatively affected employment generated by this sector with considerable unemployment increase.

A key local identity points out to a territory where inhabitants have roots in it. In relation to other considered variables it also suggest a high degree of innovation and local enterprise initiative, although this should be contrasted with supposed difficulties to assume labour market restructuration. In any case, the strong perception of their ethnographic patrimony and common values make a great influence any territorial dynamic. Given the position of settlement population and centripetal effect exerted by the main center of population it would be necessary to take into account that local identity is also determined by principal town which eliminates local identities of small settlements.

With a lower multiplier effect but also relevant to territorial processes (regulator) we can find the following macro-variables:

- Economy area: Other industries, services and commerce, building, income and its distribution.

- Population and Society area: heritage and culture, leisure and sport, social capital.

- Physical and Natural Environment area: Resources situation.

The position of other economic activities in a category with a considerable strategic relevance (although not the highest ones) could be understood as a diversification of the economic structure that could be making a considerable impact on the processes of territorial changes. Depending on the variables that intervene, income level situation and its distribution could be referred to the relevance of public aids (agrarian unemployment subsidies, CAP aids, public expenditures and so on) or to other type of aids for local population (which could be linked to the

labour market restructuration) to the family income precariousness, to an unequal distribution or an increase of income resources (following the supposition of a diversified economical structure). Above all possible interpretations, there is no doubt that is a significant aspect for local dynamics.

There are other macro-variables that apparently could be considered as non relevant factors. In spite of that, they exert a high impact on local dynamics. These macro-variables are linked to the existence of infrastructures and cultural heritage exploitation. They are also connected with leisure and sport activities (probably they offer other diversification of local economical structure) and with territorial social capital, being this, an extensible valuation to the complete region).

Resources situation macro-variable should be interpreted considering that management and resources exploitation belong to key macro-variables and natural resources corresponds to autonomous ones. It will easily perceived that natural resources exploitation obtained by locals is much more conditioned by its conservation state and quality level than by the quantity endowment (being autonomous maybe it will not be considered as a limitation).

With a less multiplier effect and with less relevance to territorial dynamics we find what we call *secondary* macro-variables:

- Economy area: cooperation and nets business, financing resources.

- Macro-variables connected to infra-structure and transport: Accessibility, maintenance & mobility, Population basic services, Basic supplying nets.

- Public Administration area: Income tax & public expenditure.

- Others: Legal frame (environment) and Human capital (population and society).

As we can observe, Jerez regulatory macro-variables show different motivity levels: from a medium motivity (cooperation and nets business; human capital; population basic services; accessibility, maintenance & mobility) to a very low motivity (Income tax & public expenditure; legal frame).

Medium motivity macro-variables, due to their nature, are like structural pillars for the territorial system. They have certain importance for the region as their position show an important capacity to generate multipliers effects in other territorial processes (cooperation and nets business; human capital; population basic services; accessibility, maintenance & mobility). Depending on the way we treat them, it is possible to provoke an impact on other macro-variables regulators and key. Apparently, this macro-variables don´t point out to territory problems.

A similar interpretation could be done for macro-variables named *basic supplying nets* and *financing resources*. Their capacity to generate multipliers effects is lower and they do not seem to show territorial weakness neither related to basic services provision neither to financial resources.

We would consider in more detail both macro-variables belonging to Public Administration[3]. They point out to regions with little help from public action. Both macro-variables have a low impact on territorial dynamics: low motivity (see Figure 4), although they receive an great influence (see on DIM plane medium and high values on dependency for these macro-variables). This last interpretation show a considerable demand of public action in the region, motivated for deficiencies in social services, for the need of labour work, for the region economical revitalization and for the region organization among other possible motives.

Finally, macro-variables with lower strategic value (autonomous ones) are:

- Economy area: Fishing

- Population and society area: Social conciliation

- Infra-structure and transport area: Information and communication technologies.

- Environment area: Socio-cultural & demographic frame, Technologic frame, macroeconomic situation

- Physical and Natural Environment area: Nature resources.

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[3] Secondary classification is the result of the application of the presented algebraic procedure. However, in Jerez DIM plane we can observe that this two macro-variables are situated in the inferior right part which corresponds with *result elements*, which would give a more coherent interpretation. After this clearance we keep result obtained with the algebraic procedure.

It should be necessary to distinguish, al least, three big groups of macro-variables, according to motivity level shown (see figure 4).

Fishing could be apparently be considered as an element of the environment. It is an activity with a great impact although it seems to be inaccessible to the region influence due to three reasons: 1) the little capacity to influence on fish quotes; 2) to the fact that fishing has external investors; 3) exhaustion locals fishing ground or 4) subordination to fishing ground outside the region, among other reasons.

Social conciliation and ICT have medium motivity level. They are always autonomous macro-variables. The first one suggest little attention and incidence (dependency) on the population with precariousness situation and/or social exclusion (immigration, dependent population, marginality groups and so on) although it is an issue with certain relevance to the region. In the case ICT, they also have an impact in territorial dynamics although it is more significant the incidence on them (private and public investment, service computerized).

Finally, we consider macro-variables that do not have or exert very little influence on region dynamics. Three of them belong to Environment: Socio-cultural & demographic frame (aging, less young population, immigration); macroeconomic situation[4] and technological frame. The fourth one is connected to nature macro-variable (nature resources) explained in regulator macro-variables part.

5. CONCLUSIONS

Results obtained from the analysis lead us to very important conclusions. First of all, we can state that prospective structural analysis is most suitable in the process of elaboration of rural development strategies specially, when many participants take part on it.

In a context where multiple actors and factors intervene, MICMAC software helps to clarify variables relationship classifying each variable position in the region in which development strategy is desired.

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[4] This strategy was carried out in 2007, before the economic crisis was being considered by citizens.

It could also be very useful for future research to compare results obtained after applying

MICMAC software with database obtained once strategy has been carried out. We have no doubt

that it would be very helpful in order to validate participants' expectations while elaborating

Jerez rural strategy.

Acknowledgements

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