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Understanding rural areas dynamics from a complex perspective. An application of Prospective Structural Analysis

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Abstract – The development of rural areas continues to be an international priority. The urgent need to fight poverty (mainly concentrated in rural areas) in developing countries, and the demand for increasing economic and social cohesion in developed countries, explain this priority on the political agendas of multilateral bodies, the EU and most other countries. When Development Economics was acknowledged as part of the social and economic theory in the 50's, different theories and models have tried to explain the unevenness of development and the key elements or conditions that foster it. Traditional rural development programmes were characterised by the implementation of non coordinated, sectoral, horizontal and top-down policies and strategies. The lack of effectiveness and the failures prompted by these policies have propelled the development of new approaches. Territorial rural development is a policy approach embracing contributions from different theoretical frameworks that attempt to foster development strategies based on the consideration of territory as a social construction. Thus, the territory (including all the existing elements and its interactions) has become a key actor for development. However, most of these approaches contemplate rural world through simplistic and mono-dimensional analysis based on methodologies from single disciplines and on quantitative and/or qualitative morphological descriptions. The pretended multi-disciplinarity, frequently ends up on an addition of mono-disciplinary analysis around the object of study. The objective of the present paper is to check the role different elements considered relevant for development by literature's recent approaches play or can play in rural territories with a very different development situation, using techniques and tools that allow the analysis of rural areas from a complex perspective.

Keywords – territorial rural development, complexity, prospective structural analysis

I. CHANGES IN RURAL DEVELOPMENT THINKING

Major switches in rural development thinking have occurred over the past half-century [1]. The importance of the topic has led to an expansion of specific approaches and to the adaptation of relevant contributions from other disciplines as a way to

understanding development trigger and blocking factors.

Last decades have seen the emergence of different policies for rural areas. At EU level the search for economic and social cohesion has prompted the launching of a set of policies aimed at improving the living standards in the less favoured regions (the rural areas among them). A further step has been the introduction of *territorial cohesion* concept, as a more balanced distribution of competitiveness and activity functions over the EU regions is pretended. According to this new perspective, the main drivers for a balanced development are: the fostering of innovation and territorial competitiveness based on territory specific strengths; the development of a polycentric and balanced urban system promoting new urban-rural links; sustainable development patterns, comprising a sound management of cultural and natural heritage; the guarantee of access to knowledge-based society and a better coordination and coherence among the regional and sector policies applied to every single territory [2, 3, 4]. Under this broader perspective, changes in rural areas greatly rely on the ability of local agents not only to seize their territorial assets, but mainly to establish innovative functional linkages among them and with exogenous agents.

Territorial rural development (TRD) approach considers every single resource, asset and agent belonging to a rural territory as a potentially critical unit (a trigger) to detonate the structural changes needed for development. The crucial processes identified by TRD can be summarised in: 1) *economic processes* such as 'valorisation' of endogenous resources, diversification of territorial economy, exogenous demands, strengthening of urban-rural linkages and sustainable management of natural resources; 2) *institutional processes* such as territorial autonomy, devolution and transfer of responsibilities, participation of the population in decision-making, joint-action among agents (local partnership) and horizontal and vertical co-ordination mechanisms; and 3) *transversal processes* such as innovation, integrated and multi-sectoral approach, and territorial competitiveness. Policies such as decentralisation of

decision-making processes, context specific approaches, revalorisation of endogenous assets, territorial competitiveness, participation of the stakeholders and co-ordination of the actions implemented by the various sectors, agents and administrations are central to TRD [5, 6, 7, 8].

To explain development outcomes in a territory, *sustainable rural livelihood* approach stresses the importance of aspects such as policy setting, politics, history, agroecology and socio-economic contexts or the combination of livelihood resources (natural, economic/financial, human, social and institutional capitals) [9, 10, 11]. Though this framework was originally developed to be applied at a household level, it has also been scaled to identify the available assets in communities, as a way of identifying the whole set of potentiality options for change on a territorial basis [12, 13, 14].

But rural territory is no longer conceived as a mere set of resources or just as a physical support for resources and human activities. Rural territory turns into a *social construction* shaped by the agents, the resources and the processes resulting from their interactions. The territory becomes a key actor, and the participation, knowledge and perceptions of local agents are considered to be critical for development.

The social construction of territories can activate the potential options of individuals and communities in order to create wealth, through a different use of the existing assets. The social construction of the territory has to rely on building a consensus project of the future based on an interaction of bottom-up and top-down logics. Economic, social and institutional logics have to interact in order to foster development. Implication and participation of local actors as well as a larger responsibility of public administration are essential for opening social, institutional and economic cooperation paths that enable new governance mechanisms [15].

Governance issues also play an important role in TRD [16]. Development fosters the appearance of new agencies, stakeholders and institutions with new rationales and interests. The increasing demand of transparency and accountability led to the emergence of new structures and mechanisms. The new political spaces facilitate the activation of the available potentiality for change, even when the possibilities of the local agents to influence these arenas are quite often rather limited [17]. Yet the mechanisms and governance processes affecting any society do not only come from the influence of the local stakeholders

but from exogenous agents as well. The existence of overlapping competences between different levels of government and the scope for a diversity of actors to interrelate across these levels questions traditional and hierarchical approaches of state intervention. As multiple agents come into play *scale issues and vertical interplays* [18, 19] are critical for governing change in rural areas.

From a socio-political perspective, a first attempt to deal with these issues can be associated to the concepts of *embeddedness*, *autonomy*, *synergy* and *integration* to explain the different dimensions of social capital [20]. A further step is the concept of *multilevel governance*, originally developed as a response to state centric approaches to European integration and their perceived limitations in explaining contemporary developments [21]. Multilevel governance opens spaces for society participation at different administrative and policy-making levels [22]. Both dimensions of multilevel governance (*vertical*, referred to the upward and downward decision-making process, and *horizontal*, referred to the opening up of political spaces to non-state actors) enlarge the relevance of local actors in the social construction of territories.

Vertical interplays also have fundamental implications for economic change in rural areas. It does not only refer to access to external sources of innovation that might bring about an institutional change [23]. Economic transformation in rural areas depend not only on the ability of local agents to innovate when transforming their productive assets but also on their ability to foster and take advantage of interplays with external networks, suppliers, customers, partners, among others [24].

Thus change dynamics in rural areas does not only involve innovative social, economic and institutional interplays among endogenous agents and assets, but should mainly consider this vertical dimension that may provide the needed incentives to promote such processes, even when development might not always occur [25].

The previous paragraphs highlight how territorial rural development approaches embrace contributions from different theoretical frameworks and apply concepts and methods from them to understand the factors fostering the development of rural areas. The objective of the research presented has been to identify different variables considered as key for development in the mentioned frameworks and approaches and to test their relevance in rural territories with a very

different development level, approaching the analysis through complexity logics.

II. TERRITORY AS A COMPLEX SYSTEM

Rural studies have broadened their focus from considering only agrarian issues to tackle with a wider array of topics (sociology, politics, anthropology, ecology, history). This shift may have brought rural studies closer to a multi-disciplinary approach, in order to characterize the multiple factors that affect social, institutional and economic dynamics in rural areas as well as their mutual interrelations. The persistence of such multi-disciplinary approach may reflect a common intuition over the existence of singularities in these areas, which cannot be fully captured by means of mono-disciplinary analysis. Among such singularities, rural areas can be conceived as: isolated areas away from more dynamic centres of activity, set aside from centres of decision-making, with economic and social structures closely dependent on agrarian activity, social and economic heterogeneity not always sufficiently evidenced, and highly sensitive to modernization dynamics from urban areas. Also some rigidities and shortcomings appear to be quite common in such areas, as a kind of collective sense of permanent crisis, a certain deterministic vision of the future and an affected exaltation of foreign influences in comparison to those autochthonous.

Validating such intuitions is frequently handicapped by the restricted concepts and tools provided by a single discipline. Though multi-disciplinary approaches used to be very common to deal with a multidimensional reality, they finally result into an addition of mono-disciplinary analysis around such research object. In a similar way, *rural territory* has been traditionally assessed as a sum of its constituent parts, as we lack of analytical categories and tools to proceed far from mono-disciplinary analysis. This shortage clearly points out the dilemma between our comprehensive perception of the rural areas and how we tackle to generate scientific knowledge.

A. Rural territory as a complex reality

The starting-point to approach rural areas analysis has been the recognition of phenomena (situations, facts) determined by a multiplicity of converging factors, interacting one with each other in such a way that their individual isolation is not feasible (a *complex*

object). The perception of the reality (sense of complexity, what is a rural area?) confronts empiricist-positivist rationale and lineal thinking (paradigm of simplicity).

A complex object is defined by: heterogeneous constituting elements; mutual-interdependency among these elements, whose individual functions draw on their interrelations with other elements; hysteretic and path-dependent nature of the interrelation processes, that is, the historical evolution determines the current state of the constituents and hence of the system; and non-linear interrelations [26, 27].

From these characteristics, non-linear activity leads to novel output whose properties differ, on the one hand, from those present in their individual elements taken in isolation and, on the other hand, from those attached to objects attained from the simple addition of the elements (linear interrelation). The appearance of this ‘novel output’ is known as *emergence*, a process by which new objects crystallized from non-linear interactions among the elements of a system. This process results from the tendency for individual interactions to become magnified when conditions are right instead of dying away (*self-organization*) and the existence of a set of configurations (*attractors*) towards a system tends to move [28]. Both mechanisms explain dynamic behaviour of the output, through which unexpected variety and novelty is produced, making emergence unpredictable [29].

But the most common mistakes may not necessarily be related only to our knowledge or perceptions. Knowledge built upon mono-disciplinary contributions is assumed to result insufficient to deal with complex realities, as such realities cannot be described and analysed by a simple addition of mono-disciplinary contributions. As a methodological consequence, the study of a complex system should be rather undertaken from *interdisciplinary approaches* by which a previous integration among disciplines is necessary in order to define the research problem and the object under study [30]. To deal with such phenomena that lay between two or more disciplines, new conceptual categories are needed and that question the way we organize our ideas [31].

The ‘rural territory’ will be considered as an emergent ‘research object’ resulting from the multiplicity of interrelations between local agents and resources in a rural area. Rural areas are complex realities, and as such, it is not realistic to tackle their analysis through a paradigm of simplicity. This epistemological shift has direct implications on both

how do we define rural territory as a research object and how do we manage to generate scientific knowledge. To analyse this complex reality, a systemic approach has been used [32].

B. Rural territory as a socio-ecological system

A rural territory may be considered as a social system embedded in ecological surroundings and whose survival depends, among others, on its interrelations with the system of natural resources. Environment and natural resources condition and simultaneously are conditioned by the actions exerted by the population. Rural territory can also be termed as a *socio-ecological system* (SES).

The relationships between both ecological and human subsystems shape a “subset of social systems in which some of the interdependent relationships among

humans are mediated through interactions with biophysical and non-human biological units” [33]. Such mediation makes the presence of the human subset critical to the SES.

To be able to analyse the rural territory as a complex socio-ecological system, and identify the emergence of its intrinsic features, the system should be divided into more simple units [31, 34]. Adapting a conceptual proposal of such systems [33] into rural areas reality, four territorial subsystems have been identified as key to understand the functioning of the system, namely: *territorial assets* (Fig.1), *livelihood strategies* (Fig.2), *supra-territorial conditions* (Fig.3) and *institutional agreements* (Fig.4). This division is a simple practical decision to facilitate the analysis.

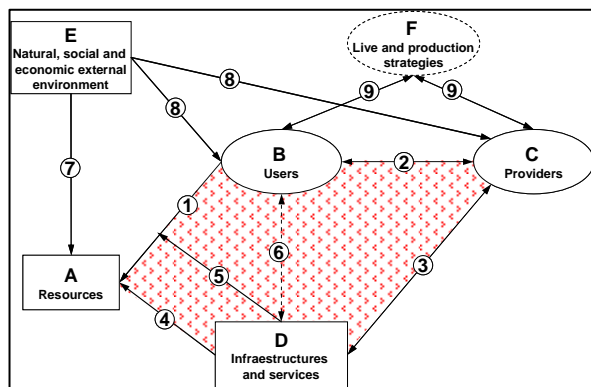


Fig. 1 Territorial assets subsystem

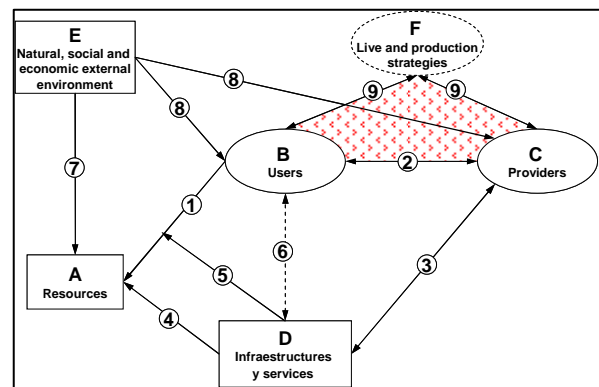


Fig. 2 Livelihood strategies subsystem

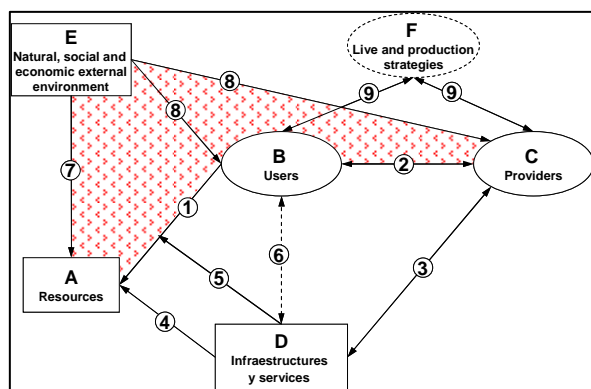


Fig. 3 Supraterritorial conditions subsystem

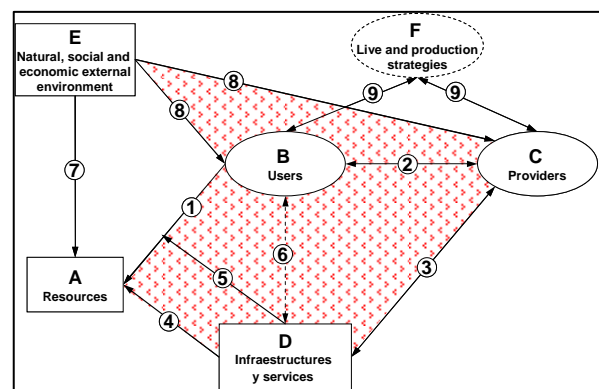


Fig. 4 Institutional agreements subsystem

If we aim at assessing rural territory as a complex, systemic and evolutive reality, its analysis will require a tool that allows us to take into account its heterogeneous constituent elements, their mutual non-

linear interrelations as well as its dynamic nature, by considering the impacts in the whole system of any eventual change in any of the constituent elements. Assuming rural territory as a social construction,

interpretations of local agents on constraints, potentialities and incentives for change in their communities should serve as fundamental input to elaborate the ‘territory’ as object of study. To achieve these goals, *prospective analysis* is proposed.

III. A TOOL TO ASSESS COMPLEX OBJECTS: THE PROSPECTIVE STRUCTURAL ANALYSIS

Prospective analysis techniques assume that the future is different from the past and is not imposed, but can be built. In our case, these techniques can describe present situations but also allow drawing scenarios through stimulating and structuring collective reflection processes to construct the vision of rural territories’ future and to highlight the necessary actions to reach it [35, 36].

To analyse the complexity of elements, factors and interactions present in rural territories and to understand the key variables in their current and future situation, *prospective structural analysis* (PSA) techniques have been used. This method is based on the development of future scenarios inferring historical tendencies within the system [35, 37, 38]. The main objective is to reduce future uncertainty building possible or desirable scenarios and fostering the necessary actions to reach them.

The PSA technique can help to describe a system identifying influence relations (in opposition to traditional cause-effect relations) among the different existing elements, through a collective reflection process and a double entry matrix. As an outcome, the

method highlights the ‘structure’ of relations of *motricity* and *dependency* among the system variables and points out the essential variables in the system evolution.

Loop effects on every system element are considered and a hierarchy of variables is established according to the mentioned *motricity* (the influence they exert in the functioning of the system) and *dependency* (the influence they receive from other elements) properties. The importance of a variable may not only be measured by its direct relations with other variables, but also by the millions of indirect relations [38]. Countless indirect influences on an element show the invisible structure of relations among the system elements and give an image very close to the *real* one, at least regarding the elements shaping its evolution.

Applying the Markov chain properties, this tool lets establish hierarchies and classifications of the elements according to their motricity and dependency properties [35]. The successive elevation of the matrix to 2, 3, 4 ... n potencies leads to classify the different matrix elements according to the total number of influences exerted or received. From a given potency the results become stable and this matrix is considered to measure the motricity and dependency of every variable.

PSA method has been adapted to the reality of rural areas. The method is structured in 3 phases.

Table 1 List of constructs for every territorial subsystem

TERRITORIAL SUBSYSTEMS			
Territorial assets	Livelihood strategies	Supraterritorial conditions	Institutional agreements
<ul style="list-style-type: none"> ▪ Natural Resources (<i>RecNatur</i>) ▪ Local identity (<i>Ident</i>) ▪ Sociability (<i>Sociab</i>) 	<ul style="list-style-type: none"> ▪ Rural poverty (<i>Pobrez</i>) ▪ Settlement patterns (<i>Asenta</i>) ▪ Migration strategies (<i>Emigr</i>) ▪ Household capital flows (<i>Capit</i>) ▪ Households’ income and activity diversification (<i>Divers</i>) ▪ Upgrading of agriculture production systems (<i>Modern</i>) ▪ Access to information and mass media (<i>Media</i>) 	<ul style="list-style-type: none"> ▪ Access to basic public services (<i>Servic</i>) ▪ Infrastructures (<i>Infraest</i>) ▪ Territorial administrative organization (<i>Adminis</i>) ▪ Local government (<i>GobLoc</i>) ▪ Land tenure patterns (<i>Tierra</i>) 	<ul style="list-style-type: none"> ▪ Political representativeness (<i>Repres</i>) ▪ Professional network and associations (<i>OrgProfes</i>) ▪ Local leaderships (<i>Lider</i>) ▪ Public – private joint action (<i>AC_GobPriv</i>) ▪ Public – civil society joint action (<i>AC_GobSoc</i>) ▪ Private – civil society joint action (<i>AC_PrivSoc</i>) ▪ Joint action among local governments (<i>AC_Gob</i>) ▪ Joint action among business organizations & professionals (<i>AC_Priv</i>) ▪ External agent influence (<i>Extern</i>)

A. Phase 1: List of constructs

The first step is to elaborate the list of internal and external variables shaping the system. The list should not contain more than 70-80 variables and every variable must be clearly defined and characterised, stating past and foreseeable future evolution tendencies.

Provided the difficulty to measure variables in rural areas, the approach of *construct* has been used. A construct is a “concept that researchers can define in conceptual terms, but can not be directly measured (...) or measured without mistakes” [39]. In the research presented in this paper the list of constructs for every territorial subsystem has been identified through the literature review on theoretical frameworks dealing with rural development. In any of the four territorial subsystems important variables have been identified. The list of selected constructs is shown in Table 1.

B. Phase 2: Description of relations among variables

In this phase a double entry matrix is filled up. Every element (a_{ij}) represents the influences of row (i) variables on column (j) variables. This is a key step in the process. A deep reflection on the nature of the influences is very important to clearly conclude whether the influence results on j by i (Fig.5a), due to a third variable k influencing both of them (Fig.5b) or even if it is mediated by a third variable m (Fig.5c).

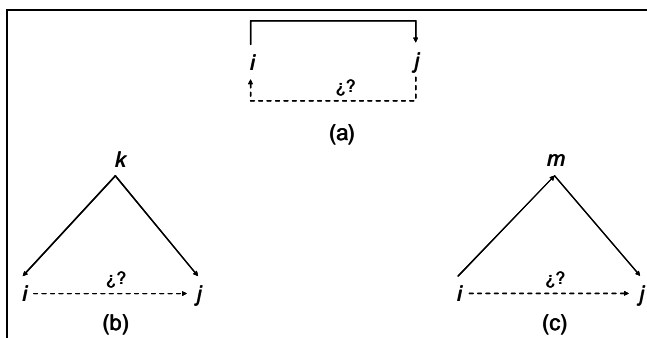


Fig. 5 Possibilities of influence among variables [35].

Values range from 0 to 3 (0 means that there is no direct influence between the two variables, 1 means a weak influence, 2 a medium and 3 a strong one). Also a P value (potential) can be assigned, meaning that the influence could be more important in the future if some circumstances change. The sign of the influences is not considered.

In this research, the PSA method has been applied in the analysis of four rural areas, two in Spain and two in Nicaragua. According to the research objective two countries with a very different development level have been selected. In addition, in every country two contiguous areas have been selected (to avoid spatial bias on the results) but also with different development levels. The aim has been to analyse the performance of the chosen construct list in these territories and to identify the variables explaining the development path.

The filling up of the influence matrixes has been done through *prospective workshops* with local actors. To be effective these techniques need the implication and the persistent commitment of key territorial actors. They not only contribute with their local knowledge and experience but their involvement in the process, can lead the future changes.

C. Phase 3: Identification of key variables using MICMAC tool.

To classify the variables MICMAC tool is used. MICMAC is a computer tool that uses the properties of Boolean matrix to classify the variables according to their motricity and dependency properties [38, 40]. The motricity order is calculated by the number of paths and loops of 1, 2... n length leaving from any variable. The dependency order is calculated by the number of paths and loops of 1, 2... n length entering to any variable.

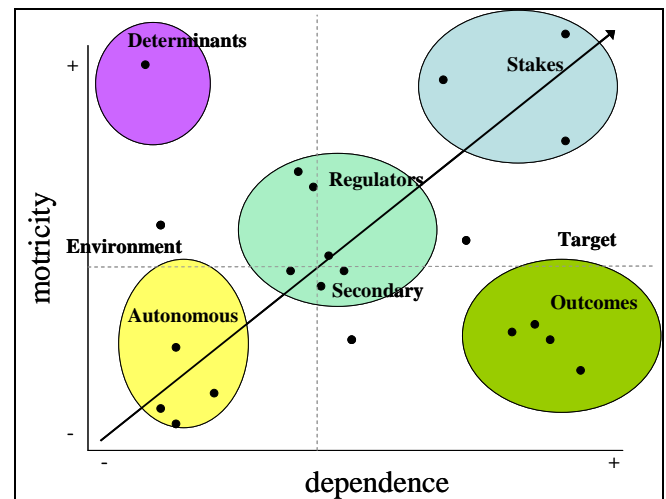


Fig. 6 Types of variables in motricity-dependency plan [41].

The variables hierarchy is established by the number and intensity of relations affecting them, both in motricity and dependency terms. Eight clusters can

be defined, consistent both with an input-output logic (*determinants, environment, target, outcomes*) and with a strategic logic (*stakes, regulators, secondary and autonomous*), as it is shown in Fig. 6.

The location of variables in any of the clusters means a different function in the system evolution. According to the input-output logic:

As input elements, the *determinant* aspects in system evolution are found. They have high motricity and few influence possibilities. In a second level we find *environment* aspects (medium motricity and low dependency).

As output elements, the *target* elements are the goals of the system, since it is possible to influence them (medium motricity). On the other hand, the *outcomes* describe the evolution of the system, but low influences can be exerted on them.

From a strategic logic [41], the following elements can be classified:

- *Autonomous* elements with a low potential to generate changes and also receiving few influences.

- *Transmission* elements that can be subdivided in two types: *regulators* (medium capacity to foster changes and medium capacity to be influenced) and *secondary* elements with a lower importance for the system functioning.
- *Stake* variables are critical to the system since their high motricity and dependency mean that any influence on/of them can highly disrupt normal system functioning.
- In addition, the variables located in the *strategic diagonal*, the angle bisector, are especially relevant, since they are important for the system functioning, but in addition it is possible to act on them. They are considered as transmission elements. They transfer the influences received from input elements to stake variables, but acting as multiplier. Furthermore, the biggest the distance from the origin, the most strategic their character is [41].

It is important to highlight that the image shown in these figures is the result of participants' understanding of direct influences among system elements.

Table 2 Description of the territories

Valle de Pedroches (SPAIN)	Valle del Guadiato (SPAIN)	Camoapa (NICARAGUA)	Matiguás (NICARAGUA)
<ul style="list-style-type: none"> ▪ Agricultural area ▪ Isolated area, but recent improvements in roads network ▪ Long history settlement patterns ▪ Strong local identity and risk aversion mentality ▪ Activity and population concentrated in bigger villages, but good settlement network ▪ Rural exodus from half XX century. Lost of young population, but some very dynamic villages ▪ Endogenous economic initiatives such as COVAP (one of the biggest farming cooperatives in Andalusia) ▪ Public incentives to agriculture modernization ▪ Local entrepreneurs and leaders highly accepted by population ▪ Financial support to economic diversification (LEADER). ▪ Powerful local administrations ▪ Initiatives of joint action among local administration locally accepted and with strong agency capacity 	<ul style="list-style-type: none"> ▪ Mining and energy area, highly dependent of external regulators. Hunting area ▪ Long history settlement patterns ▪ In mining villages, wages mentality. In agriculture villages, risk aversion mentality ▪ Population concentrated in the main town even if there is still some hamlets. ▪ Good communications network ▪ Strong migration from small villages. ▪ Miners get retired quite young with good pensions, but they don't invest in the local area ▪ Land concentration, in big farm holds (mainly dehesa system) with low incidence in the local economy ▪ Financial support to economic diversification (LEADER). ▪ Powerful local administrations ▪ Strong political character of the local leaders. Not much accepted by population ▪ Initiatives of joint action by local administration (Municipality associations) with external influence capacity ▪ Initiatives of joint action by local administration (Municipality associations) poorly accepted and with limited agency ability. 	<ul style="list-style-type: none"> ▪ Livestock production ▪ Isolated area with bad internal communications ▪ The main town is a recent settlement ▪ Limited influence of 'guerrilla' and agriculture frontier ▪ Migrant return ▪ Strong dependency of livestock and subsistence agriculture. Small businesses set up ▪ Rural poverty, more accentuated in rural villages ▪ Low access to basic services ▪ Low interest of public administrations in the territory ▪ Low management capacity and budget of local administration. ▪ Low impact of Agrarian Reform. Uneven access to land ▪ Limited agriculture modernization ▪ Endogenous development and joint action initiatives with exogenous support ▪ High participation of agents in initiatives 	<ul style="list-style-type: none"> ▪ Recent population settlement with migrant people or people from other parts of the country ▪ No local identity ▪ Weak social fabric. Conflicts related to land property ▪ Extreme poverty in some areas with low access to basic services ▪ Low population concentration in nucleus ▪ Strong dependency of livestock and subsistence agriculture ▪ Weak economic fabric in the main villages ▪ Some agriculture modernization initiatives, but limited ▪ Low economic incentives from administrations ▪ Bad experiences with Agrarian Reform ▪ Extensive and low productivity production system ▪ Good external communications, but bad internal connections ▪ Services concentrated in the main town ▪ Low management capacity and budget of local administration

IV. AN EMPIRICAL APPLICATION: THE FUNCTIONALITY BEHIND TERRITORIAL ELEMENTS IN NICARAGUAN AND SPANISH RURAL AREAS

Table 2 presents a short description of the study territories. It is the result of a morphologic-descriptive analysis of every territory done before the prospective workshops. Its importance derives of the lack of consideration of the sign of the influences by the PSA.

The method takes into account the intensity of the influences while does not make any distinction

between the positive or negative nature of such influence (a stake variable can have a very positive or negative influence on the system). So that the results obtained from the PSA should be supported by a context-specific analysis in order to make an appropriate assessment of the aggregated outcomes. Fig.7, Fig.8, Fig.9 and Fig.10 show the results of MICMAC analysis for any of the territories. Aggregate influences exerted by every element are considered (both direct and indirect influences).

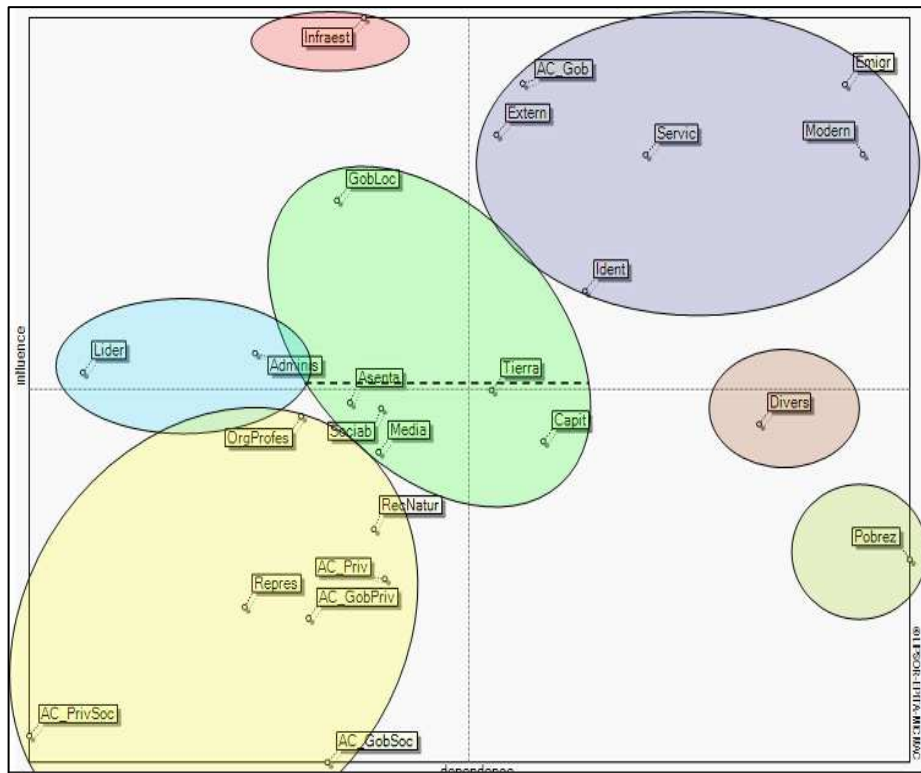


Fig. 7 MICMAC results for Valle de los Pedroches (Spain)

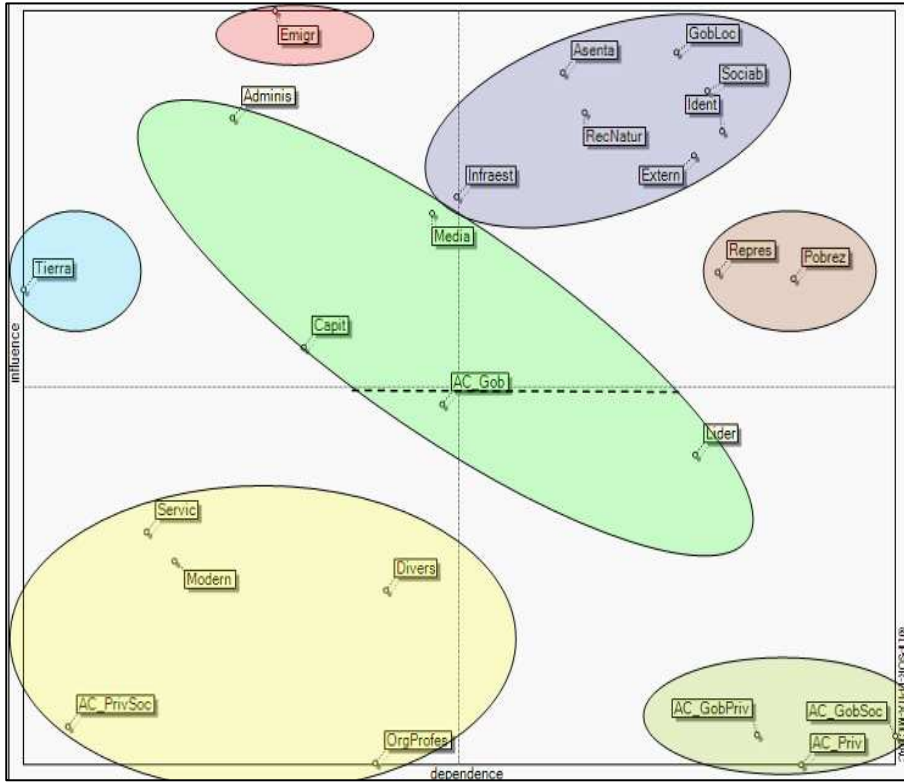


Fig. 8 MICMAC results for Valle del Guadiato (Spain)

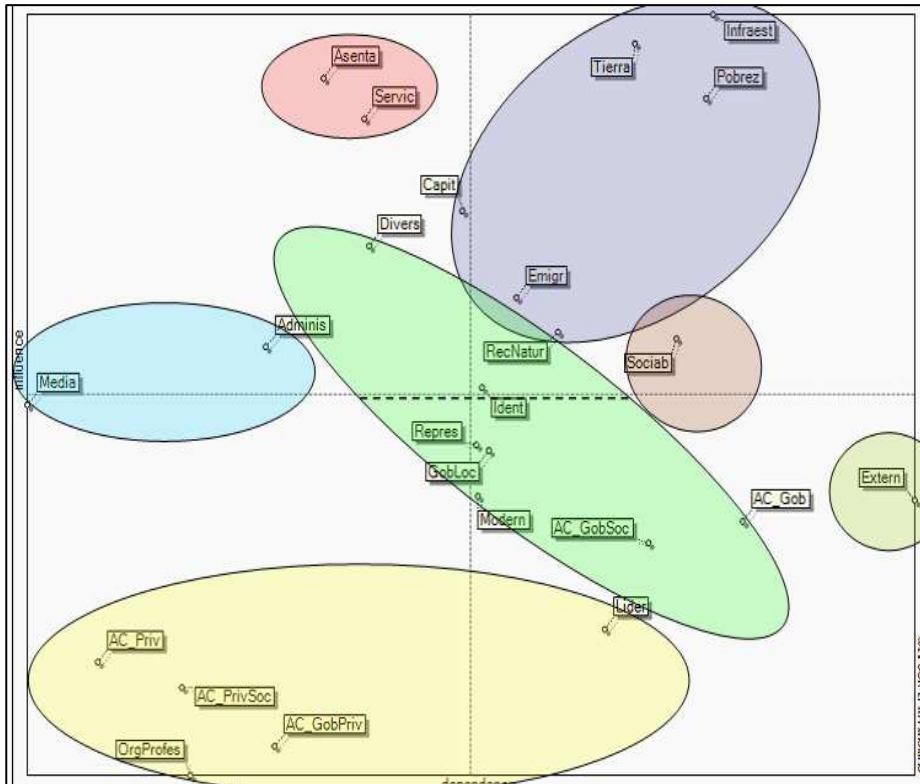


Fig. 9 MICMAC results for Camoapa (Nicaragua)



Fig. 10 MICMAC results for Matiguás (Nicaragua)

Only the more relevant results of the graphs will be commented. In **Valle de los Pedroches**, the territorial system has been conditioned (determinant and environment variables) by local leaderships (*Lider*), territorial administrative organizations (*Adminis*) and the lack of infrastructure (*Infraestr*). Stake variables are the Municipalities Association (*AC_Gob*), the local identity (*Ident*), the existence of exogenous development initiatives (*Extern*), the migration flows (*Emigr*), the limited modernization of agriculture activity (*Modern*) and the perceived limited access to basic public services (*Servic*). Transmission variable is the local government (*GobLoc*).

Change dynamics in **Valle del Guadiato** are determined by migration flows (*Emigr*) and land distribution (*Tierra*). As stake variables are the settlement pattern (*Asenta*), the heterogeneous local identity (*Ident*), the local government (*GobLoc*), the natural resources (*RecNatur*), the external agent influence (mainly on development and energetic resources exploitation) (*Extern*), the social fabric structure (*Sociab*) and the infrastructures (*Infraestr*). Transmission variables are central administration (*Adminis*), household capital flows (*Capit*), and access to information (*Media*).

Camoapa is highly conditioned by the deficit in basic services (*Servic*) and the settlement pattern (*Asenta*). Media y adminis As stake variables are the deficit of *infrastructures* (*Infraestr*), the extreme poverty situation (*Pobrez*), migratory flows (*Emigr*), natural resources pool (*RecNatur*) and land distribution (*Tierra*) capit. As transmission variables we find *activity diversification* (*Divers*) and local identity (*Ident*).

Matiguás is conditioned by local identity (*Ident*), the dispersion of settlement pattern (*Asenta*), and the lack of infrastructure (*Infraestruct*). Stake variables are poverty (*Pobrez*), the social fabric (*Sociab*), the uneven land property distribution (*Tierra*) and the lack of capacity of territorial administrative organization (*Adminis*). Transmission variables are the limited capacity of local administration (*GobLoc*) and the lack of political representativeness (*Repres*).

A comparison of the elements in the four territories according to their functionality is shown in Table 3. The numbers mean the number of territories in which an element has the same classification. To simplify, only four categories have been used: *input* (determinant and environment

variables), *output* (target and outcomes variables), *transmission* (secondary, regulators and stakes variables) and *autonomous* variables.

Table 3 Coincidences in the position of different variables

Subsystem	Variables	Input	Transmission	Output	Autonomous
Territorial assets	RecNatur		2	1	1
	Ident	1	3		
	Sociab		3	1	
Livelihood strategies	Pobrez		2	2	
	Asenta	2	2		
	Emigr	1	2		1
	Capit		4		
	Divers		2	1	1
	Modern		3		1
	Media	1	3		
Supraterritorial conditions	Servic	1	1	1	1
	Infraest	2	2		
	Adminis	2	2		
	GobLoc		4		
	Tierra	1	3		
Institutional agreements	Repres		2	1	1
	OrgProf		1		3
	Lider	1	2		1
	AC_GobPriv			1	3
	AC_GobSoc		2	1	1
	AC_PrivSoc				4
	AC_Gob		3		1
	AC_Priv			1	3
	Extern		2	2	

A. Discussion of results

As interesting results from the four territories analysis, it can be highlighted that most of the coincidences are in the elements positioned as transmission or autonomous. This is, in the elements located in the strategic diagonal. That means that independently of the determinant (input elements) or the objectives and expectations (output elements), there is similitude in transmission elements. In other words, the four territories show similarities in those elements able to generate multiplier effects, so the subjacent logic of these territories is not related to the conditioners or aspirations of territorial dynamics, but mainly to their endogenous functioning mechanic as socio-ecologic systems.

Within transmission elements, 4 coincidences are found in two variables, taken from indirect influence graph. These variables are the household capital flows and the local governments. The first one

(*Capit*) shows the critical role of available incomes as a driver of the territorial economy. Both, in Camoapa and Pedroches because of a vibrant agribusiness sector. In Guadiato, a territory shaped by traditionally mining villages, due to a wage mentality strongly embedded in the population and in Matiguás because of the weak presence of credit institutions and structural rigidities which limit a broader coverage for producers and considerably reduce the available incomes in the territory.

The latter variable (*GobLoc*) evidences the relevance of municipalities on the territorial dynamics, though from different perspectives. In Camoapa and Pedroches, local governments became the main institutional drivers of change in these areas, while in Guadiato and Matiguás they behaved as ‘bottle-necks’. According to the territorial assessments, the key factors of the influence exerted by these agents are: the availability of appropriate human and financial resources; their ability to mobilize and foster joint-action with other territorial actors, including other municipalities; the technical and financial support provided by supramunicipal public agencies (province and regional agencies in the Spanish cases, departament and national agencies in the Nicaraguan cases); and the tax base linked to the economic activity.

Within autonomous elements, also 4 coincidences are found in the role played by the joint-action among private and civil society actors (*AC_PrivSoc*). Like other elements of the *Institutional agreements* subsystem, their relevance to impel changes in the whole of the system appears to be reduced or quite limited. Among these institutional variables, only initiatives of joint-action among municipalities (*AC_Gob*) become strategic elements, being able to provoke multiplier effects and drive changes (be it the case in Pedroches and Camoapa) or even to become one of the fundamental ‘bottle-necks’ for the territory (Guadiato).

Regarding the variables present in 3 territories, those acting as transmission elements should be remarked. From those variables included in the *Territorial assets* subsystem, local identity (*Ident*) and sociability (*Sociab*) act as drivers in at least 3 territories. Local identity can be considered a slow-variable and place the cultural values and informal rules as elements that can be influenced within Pedroches, Guadiato and Camoapa. Only in Matiguás, the least developed area, this variable

behaves as determinant. The position of sociability suggests that the tendency to associate with others achieves impacts in territorial systems only when facing a long term perspective. Regarding the natural resources (*RecNatur*), the results show that ecological subsystem is a critical driver for the economic activity in Guadiato (mining activity) and Camoapa (agrarian and cattle farming), while in Matiguás becomes one of the main aspirations of the territory. Only in Pedroches it turns to be a less important variable, as autonomous. Economic diversification (*Divers*), which behaves as a goal of the system (output), could have reduced the relevance of agrarian and cattle activity for this area.

Within *Livelihoods strategies* subsystem, special attention deserves the upgrading of agricultural production systems (*Modern*), specially in those areas where agrarian and/or cattle activities play a fundamental role (Pedroches, Camoapa, Matiguás). In Pedroches, the large amount of public incentives has made this question to become a central driver of change for the territory. In both Nicaraguan territories, though still relevant, the strategic importance is lesser (as secondary element) and suggest ‘bottle necks’ to tackle changes in the local farms (regarding dimension, financing rigidities, productive rigidities, among others).

Within *Supraterritorial conditions* subsystem, only the land tenure patterns (*Tierra*) prevail as indicators of the relevance of primary sectors in the four cases (transmission in Pedroches, Camoapa and Matiguás, input variable in Guadiato).

Special reference can be made on three variables, which are frequently associated to rural areas. The settlement patterns (*Asenta*) greatly condition the accessibility to the territorial activity as well as the delivery of public services to the whole territory. Therefore, it plays a fundamental role as input variable (determinant in Camoapa and Matiguás) and transmission (Pedroches and Guadiato), in accordance to the intensity of the shortage, which is larger in the Nicaraguan areas. Infrastructures networks (*Infraest*) locate as transmission variable for Guadiato and Camoapa, and determinant for Pedroches and Matiguás. The relevance of the territorial administrative organization (*Adminis*) shows the extent at which the territorial transformations depend on the local agent action. The more strategic *Adminis* is (Guadiato, Matiguás), the more dependent a territory result and the less

ability within the territories to govern their structural changes.

V. CONCLUSIONS

Territorial rural development approaches emphasize a larger perspective on the social, economic and institutional factors that condition rural change. To cope with this integrative vision, rural studies have broadened the set of attached disciplines and benefitted from a variety of concepts and tools provided by multiple disciplines as well as promoted multi-disciplinarity. Nevertheless, some singularities which give rural areas their particular status still remain far from being fully captured and validated.

In regards to the methodological implications, the use of prospective structural analysis (PSA) technique to analyse rural territories has proved to be an interesting tool due to its coherence with the approaches of complex vision and territorial social construction.

PSA helps to build the rural territory as an emergent outcome through a reflective, structured process among local agents. This tool highlights reality main features and interprets them through a collective reflection process with local actors. Indirect variable matrix and feed-back effects on every variable allow establishing hierarchies among the variables. The subsequent classification lets understand the role played by the different constructs according to participant perceptions.

Some interesting remarks derived from the use of this technique are the following:

- It integrates mutual non-linear interrelations among the territorial elements.
 - It does not require quantitative data; this might facilitate assessing territories where appropriate statistics are missing.
 - It is based on qualitative considerations about the nature of interrelations, which avoid the loss of substantive information on such interrelations, in case that their quantification were not possible.
 - Instead of a logic of causation, the logic of motricity and dependence influences appears to be closer to the nature of *real* interrelations among agents and resources within a territorial system.
- Subjectivity has a fundamental role on the technique. Far from being considered a limitation, it offers an stimulating potential in order to validate the abovementioned rural singularities. Similar PSA outcomes among adjacent territories would be easily understood as shared judgements and perceptions among the local agents are more frequent theoretically.
 - But similar PSA results among distant areas suggest the presence of some kind of analogue patterns among rural territories. As our analysis has proved, territories with a very different development situation can show similar patterns. The pattern of settlements, the relevance of natural resources and the land tenure distribution condition any change in the assessed territories, which is fully coherent with traditional perceptions over rural areas. As transmission element, the local government as mediating element, becomes a primary reference as institutional driver for change in these areas. A similar role can be assigned to exercises of joint-action among municipalities, though the effective impact is context-specific.
 - It is a tool coherent with the assumed concept of territory as a social construction, as it allows building the territorial system according to local actors' vision and the interpretation they do of problem and potentials of their rural area.
 - PSA facilitates not only a systemic approach for the object of study, but also identify the functionality of the elements to drive changes within the system, according to their mutual interrelations.
 - Results highlight the need of territorial diagnosis because, as it has already been mentioned, for any given variable belonging to a certain MICMAC cluster *per se* does not involve neither a positive nor a negative influence on the system.

In the analysed territories coincidences have been found in the location of several variables. The largest number of coincidences is found in the elements located along the strategic diagonal which are related to the functioning mechanic of territories as socio-ecologic systems. Given that these coincidences occur among really distant areas in every aspect, this result hints that assessing the singularities in rural areas should be based on a functional rather than morphological approach. To better delimit such singularities, further research

should consider a larger list of constructs (40-50 variables).

As disadvantages can be mentioned that the tool is time costly. Such list of constructs results from deliberation among key local actors and the quantification of relations among variables requires a considerable involvement and reflection from their side. Also it is advisable to check MICMAC results with these experts in order to better understand the sign of influences or the reasons behind some odd results.

However, both the exhaustive deliberation and the discussion of the results can be very clarifying and useful exercises, not only as a prior step before undertaking strategic planning, but also to detonate change among the stakeholders. As TRD approach pretends, rural change is reliant on the local actors' perception and attitudes which necessarily have to be taken into account in any future change. PSA offers a technique to structure all those perceptions and facilitate discussion among local stakeholders, as well as to elaborate a shared interpretation of the topic within the group. Since around 20% of the results provided by MICMAC use to be counter-intuitive [38], such unexpected outputs can serve as change drivers within the group.

To better understand the process of rural change from this perspective of complexity, further theoretical and methodological development is needed over the mutual dependency and the dynamic nature of the interrelations among the constituent elements of rural areas.

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