

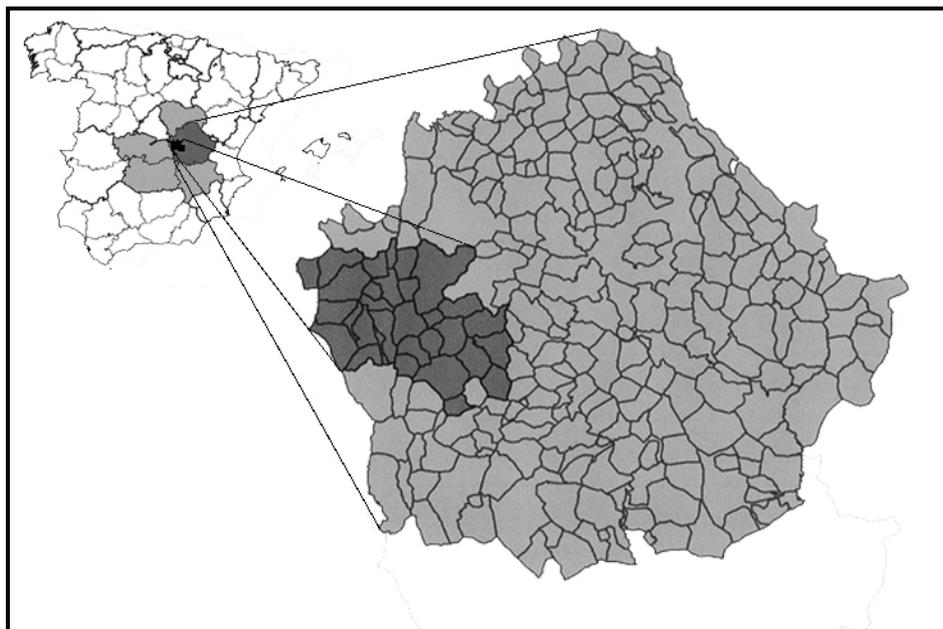
New technologies, research and marginal rural regions: The strategic formula promoted by ADIMMAC for the Local Agenda 21 of the La Mancha Alta Conquense (Spain).

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1 INTRODUCTION:

This paper examines the way new technologies (GIS & Remote Sensing Technologies) can help the management of marginal rural regions, analysing the case of an area composed by 29 municipalities within in a region known as *La Mancha Alta Conquense* (1,824 km²) located in the Autonomous Community of Castilla-La Mancha, Spain (Graph. 1) which decided to produce its own Local Agenda 21 (LA 21).



Graph 1: Study Area, (Source: ARC-GIS).

The paper is focused on this process and its results in terms of New Technologies (NT) application (partial until now, being a process still in progress) with the aim to portray the power of the NT to help the development of rural areas. The structure of the paper runs along two axes: the role of the local association that promotes the LA 21 (ADIMMAC) and its technical objectives, and its strategic alliance with the Institute of Economics and Geography (IEG), a national research institution for the provision of technical support.

The paper analyses the responses to cope with the needs related to the process of the LA 21 formulation: from the diagnosis to the decision taking process, including the training requirements for the local administrators to close the gap that characterizes marginal societies like this one.

2 THE ROLE OF THE NT IN THE PROMOTION OF SUSTAINABLE DEVELOPMENT

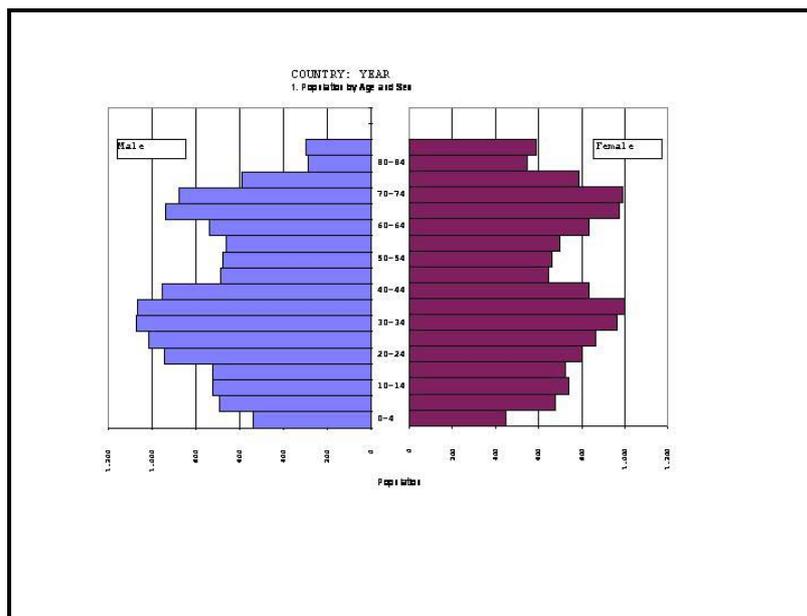
In the European Union the rural regions are facing a process of change that pursues the dinamization of the economic, social and cultural life trying to balance the conservation of nature as a way to maintain the natural resources for the coming generations. In this commitment for the future, promoted since 1992 by the EU and the United Nations as a result of the Summit of Rio de Janeiro, where local leaders play an essential role as the responsables of impelling this process of change. The programs for local leaders' education and training are fundamental to create favorable conditions for the generation of strategic activities included in Local Action Plans aimed at promoting a sustainable development in their regions.

The role of the scientific and academic institutions in the promotion of this process of change is essential, giving help in several fields such as formation of local leaders; the application of geomatics technologies (GIS, Remote Sensing and Automatic Cartography) in the elaboration of instruments of sustainable administration (specifically Local Agendas 21); the diffusion of the geographical information by means of Web Mapping technologies as facilitators for the process of decision taking; or the training of the end users.

3 ADIMMAC AND IEG: A STRATEGIC ALLIANCE TO COPE WITH THE PROBLEMS OF A MARGINAL TERRITORY.

- IEG: the Institute of Economics and Geography is a research centre located in Madrid, specialized in territorial studies and in the use of NT applied to regional diagnosis, that belongs to the Spanish Council for Scientific Research.

- ADIMMAC: acronym of the Association for the Integral Development of the Municipalities of La Mancha Alta Conquense, a group of municipalities including in a rural region characterized by a declining situation, included in an operative program of economic and rural development (PRODER-2) promoted by the Spanish Ministry of Agriculture, similar in its objectives to those of the initiative LEADER + of the European Union. The territory has the following profile:
 - *an eminently rural base economic*: most of the active population is devoted to the agrarian sector.
 - *scarce industrial activity*: only one city - Tarancón, the biggest of the local urban system - possesses an important number of workers in this economic sector.
 - *progressive loss of population*: most of the population has emigrated to urban settlements of higher hierarchy next to the local urban system (mainly Madrid and Valencia).
 - *aged population*: the average ageing index is 36,46 (Graph 2).
 - *unbalanced system of cities*: Tarancón is biggest city (11.796 hab.) while 18 municipalities (46% of the region) possess less than 500 hab.
 - *scarce social cohesion*.



Graph 2: Population Pyramid (Source: Population Census, 2001)

- The project: the idea of beginning a process of collaboration between both institutions arises as a result of the attendance of the president of ADIMMAC and the manager of the program PRODER-2 to the International Master on Local Development, organised by the IEG. The training of these directives was a decisive factor for the agreement of collaboration (signed in April 2002) to produce a LA 21 for the region. The objectives of the agreement were the following:
 - *knowledge of the regional reality*, in terms of the existing environmental, social and economic variables.
 - *improvement of the municipal management*, by means of recommendation derived from the territorial diagnosis.
 - *definition of a sustainable model for the region*, resulting from a bottom - up and participative process.
 - *implementation of the model*, giving contents to a Local Action Plan.
 - *continuous improvement of the municipal management*, as a way to promote new forms of governance.

3.1 Expected results

Five are the main expected outcomes:

1. *Environmental Audit*, an instrument used for the territorial analysis and diagnosis as well as for the definition of new strategies. The Territorial Analysis is directed to produce an inventory of the strategic natural resources; an assessment on the state of conservation; a profile of the population dynamics and its socioeconomic characteristics; and an evaluation of the main environmental vectors. The Diagnosis identifies the regional weaknesses, threats, strengths and opportunities.
2. *Sustainable Objectives and Strategic Lines*, required for the Environmental Forum to guide the definition of programs and projects included in the future LA 21. Seven were the key strategic areas selected: *agriculture, economy and enterprise; towns and cities; tourism and cultural heritage; territorial interrelations; conservation of nature, environmental education and formation*.
3. *Elaboration of a GIS*, conceived as an add-on product of the LA 21. From the beginning, the ADIMMAC local leaders realised the convenience of using the NT to help the local development process within the context of the society of the information. It is expected that the use of this GIS will help the decision taking process of all agents involved: authorities, local action groups, enterprises and society in general. On the other hand, the GIS will be the space database that support the map server in Internet used for consultation through the Local Net.

4. *ADIMMAC Local Net*, the 29 municipalities will be linked by a computerized system to follow the results of the Local Action Plan.

5. *Training of local leader in the use of NT*, by means of specific courses and workshops.

4 TECHNICAL RESPONSES

4.1 Environmental Audit.

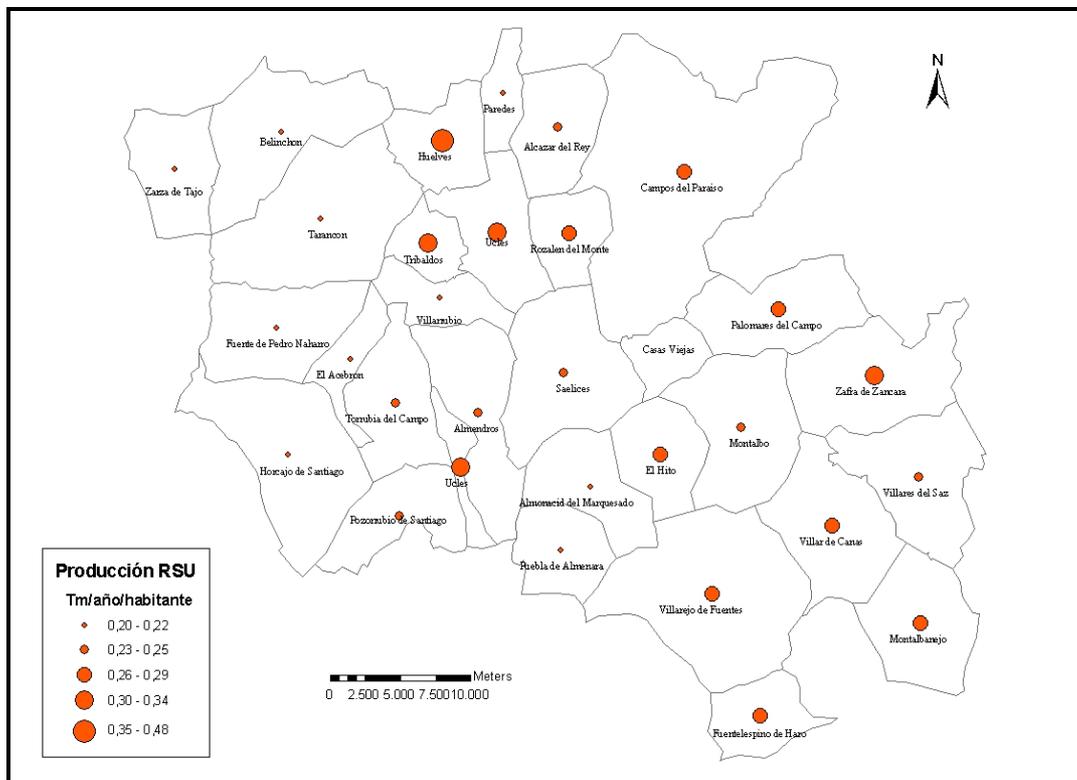
The Environmental Audit is a method that allows local communities to get regular and systematic assessments of their environment, including the impacts of the public policies (Barton and Bruder, 1995). It is an operative instrument that analyzes the regional sustainability, providing information of the existing territorial conditions.

The elaboration of the territorial diagnosis has been produced at two simultaneous levels: the treatment of the existent information in form of reports, maps and thematic SWOTs, and the definition of the database for the GIS. The existing information gave contents to a Document of Synthesis composed by two chapters:

1- *Qualitative Diagnosis*, outcome of an ample opinion surveys directed to grasp the way local people *perceive* the present regional situation. In October 2002, 80 leaders and key agents were asked about environmental, social and economic aspects, with the aim of identify the capacity of the region to cope with a process of sustainable development. The survey data – *ACCESS* was used for tabulation and statistical treatment – gave contents for the elaboration of a qualitative SWAT.

2. *Quantitative Diagnosis*, based on the existing statistical information from different sources (population censuses, agrarian censuses, directories of economic activities, reports of heritage elements, surveys of infrastructures and facilities) as well as the information produced by the GIS using space analysis operations. This information has been stored in EXCEL and has been linked to ARC-GIS through a common ID. The attributes of each municipality have been linked to different maps, traducing the numerical information into a cartographic mode to facilitate its understanding (Graph. 3). A quantitative SWAT was produce from these inputs.

To evaluate the sustainability at a municipal and regional level several geographical, social, economic and environmental indicators were selected, following the ones recommended by EEA (2000) and OECD (1993). Using the so-called *iconographic comprehensive matrixes* (Franchini, 2000) it was possible to evaluate the level of sustainability of any municipality and, at the some time, the magnitude of the public and private efforts required to be carried out to improve the present situation in the short, medium and long term. The matrixes rank the situation according to the value the indicators assume: under or above the critical threshold of sustainability defined for each case (positive or negative), modulating each case in three possible levels: high, medium or low. To facilitate the lecture, each cell has been coloured in a green range (positive) or red range (negative) (Table 1).



Graph 3: Solid Waste Production (Tm/year/inhab) in La Mancha Alta Conquense (Source: ARC-GIS).

GEOCOD	MUNICIPALITY	ROAD_DENSITY (km/km ²)	WATER LOSS (%)	SEWAGE (m3/year/inhab)	SOLID WASTE PRODUCTION (Tm/year/inhab)	UNCONTROLLED RUBBISH TIP (Presence)
16002	Acebrón (El)	0,21	5	90,00	0,21	NO
16010	Alcázar del Rey	0,18	5	111,54	0,25	NO
16016	Almendros	0,30	8	99,83	0,23	YES
16018	Almonacid del Marquesado	0,21	5	84,80	0,20	YES
16032	Belinchón	0,16	7	97,15	0,22	NO
16086	Fuente de Pedro Naharro	0,10	25	91,56	0,21	YES
16087	Fuentelespino de Haro	0,24	10	114,65	0,26	NO
16101	Hito (El)	0,13	10	132,86	0,29	NO
16106	Horcajo de Santiago	0,17	15	92,86	0,22	YES
16108	Huelves	0,42	10	226,91	0,48	YES
16129	Montalbanejo	0,16	5	126,28	0,28	YES
16130	Montalbo	0,29	30	101,46	0,23	YES
16148	Palomares del Campo	0,34	10	115,01	0,26	NO
16151	Paredes	0,20	12	90,76	0,21	YES
16167	Pozorrubio	0,09	10	105,30	0,24	YES
16172	Puebla de Almenara	0,22	3	96,39	0,22	YES
16181	Rozalén del Monte	0,18	3	116,53	0,26	NO
16186	Saelices	0,43	20	105,68	0,24	NO
16203	Tarancón	0,23	50	86,22	0,20	NO
16212	Torrubia del Campo	0,17	20	110,43	0,25	NO
16217	Tribaldos	0,18	20	155,15	0,34	NO
16218	Uclés	0,08	10	144,85	0,32	YES
16253	Villar de Cañas	0,27	10	117,89	0,26	YES
16264	Villarejo de Fuentes	0,27	15	119,14	0,27	YES
16269	Villares del Saz	0,25	20	105,59	0,24	YES
16270	Villarrubio	0,43	20	91,52	0,21	NO
16277	Zafra de Zancara	0,27	40	147,59	0,33	NO
16279	Zarza de Tajo	0,37	10	97,06	0,22	NO
16901	Campos del Paraiso	0,32	9	116,69	0,26	YES

Table 1: Fragment of an Iconographic Comprehensive Matrix (Source: Survey of Infrastructures and Facilities, Spanish Ministry of Publics Administrations)

4.2 GIS

The regional GIS seeks to fulfil three purposes: definition of the present territorial situation; monitoring of their environmental conditions and evaluation of the impacts of environmental policies.

The GIS describes the geographical space in a dual way: directly, by means of their attributes, capturing the data coming from satellite images and Digital Elevations Models (DEM), and indirectly, from the elements or parts described by their attributes and relationships. For the capture of the data it has been used a CAD of general purpose (Microstation) and a relational GIS (Microstation GIS Environment, MGE), due to its simplicity and flexibility (Newell and Theriault, 1989). However, for the future installation of the GIS in the inter-municipal net it is foreseen the use of ARC-GIS, given its easy handling. To facilitate the exchange of formats it is used GEOMEDIA (Intergraph).

- Sources of information:

- *Geographical Service of the Spanish Army*: numeric cartographic base (NCB50), scale 1/50.000, format * dgn.

- *National Meteorological Institute*: climatic database

- *Ministry of Agriculture*: facilitated the map of the present uses, including crops, in digital format.

- *Ministry of Environment*: list of Sites of Community Importance (SCI), proposed by the regional government to become part of the Natura 2000 Network.

- First GIS product:

- *Regional Digital Elevations Model*: to analyze environmental aspects starting from the levels contour and the enclosed points of the NCB50, from which other maps derives (hypsometric, of slopes and aspects).

4.3 Social responses: the value of the technical information

The information produced by IEG acquired a high value, so much for the 120 people that compose the Environmental Forum facing the definition of the LA21. The improvement of the territorial knowledge in terms of sustainability is an already reached objective.

As a result of the successful social movement organized around the Environmental Forum, the Government of the Autonomous Community of La Mancha – that participates in the project as an observer – it is considering this experience as an example to be followed. If the results are positive, the Government is willingly to impel the application of the same methodology to the rest of the rural territories of the region.

5 PENDING TASKS

While ADIMMAC is elaborating its proposals for the LA21, the activities of the IEG are centred in completing the remaining tasks: completion of the GIS; organization of the ADDIMMAC Local Net, and definition of the contents for education and training.

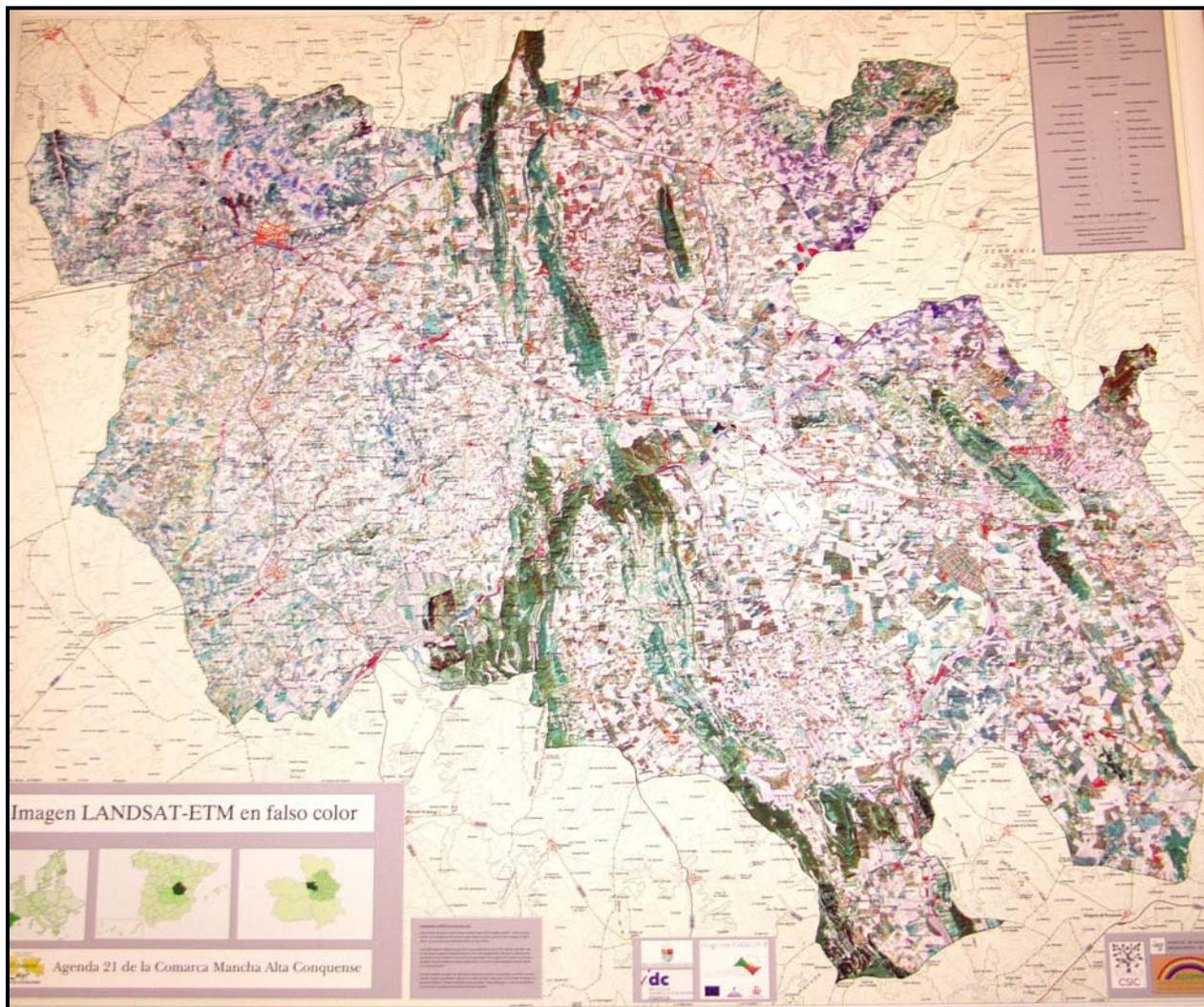
5.1 GIS completion

The Spanish Geological Institute will provide the geological map, scale 1/50.000 in digital support, to get information of underground aquifers and hydrographical basins, using the DEM. The climatic data, correlated with the DEM and with data of latitude and longitude, will allow modelling outstanding biophysical variables to be included in models of agricultural capacity of soils and erosion. For the upgrading of the map of land uses is interpreting visually, by means of digitization on screen, a scene Landsat ETM+ of August 5 2002 (Graph 4) with the support of digital blank and black aerial photographs, of 1 m of spatial resolution.

Their comparison will allow to know the structure of the changes taken place in the land uses and to formulate patterns of change, tendencies and to apply indexes of ecology of the landscape using FRAGSTAT, for example. On the other hand, the use of the land is a strategic variable to derive studies of the visual quality and fragility of the landscape and to assign protection levels to habitats and fauna species. Also, they will be able to simulate future scenarios, by means of cellular automata, introducing diverse conditions of change (Lavalle et al., 2002). Finally, it is working to incorporate the running planning instruments and a tourist map in which specific routes for eco-tourism and the most interesting points of geologic, natural and patrimonial interest are pointed out.

5.2 ADIMMAC Local Net installation

For the purpose to improve the capacity of the municipal administrations in the decision taking process using the GIS, it will be defined a protocol to connect terminal nodes in each municipality served by an administrator of the system located in ADIMMAC headquarters. To reach these objectives, GIS is a key piece: it should integrate the whole information in a standard structure and very well documented (Metadata). The server will provide to the end users maps using web mapping technology, and will have an interface that facilitates the consultation, the visualization and the analysis of the information integrated in the GIS.



Graph 4: LANDSAT ETM+ image of La Mancha Alta Conquense (Source: Microstation GIS Environment)

5.3 Education and training for end users.

To reach conditions of success it is indispensable that the end users commit to participate in a formation program and technological training that qualifies them in their handling, as a way to extract the maximum possibilities to the GIS. The project expects to contribute in the modernization of the municipal administration. The formation should be organized at several levels: seminars and workshops for users of terminal nodes and advanced courses for the system administrator.

6 THE NTS, THE MARGINAL RURAL AREAS AND THE CONDITIONS OF SUCCESS

1. *The leaders*: it is of great importance the presence of enthusiastic local leaders capable of dynamizing the social and economic life of marginal rural regions, especially those affected by a selective emigration of the most dynamic groups. It is also fundamental the existence of local attitudes towards change, and the willingness of being involved in the processes of recycling of knowledge.
2. *Scientific institutions*: it is also essential that research organizations centered in applied investigation contribute to solving concrete problems of the society, especially those ones involved in the use of New Technologies.
3. *Finance*: in economic terms, these rural territories must have a minimum of economic base - reinforced for initiatives such as Leader or Proder - to promote new investments and to open new perspectives.
4. *Public participation*: a local community that supports the initiatives of the leaders is essential to promote a process of change. Without a civic participation it is not possible a successful LA 21.
5. *NT Infrastructure*: it is indispensable for the marginal rural communities to have a minimum level of this kind of infrastructure. The access to the broadband communications in these regions is a challenge governments should face. New technological conditions opens the possibility to reduce economic and social differences among urban and rural areas.

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