Digital strategies and solutions for the development of remoted rural areas. The case of the Orchidea Project in Valceno, Italy.

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1. Introduction

The Orchidea (Orchid) Project is part of a wider range of initiatives undertaken by the Centro Studi della Valle del Ceno, Cardinale Antonio Samorè, initiated in 2000, with the final aim to reverse the heavy depopulation, socio-economic decline and cultural impoverishment experienced by the Valle del Ceno.

The Valle del Ceno (Ceno Valley), is located in the Apennine mountains of western Emilia, in northern Italy. Administratively it is part of the Province of Parma. Its historic remoteness and isolation, conditions dating to pre-Roman times, have given the territory its very own specific cultural and behavioural identity.

Centro Studi Val Ceno Card. Antonio Samorè is a cultural, non profit-making association, established in 1972 by Card. Antonio Samorè - born in Bardi (Parma) and responsible at that time for the Vatican Secret Archives - together with a limited but reliable group of intellectuals native to Val Ceno.

The founders' vision has enabled the Centro Studi to become an informal research and consultative forum, shared by various stakeholders of the Valle de Ceno community. The Centro Studi's constitution provides for the Mayors of the Valle de Ceno villages to sit on the Executive Council.

Past Chairmen have included Prof. Vito Fumagalli, a leading world authority and historian of the Middle Ages - Professor of Medieval History at the University of Bologna and Senator of the Republic.

The present Chairman is Ing. Andrea Pontremoli, formerly Chairman and Managing Director of IBM Italia S.p.A. and IBM Foundation, now Partner and Managing Director of Dallara Automobili S.p.A., Member of the Board of Directors of Barilla S.p.A. and Director of the Master's Innovation course at the University of Bologna.

Established in June 2003, Harimann Consulting & Technologies Srl has its seat in the Apennine town of Bardi (near Parma) and is made up of professional people who, over the years, have worked for major Italian consulting companies. Harimann is an ICT company focused on the application of digital technologies aimed at the creation of new value for private and public sector enterprises.

Harimann has been responsible for the "Orchidea Project" since its inception in 2003. The Project's aim is the establishment of an organisational model and the creation of a web based information system capable of initiating and supporting the economic revitalisation of rural territories.

The Project was conceived by Harimann and proposed to the Association "Centro Studi Valceno Cardinale Antonio Samorè" in response to their tender announced in October 2003. Funding of the Centro Studi is provided by a mix of central Government (via the Ministry of the Environment) and local Government (including the local administrations of Bardi, Varano dè Melegari, Varsi as well as from the West Mountain Community of Taro and Ceno Valleys).

A critical contribution was provided by the Department of Functional and Evolutive Biology of the University of Parma.

The initial, wide ranging, desk research gathered information from different disciplines including regional economics, management, and social sciences (i.e. demography); from the natural and environmental sciences (i.e. ecosystem, urban and landscape ecology, botany, geobotany, fito-sociology, zoology, climatology, geology, geomorphology); and – last but not least – from media and communications studies.

From this activity there emerged a vision and ideas considered applicable and practicable to achieve the overall aim of socio-economic regeneration. These were progressively translated into functional requirements during the analysis and design phases of the Project, with informatics providing the enabling technology to translate the various processes within the local community and to the outside world. A great effort has been made to converge into a coherent system the different technical domains that traditionally rarely communicate with each other.

2. General concepts

a. Remote and Rural

The term "Remote Rural Area" contains two different concepts: "remoteness" and "rurality"[1].

"Remote" is related to physical distance and/or difficult geomorphology with subsequent poor logistic infrastructures and scarce transport efficiency. The conventional wisdom traces back the

[1] Zabbini E., Grandi S., Dallari F., Relative Remote Rural Areas (RRRA) in Developed Regions: an Analysis of the Emila Romagna Region to Support Policy Decision Making, in Note e Ricerche – Biblioteca Centralizzata del Polo Scientifico – Didattico di Rimini, Università di Bologna, Working paper n. 4 (2007), pp. 1-29. Downloadable at: http://mpra.ub.uni-muenchen.de/4661/ .

limited economic development of these territories to these causes. Also early theories about the localization of production activities considered these as the main factors affecting territorial competitiveness.[2]

The European Union research project TERA (Territorial Aspects of Enterprise Development in Remote Rural Areas)[3] applied a methodology for the comparative identification of the marginalised areas within the E.U. countries. The researchers based the classification of the size of the considered territories upon the "Eurostat NUTS standard"[4], a subdivision of countries in smaller entities, arranged in a hierarchy, which was originally created for statistical purposes.

NUTS 4 level has been adopted as the most appropriate geographical scale: the NUTS 3 level would have entailed the consideration of too large territorial units and a substantial loss in information, while level 5 would have meant an excessive fragmentation of the data.

Italy does not have any administrative authority corresponding to NUTS 4 level; the authority for NUTS 3 is the "Provincia" ("Province"), for NUTS 5 is the "Comune" ("Municipality") and both would not be coherent with the analysis level. To overcame the problem, the research proposed to adopt an informal kind of territorial units, the so called SSLs ("Sistemi Locali di Lavoro" or "Local Labour Systems"). They are virtual aggregations of municipalities which share similar social, cultural and economic characteristics. These areas describe - in geographical terms – the interdependence between municipalities, the way they co-operate and form a coherent economic system. Their structure is dynamic and adaptive and changes according to the evolution of long term socio-economic trends.

Through a multidimensional comparison of the SSLs in the Emilia - Romagna region, the TERA project identified two weak areas, located symmetrically east and west of the Via Emilia axis: the Po plain area (NUTS 3, covering the provinces of Ferrara and Ravenna) and the Apennine mountains (part of NUTS 3, provinces of Piacenza and Parma), exactly where the Ceno Valley is located.

Therefore the territory of the Ceno Valley constitutes a paradigmatic sample of what is commonly intended as "a remote area" (isolated from the main channels of communication) and of what an "SSL" is (a interprovincial – and possibly - interregional group of municipalities with common intrinsic characteristics, struggling against unfavourable conditions)[5].

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[2] Capello R.,: Economia Regionale, Milano, 2004, pp. 24-26, 41-68, 72 -100.

[3] Bednarikova Z., Doucha T., Nohel F., Stolbova M., Travnicek Z. : Study Area Contexts (Comparative Analysis), Bologna, TERA, Deliverable n.2/WP1, Project n° FP6-SSP-2005-006469, www2.dse.unibo.it/tera/.

[4] NUTS means Nomenclature des Unitès Territoriales Statistique, in English: Nomenclature of Territorial Units for Statistics. See the following examples. Nuts 1: Italy, Gruppo di Regioni (not existing)/ UK, Government Office regions (England) Country (Wales, Scotland, Northern Ireland); Nuts 2: Italy, Regione / UK, Cerimonial (or Geographical) Counties, Inner and Outer London (England), Groups of Unitary Authorities (Wales, Scotland, Northern Ireland); NUTS 3: Italy, Provincia / UK Upper Tier Authorities or Groups of Lower Tier Authorities (Unitary Authorities or Districts) etc.

[5] "*Composed of the Municipalities located in the mountain area in the Apennines. As for demographic indicators these areas present a low number of inhabitants in absolute term, as well as density of population and a negative population balance, linked with very high seniority and dependency indexes. Per capita disposable income is relatively high on average, as well as unemployment and local unit/inhabitant does not show significantly negative values. Low commuting patterns is an additional indication of the relatively "close" economic system. The presence of a lot of vacant houses witnesses the use of the territory as a leisure area*" (page 14).

The Orchidea Project also took inspiration from a different set of theories related to the concept of space as a relational and diversified entity, recognizing a disomogeneous ("diversified") distribution of enterprise activities within regions. This also observes that local development is based on the convergence of two groups of factors. The first are exogenous ("external") factors, such as regional infrastructural investments, initiatives financially supported by central governments, the presence of multinational companies. The second group are endogenous ("internal") factors, in particular the presence of a micro social and cultural system, whose intrinsic relationships are able to generate productive efficiency and innovative efficacy (and hence "relational").

All of these provided the Orchidea Project with a wide range of conceptual tools. The traditional negative meaning attributed to "space" - considered as a "physical barrier" - is changed into a more complex yet positive concept, of space as an "economic resource" and an "autonomous productive factor". As a consequence "remoteness" may be interpreted not only as "isolated" but also as "different".

At the same time, "rural" acquires different meanings according to the speaker's point of view. We may interpret it as "agricultural" (from an "industrial" point of view), "unsettled" ("demographic"), "natural" ("ecological") or simply "non urban".

Adopting this latter conventional meaning, rural areas constitute more than 90% of the European Union territory[6] . The "Rural Development Policy 2007 – 2013" is orientated to reduce the unbalance between the urban and non urban areas. Improvement of competitiveness for farming and forestry, environmental preservation, enhancement of the quality of life and diversification in the rural economy, are recurring buzz-words in European Union documents.

Multiformity is finally recognized as a component of a rural identity. This is the pre-condition for mining new potentialities, which have been put in the shade for long by the degeneration of welfareism towards traditional farming.

During the 38th Congress of the Regional Science Association, the Work Group on Innovation"[7] of the "European Leader Observatory" remarked the contraposition between "rural" and "innovative".

"*Rural areas are somewhat deleted with regard to innovation and technology development, because mainly urban based scientists, administration and business people implicitly define it as an urban affair. Rural territories are the space between places where innovation is likely to happen (...)*

However, rural areas are sometimes addressed in the mainstream discussion; their role is distorted towards that of a passive receiver. Actors are advised to make their regional production and support systems fit for absorbing and adopting new technologies and the related skills stemming from urban–industrial research and development. They are rarely taken into consideration as creators of innovative practices.

The current perception of innovation in rural areas aims to diminish gaps between them and economically dominant agglomerations. Rural enterprises apply mature technologies exploiting

[6] Zabbini, 2007, pag 1.

[7] Work Group on Innovation, Gilda Farrel (AEIDL, BE) , Robert Lukesch (ÖAR, AT) ,Eveline Durieux (AEIDL, BE), Martine François (GRET, FR), Elena Saraceno (CRES, IT), Paul Soto (Iniciativas Econòmicas, ES, Samuel Thirion (INDE, PT): *"Europe quo vadis? Regional Questions at the Turn of the Century" European leader Observatory, Bruxelles, 2000.*

comparative advantages such as low wages and infrastructure costs. Innovation is rather directed toward the generalisation of practices and the equalisation of framework conditions than towards the enhancement of uniqueness and diversity, which is indispensable for creating competitive advantages"

These words describe in real terms the situation faced by the Centro Studi Valceno and the small group of local firms at the beginning of the Project.

Furthermore:

"*The grid which is currently used to read success stories of innovation is focussed on enterprises. Innovative regions play the role of milieus in which innovative enterprises emerge, thrive and sometimes fail. A concept which is based on single heroic global players, the vanguards of excellence, automatically produces the depicted caricatural image of the role of rural areas with respect of innovation*"

And finally:

"*While reading about 100 stories of innovative actions in rural areas the work group on Innovation discovered the opalescent richness of the emerging patterns, when it started to conceive the rural territory as a virtual innovative actor by itself. Enterprises, voluntary actors, public institutions operated in a co-ordinated, but not always intended way and the resulting innovation opened up new options and space for more creative developments within the regional system. In fact innovations in rural areas have the same objectives as innovations in enterprises: to reinforce the competitive advantages of the territory. The major difference lies in the fact that considering territories both: economic competitiveness and social competitiveness have the same importance and weight*"

Under many aspects, the Orchidea Project has much in common with the actions mentioned above. It reflects the promoters' aim to start a long term initiative driven by local forces - a way to develop a self designed strategy, customized tools to pursue it, and a challenge for local operators to think and produce innovation.

The first result achieved by the Project was intangible: the "spontaneous co-ordination" between stakeholders with different professional backgrounds which emerged. This bottom – up approach caught off- guard those provincial and regional institutions accustomed to rigidly controlled planning.

b. **Environment and Culture**

The environmental integrity and the rich cultural heritage are valuable assets for the re-vitalization of rural areas in Europe. To regional economists the unparalleled variety of natural characteristics, languages and traditions, urban and architectural styles, historical and artistic backgrounds, provide the true growth potential for peripheral territories.

Axiomatically they attribute the potential attractiveness of rural areas to a higher quality environment than that of urban areas.

The settlement of new residents and private businesses from outside the territory can be seen as the beginning of a positive economic cycle, as long as they fulfil the preservation of the original favourable conditions that allowed it in the first place. In fact the term "cycle" implies the "reproducibility" of the process in the long term. The capability of a territory to attract private ventures is an indicator of competitiveness, but does not necessarily mean that the territory has entered into a sustainable development cycle.

These issues were investigated in the Catalan project "Cultural Gateways"[8] whose aim was "*the development of a sustainable urban – rural relationship in the organisation of tourist regions around main urban destinations*" In 2005 Antonio Russo[9] - director of the project - published some provisional conclusions, which are useful to recall.

The relationships between high-end destinations and their surrounding territory is often distorted. The concentration of tourism flows on a few points of interest may lead to a progressive "erosion" of the destination and to economic decline.

"*A destination which cannot produce sustainable tourism may waste its capital assets. The economic capital needed to keep the development cycle going; the society needed to preserve, nurture and regenerate the local culture; and ultimately the physical integrity of monuments and landscapes (...) It is believed that there is some maximum level of tourism or recreation activity intrinsic to an area above which the system is harmed beyond recovery or unable to continue delivering the same level of utility to its stakeholders*" [10]

Tourist distributors concentrate on "easy spot central locations", attract tourism flows with few, strong and oversimplified icons and exclude everything that does not fit this stereo type image of the advertised destination, tailored for marketing reasons.

This trivialization "*is the result of a short – sighted institutionalization of cultural symbolism by the tourist industry. One line of argument is that as control over distribution channels is largely in the hands of outsiders, any concern of interest for the community is not internalised in the behaviour structure of these agents, so they just profit maximize*" "

But immediate profitability of a few big operators does not coincide with sustainability:

"*This process is unsustainable because it goes against the ecology of any local cultural system, which needs to be kept alive through a process of value attribution and active endorsement by the local community. It is also inherently unstable from the economic point of view, as a commoditized or turisticised culture becomes subject to downturns in fashion etc.*."

So the case of the tourism industry is an example of how the settlement of activities may not necessarily lead to a sustainable development. In the case study of Catalonia, described by Russo, the analysis emphasized a "*strong spatial mismatch between the provision of culture and tourism activity* " explainable with the fact that "*a cultural product is attractive only if it is "close enough" – spatially and thematically – to the core elements*".

[8] Project was financed by the Autonomous Community of Catatonia and was carried out by Antonio Russo and his assistants at the Department of Geography, Universitat Autonoma de Barcelona.
[9] Antonio Russo, Cultural Gateways: Building Relationships for Sustainable Development in Destination Regions, Paper presented for the 45th Congress of the European Regional Science Association, Vrije Universiteit Amsterdam, 23 – 27 August 2005.
[10] Ibid, pag 2.

"*Developing a large number of cultural "products" in attractive areas*", "*increasing the variety of cultural attractions*" and "*developing cultural enterprises in virgin tourism areas*" are the main corrective actions proposed by Russo.

The pre-condition to their fulfilment is the involvement of resources aware of sustainability, such as, for example, small indigenous start ups. "*Deviating from the main route is risky and difficult to organize at an industrial scale for large tour operators and wholesalers, whereas it may be an interesting niche for specialised small scale tour operators*"

The creation of networks of resident companies closely linked to the local community could provide a viable way to sustainability. In this sense Russo focuses specific attention to the use of ICT as a "*tool for tourism industry deconstruction*".

As seen with "rural", also the term "environment" is multi faceted and recalls a variety of aspects beyond the ecological one. The Orchidea Project participants adopted the concept of "sustainable development" suggested by the United Nation Commission for Environment and Development. This is based on four basic dimensions - ecological, social, cultural and economical - interconnected and inter-independent. The Project has focused its attention on the "environment" as a collective resource and, in the case of social aspects, as an intangible resource.

If a strategy is set up to attract people and business ventures in the territory, efforts and investments should be equally dedicated to create the conditions of sustainability. Since "environment" is a collective asset, these efforts should be addressed to all the components of the community.

Taking Russo's suggestions further, linking the activities to the local community can be an effective strategy if the local community is able to understand and accept the basic values underlying sustainable development, i.e. if it has a reasonable cultural background and the possibility to work out shared opinions and ideas at a sufficient intellectual level.

These conditions should not be taken for granted, since depopulation (which may derive from long standing migratory movements, frequent in rural areas) always entail cultural regression. When families disconnect the idea of their personal future from that of their territory's future, then sustainability becomes less or not important to them. The best leave, those who remain are neither able to keep alive and revamp traditional cultures or elaborate new original identities. The arrival of new residents – bearing fresh enthusiasm, dynamic social behaviour and personal expectations - may generate conflicts within the community.

Over the period February - May 2008, the Orchidea Project authors directly witnessed the local reactions to the settlement of some "Sites of Community Importance" (SCIs)[11] in the Ceno Valley territory.

Instead of perceiving them as "attractive factors" of tourists flows and a big opportunity for new business, a significant portion of local residents expressed hostility (and on occasions clearly overstepping the mark of civil behaviour). This was largely due to a "knowledge gap" concerning the real nature of these insitutions. Residents were unaware of the potentialities in terms of business generation offered by environmental protection in that area. They became the target and at times the unwitting vehicles of a pervasive disinformation campaign, based on

[11] The Sites of Community Importance are geographical areas whit high ecological value defined in the European Commission Habitats Directive 92/43/EEC.

word of mouth and cooked up by few, whose interests were incompatible with the new regulations and controls. Fortunately this protest lead to nowhere, but the episode reinforced the assumptions underlying the Orchidea Project.

The presence of an institutional, consistent and reliable point of knowledge sharing, easily and freely accessible, helps both the formation of documented and rational opinions and to further democratic debate – encouraging the Orchidea Project authors to investigate new possible solutions beyond the traditional media and web based ones.

The concepts of "environment", "sustainable development", and of "culture" appeared thus logically consequential to each other and led, eventually, to the concept of "shared knowledge".

c. Information and communication (technology)

Informatics and telematics are generally seen as levers to overcome the reduced accessibility of rural areas. According to spatial economy theories, "accessibility" is the basic determinant in the localization of production activities: firms locate where exchange of goods and information have lower costs.

In a recent research, Roberta Capello and Alessia Spairani[12] focused "*on a more modern kind of accessibility, a sort of "virtual accessibility", based on information and communication technology (ICT) networks. These networks become strategic resources underpinning the competitiveness of firms and territories. These technologies allow information and knowledge to be achieved in a real time and with no geographical constraints*".

The study investigates "*the relationship between ICT and growth*" which then is described using an econometric model on the basis of pre-identified indicators.

The comprehensive definition of "ICT" is more analytically divided in the two main components of "Infrastructures" and "Services". They are considered as "*production factors, which, together with the traditional labour and capital factors, account for the GDP level*". The final aim is to estimate "*the future GDP growth and its spatial distribution*" given some hypothetical investment policies.

The identified possible actions are to:

- Strengthen ICT infrastructure: provide a better connection system in terms of pervasiveness, speed, security, price and assistance.
- Train people and develop skills: support people's training and know how
- Stimulate the internet service development: finance e-government, e-commerce – intelligent transport system projects.

These actions can be applied through three policy options:

- "Indiscriminate": investments are assigned to each region in proportion of its population. The three actions (listed above) receive equal financing.

[12] Roberta Capello, Alessia Spairani, Accessibility and Regional Growth in Europe. The role of ICT Policies, in Giovanna Vertova (Ed.), The Changing Economy Geography of Globalization, London and new York, 2006, pagg. 192 – 215.

- "Efficiency": 80% of investments are destined to non lagging regions (shared as follows: 10% to action "use", 90% to action "internet"), 20 % to lagging regions (shared as follows: 90% to action "use" and 10 % to action "internet").
- "Cohesion": 100% of investments goes to lagging regions in proportion to their population. The three actions receive equal financing.

In absolute terms – considering the sum of the results obtained in the lagging and non lagging regions by each policy - the "efficiency" scenario emerges as the best option. In relative terms – comparing the single results obtained in lagging or non lagging region by each policy – the highest result is achieved in lagging regions with a cohesion policy.

"*The importance of accessibility through ICT and not only through physical networks for economic growth is clearly evident. In particular, ICT accessibility policies show very different impacts (from the point of view of cohesion and efficiency) when projected twenty years into the future. (...) Once applied, ICT policies should also take into account the different local preconditions relating to the level of ICT use, the level of ICT endowment and the learning processes required to use these technologies. All these elements affect the impact of ICT policies in fostering regional development and cannot be ignored when policy actions are planned*"[13]

Both the methodology and the results of this study have been considered as a providing a possible frame work for the various interweaving initiatives in the territory of the Val Ceno. In addition to the Orchidea Project – whose aim is the development of a "service" system – the Centro Studi proposed to the Emilia Romagna Region to provide a wide area infrastructure for fast internet connection in the Ceno Valley and in the nearby Taro Valley.

In 2006 the Regione Emilia - Romagna was at the initial stage of the creation of its regional optical fibre backbone "Lepida" (the name recalling the roman consul Marcus Emilius Lepidus, who traced the "via Emilia" along which the backbone was initially laid). The proposal of Centro Studi was accepted by the Regional Government and the first ramification was set up using wi – fi technologies. This network served the local public administration as well as the private and corporate market. The commercialization of these latter was entrusted to a group of local companies, called "Comunica" (a unique experimental case in the Regione Emilia Romagna).

"Virtual accessibility" goes along with the concept of the "knowledge economy". As we saw, "Environment" is a non de-localized asset deeply connected with "culture". Its preservation and use for sustainable activities largely depending on knowledge exploitation.

Carla de Laurentis[14]studied the implication of digitalization of the cultural assets (a component of the wider asset "environment") and the "digital value chain" which may originate from them.

"(...) *the growth of a knowledge economy creates great opportunities and, at the same time, poses great challenges for European localities , but particularly for those that are peripheral regions and those that are lagging behind. Such lesser "knowledge economy" regions are often remote, insular, rural, agricultural and endowed of touristic resources. Traditional activities (..) One of the first challenges that peripheral regions are facing for entering a knowledge*

[13] Ibid., pag. 212.
[14] Carla De Laurentis, Digital Knowledge Exploitation: ICT, Memory Institutions and Innovation from Cultural Asset, in Journal of Technology Transfer, n° 31, 2006, pag 77-89.

economy is the development of a coherent strategy building more on their regional distinctiveness."[15]

A well known 'leit-motiv' in internet literature, sees ICT not only as providing a more efficient way of propagating information along a traditional value chain ("virtual accessibility") but also as offering potential for the creation of entirely new value chains ("digital value chains"). They should be based on "products" and "services" made possible by the specific interactivity and integration offered by internet applications.

In spite of the treatment of a boundless number of success and failure stories, little attention has been placed on how this potential is applicable to an entire territorial advantage.

What deserves attention is the "territorial" perspective, investigated by De Laurentis.

Quoting Graham (2002) and Florida (2000, 2001 and 2002) she says "*Regional natural resources can be seen as knowledge, which constitutes both economic and cultural capital, and (...) the presence of a rich and diverse cultural scene and a high concentration of people working in cultural and creative occupations, among attractiveness and condition of the natural environment and built form, can fuel innovation and growth. (...) Digital developments will enable peripheral regions to increase their competitiveness in the global economy claiming that much of the content will derive from the particularism of cultural heritage leading to the "culturisation of the market and the marketing of culture (European Commission, 2002)"*[16]

The presented case study shows how complex and uncertain is the partnership among different communities of practice, each bearing a residue of awareness of its own social role. New business models require a re-negotiation of consolidated behaviours which may reveal a far more difficult constraint than that represented by technologies.

Furthermore a profitable use of environmental knowledge depends on the general receptiveness of the market. The conclusive remark speaks on its own: "*Thus far, in Wales and elsewhere, the market for innovative memory institutions products has yet to materialise, whereas the market for computer games grow exponentially*"

Nevertheless this is a perspective that territories should pursue.

3. **Orchidea functional macro requirements and general overview.**

A simple and effective schema by the Innovation Group[17] describes a virtuous course for the re-vitalization of the rural communities.

The "Pathways to innovative rural territories" sees the intersection of four core capabilities:

I. "*Diversity as an Asset – conceive an innovating territory*": exploring and rediscovering a territory to acquire a clear vision and conceive an innovation strategy;
II. "*Empowerment of the actors – acquire social competitiveness*": increasing "*the ability of the members of the community, to communicate in various efficient manners*" and improving their proposition and action abilities; "*This process need trust and communication skills (..) and it finally leads to empowered local actors; empowered*

[15] Ibid, pag 78.
[16] Ibid. , pag. 79
[17] Ibid., pag 4 and following.

does not only mean endowed with skills, competence and negotiation power. It also means empowered to change self imposed beliefs systems, one of the strongest barrier to innovation"

III. "*Autonomy to take action – acquire economic competitiveness*": use the territorial specificities to build product and service offers on a perspective of scope, scale and originality, identify viable markets, mobilise supply for weak and dispersed demand structures;
IV. "*Creative integration - Change terms of exchange in favour of the local*": develop fruitful interactions with the outside world, and "*renegotiate the political and institutional rules of the game*"

Each of these capabilities identifies processes that can be made easy trough an appropriate use of ICT. The Orchidea Project authors were not aware of this schema when they designed the original functional set of the prototype, in the spring of 2003. Nevertheless they found it provides a semi-formal, synthetic and intuitive description of the issues underlying the project strategy.

The Orchidea Project is developing a service layer based on web technologies and integral with front end objects such as web sites or mobile applications. It should ideally improve the efficacy and efficiency of specific processes of rural communities and their clusters of small companies.

The main functional areas are to:

I. provide a rationalized and synoptic vision of the environmental information of the territory encompassing public and private sources; (foreseen aim I);
II. provide the possibility of contributing in the knowledge base content production in a wiki-logic (foreseen aim II);
III. provide vertical solutions for supporting decision of territory planning (foreseen aim III);
IV. provide services for enabling e-commerce and distribution of goods and services to small companies (foreseen aim IV).

The Orchidea Project started in the spring of 2003. The first prototypal iteration (October 2003 -January 2005) was followed by a period of field trials, followed by a second and a third prototypal iterations (November 2007 – March 2008 and June - November 2009).

The Project is now approaching the development of its release 1.0. The following paragraphs describe a number of technological orientations for the development of an environmental knowledge integrator and a local decision support system for territorial planning.

1. Focus on: Technologies for Knowledge Sharing in the Context of a Rural Community

The development of an infrastructure supporting the collaborative platform outlined so far faces major technical and organizational hurdles, as both information producers and consumers (the users) are dispersed and likely to adopt an impressively wide range of solutions for publishing and managing data.

On the producer side, the system must be able to harvest and integrate data managed with tools ranging from static, hand-crafted HTML pages to high-end content management systems (CMS) and customized portals, backed by dedicated databases and back-office applications.

On the consumer side, the system must support the development of a multiplicity of applications, taking into account issues related to multi-channel delivery and enabling an open-ended approach. The latter requirement implies a flexible and application-agnostic design of the data management layer, in order to avoid stifling the introduction of unforeseen, innovative services.

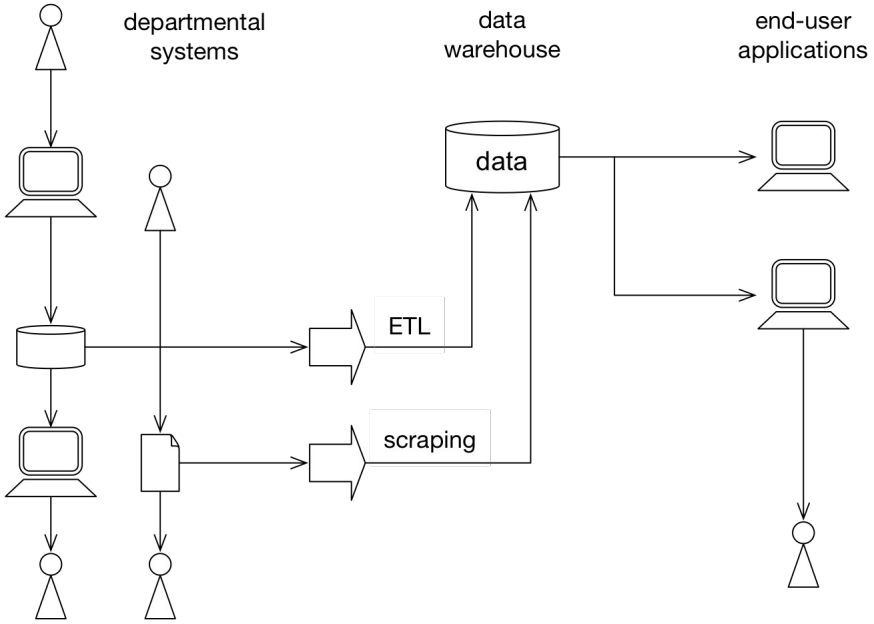

Figure 1 – Data warehousing architecture.

The overall requirements call for a loosely coupled, service oriented architecture, where internal and third-party data sources are consolidated into a data warehouse that in turn provides a standardized and integrated view to dedicated end-user applications. (Figure 1).

This approach is widely adopted in the context of enterprise information systems where multiple departmental data sources must be integrated to provide decision makers with a global and coherent picture of their business. The architecture is well understood and widely supported by software vendors, but its costs are not negligible and its scalability is still questioned: the main trouble lies in the centrally managed *extraction, transformation and loading* (ETL) procedures responsible for harvesting or scraping data from local repositories and applications and converting them to a standardized form, suitable for further analysis outside the context where they were originally produced.

In the specific context we are considering, this issue is exacerbated by the large number of potential providers and by their geographical and organizational dispersion. Developing and maintaining dedicated ETL procedures are no trivial tasks and require a substantial commitment both from the producer and the integrator: given the cooperative nature of the system, if a shared technical baseline for interchange formats and protocols is not defined, negotiating and supporting a bilateral agreement with each provider may easily overwhelm available resources.

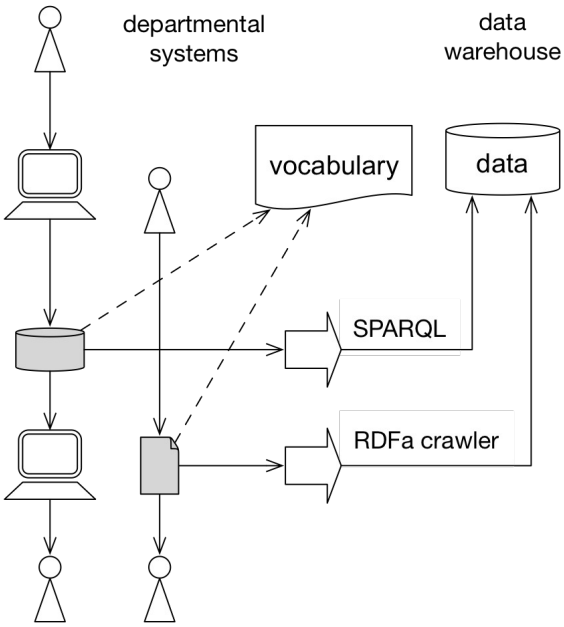

Figure 2 - Linked Data harvesting.

To overcome this apparent bottleneck, the Orchidea Project is exploring the viability of a somewhat different approach based on the *Linked Data*[18] concept, increasingly being considered as a lightweight, pay as you go alternative to centralized data warehousing efforts[19]. The overall architecture of a Linked Data integration platform (Figure 2) is quite similar to the one already discussed, but the critical harvesting subsystem, relying on dedicated ETL procedures, is approached in a distributed way, building upon the emerging W3C Semantic Web interoperability standards.

The underlying idea is to standardize as much as possible how data is published by the local data sources and to delegate the implementation of the exporting procedures to the same people already in charge of the web presence of the organization.

The first step in this direction is to define, usually within a collaborative process, a shared vocabulary for describing entities and relationships in the domain of interest. The shared vocabulary models the domain within the *Resource Description Framework* (RDF)[20], a graph-oriented knowledge representation methodology, developed by W3C members over the last 10 years. Wherever required, the vocabulary may formalize concept taxonomies and complex domain knowledge, taking advantage of specialized standards built upon the basic framework,

[18] Linked Data, *Guides and Tutorials*, http://linkeddata.org/guides-and-tutorials
[19] PricewaterhouseCoopers, *Technology Forecast*, Spring 2009
[20] F. Manola, E. Miller, *RDF Primer*, W3C Recommendation 10 February 2004, http://www.w3.org/TR/rdf-primer/.

such as the *Simple Knowledge Organization System* (SKOS) [21]and the *Web Ontology Language* (OWL)[22].

Existing data management systems, already in place to support web applications, are then retrofitted to publish available data as RDF graph, structured according to the shared vocabulary. Technical options for publishing local RDF graphs range from simple textual representation embedded within existing web pages using the RDF annotations (RDFa)[23] to high-end endpoints for dedicated protocols and query languages (SPARQL)[24]. Regardless of the adopted approach, the publishing interface may tap existing databases, with no need for costly reworking of back-office applications or complex synchronization procedures toward dedicated storage engines.

From the producer point of view, the retrofitting effort is substantially simpler than the development of an ETL procedure, as it usually reduces itself to adding a couple of attributes to existing HTML templates, extracting data from the same database used for publishing on the web and within the same technical framework (e.g. JSP, ASP, PHP,…).

As an additional benefit, standardized RDF data published either as embedded RDFa or through a SPARQL endpoint may be eventually tapped by third-party systems not originally envisioned, gaining further visibility to the originating system. The combined effect of the reduced implementation effort and the increased visibility will be hopefully able to lower current thresholds to data sharing initiatives.

From the integrator point of view, harvesting and integration are simplified as well: having delegated the adaptation of the local data sources to the owning organizations and replaced a plethora of specific ETL procedures with a couple of generic RDF crawlers, the integrator is free to concentrate on its specific responsibilities, that is the coordination of the collaborative definition of the shared vocabulary and the creation of an integrated view assembled out of the data provided by the local sources. To this end, the integrator may take advantage of advanced validation and inference tools driven by the domain knowledge embedded in the shared vocabulary and in supporting taxonomies and ontologies.

[21] A. Isaac, E. Summers, *SKOS Simple Knowledge Organization System Primer*, W3C Working Group Note 18 August 2009, http://www.w3.org/TR/skos-primer/

[22] P. Hitzler et al., *OWL 2 Web Ontology Language Primer*, W3C Recommendation 27 October 2009, http://www.w3.org/TR/owl-primer

[23] B. Adida, M. Birbeck, *RDFa Primer: Bridging the Human and Data Webs*, W3C Working Group Note 14 October 2008, http://www.w3.org/TR/xhtml-rdfa-primer/.

[24] E. Prud'hommeaux, A. Seaborne, *SPARQL Query Language for RDF*, W3C Recommendation 15 January 2008, http://www.w3.org/TR/rdf-sparql-query/.

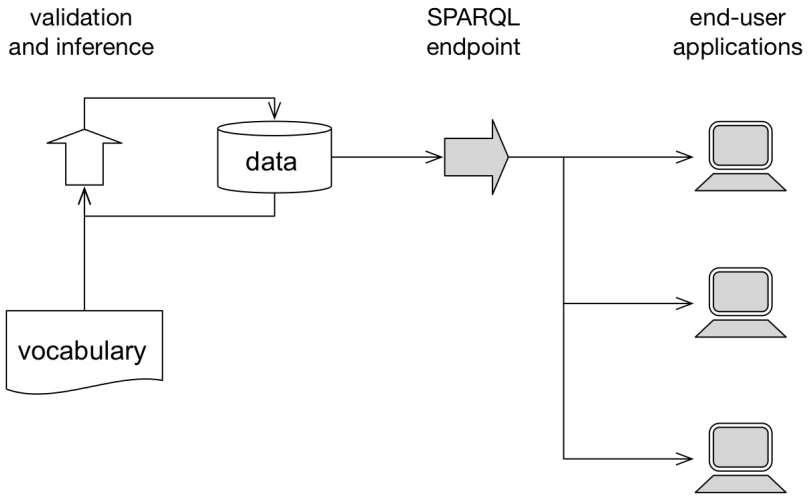

Figure 3 – Linked Data integration and publishing.

The same technical framework adopted for collecting data from local sources, may be adopted as well for making them available to end-user applications, by means of a SPARQL endpoint exporting integrated data downstream of validation and inference services (Figure 3). Further access to RDF data may be embedded into end-user applications in the form of RDFa annotations.

As a concluding remark, it's worth highlighting the strong decoupling among data and applications introduced by this arrangement: the integrated data published through the SPARQL endpoint supports a basic set of in-house applications, but nothing prevents authorized third-parties to access the same source in order to integrate it into novel applications of their own devising, possibly alongside a growing collection of public and open Linked Data sources[25]. This feature and the flexibility inherent in the schema-less, graph-oriented formalism at the core of RDF provide a strong foundation for the kind of open-ended development the Orchidea Project is envisioning.

4. Focus on: environmental problem solving and decision making

Over the last 3 years a great effort has been dedicated in the development of several novel algorithms and related software for environmental decision making and problem solving. These packages all share the same path:

- required GIS layers enter the software;
- the user specifies some criteria;
- the software produces the results in a GIS form;
- the package creates a standalone *.exe* file containing all the results (text and maps).

Here are some examples:

a. PAO (*Protected Areas Optimisation*)

[25] Linked Data, *The Linking Open Data Project Cloud Diagram*, http://linkeddata.org/home.

The search for a balance between nature conservation and tourism development within protected areas is becoming an increasingly multifaceted problem worldwide, as outlined by several authors and high lighted by several international events and documents.

Since it is unlikely that all management objectives reach their optimum values simultaneously, an optimization approach is required to meet multiple, conflicting goals and to obtain an overall trade-off in terms of all the conceived objectives. A complex model based on genetic algorithms is required, instead of a common multi-criteria analysis, to get a complex interplay in the form of a dynamical simulation where candidate solutions are interactively evaluated.

To this aim, the Orchidea Project developed a new algorithm and related software to:

- decide quantifiable criteria encompassing all the relevant tourist activities within the study area,
- translate them into GIS layers,
- submit them to a genetic optimization procedure, and
- compare the performance of the optimized tourist allocations with those of existing infrastructures and with the worst possible solutions.

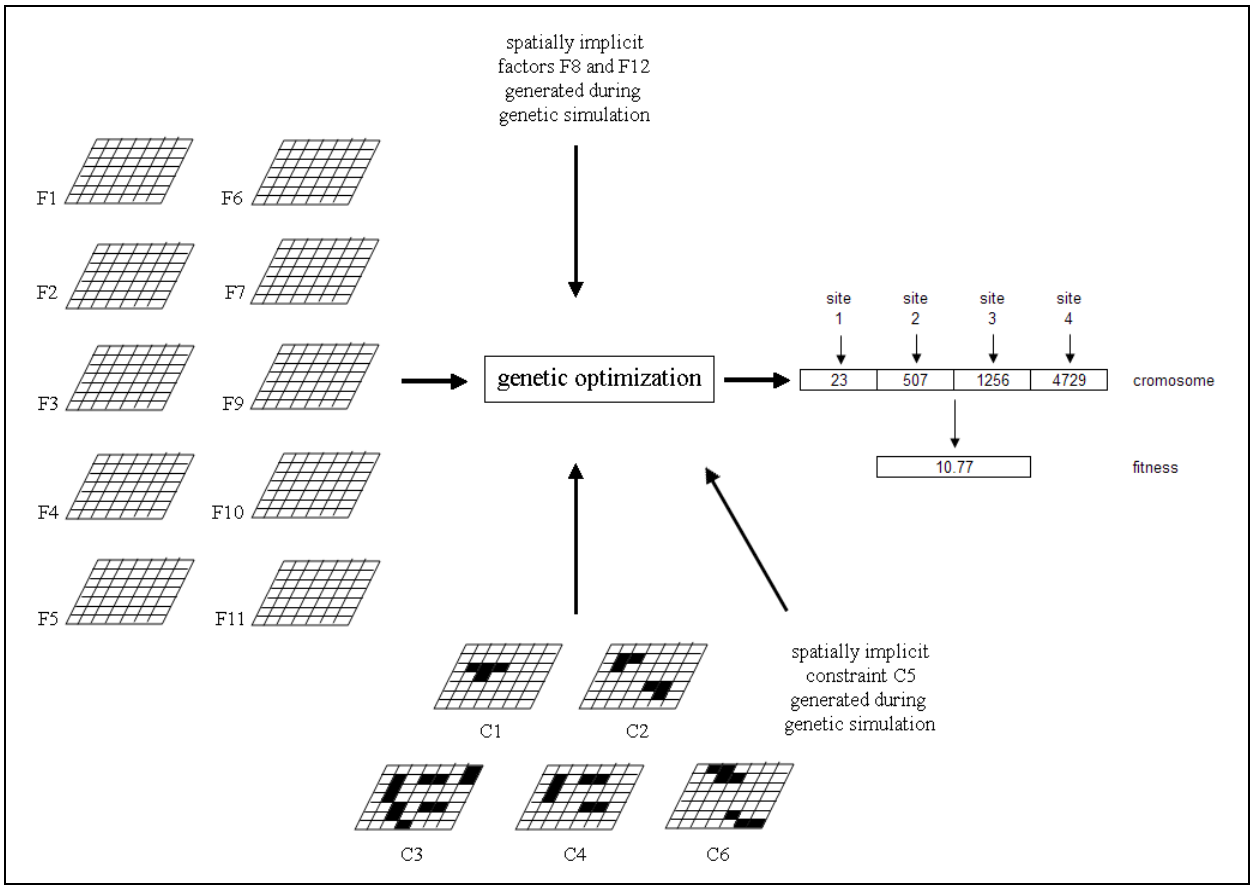

Fig. 3. An example of the application of our PAO package to a protected area. A genetic optimization algorithm takes into account 8 GIS and 2 spatially-implicit criteria, 5 GIS and 1 spatially-implicit constraints during the search for optimized tourist sites.

The proposed algorithm (and the related software) is a flexible and effective tool, easily exportable to any protected areas, with significant implications for researchers and policymakers seeking an effective balance between nature and humans activities. It can be used with two purposes:

- tracking optimized tourist paths (polylines) within protected areas
- placing optimized sites (points) within protected areas

Results are also converted to *.gpx* format for GPS and *.kml* for Google Earth. A previous version of the Orchidea Project algorithm has been applied to two case studies and published in international scientific journals (Ferrarini et al., 2008; Parolo et al., 2009).

b. OSR (*Optimised species reintroduction*)

Under the effects of rapid environmental change, such as climate change and land degradation, assessment of plant species potential distribution is becoming increasingly important for conservation purposes. Moreover, land administrators need reliable predictions of species suitability for planning a wide range of management activities. Examples include predicting the distribution of rare and threatened species and plant communities, risk assessment of invasive species in new environments, and estimates of the likely intensity of biological responses to climate change. Reintroduction and augmentation of small natural populations of threatened or rare plant species rely on reliable distribution models as well.

With this in mind, the Orchidea Project built a novel algorithm and related software for optimised species reintroduction taking into account (a) the minimization of spatial autocorrelation through the use of a constrained random split of sampled data; (b) the use of a stepwise selection of predictors in order to obtain a reduced model containing only meaningful variables; (c) the comparison of the predictive power of three sets of environmental predictors; (d) the identification of the most suitable areas by overlaying predictions of three competing models; (e) the use of divergence maps as a complement to conventional performance comparison assessments.

Results are also converted to *.gpx* format for GPS and *.kml* for Google Earth. A previous version of the Orchidea Project algorithm has been applied to a case study and published in a international scientific journal (Parolo et al., 2008).

c. LFS (*Land Fire Simulator*)

In the case of fire events, there are both positive and negative consequences. On the one hand, fire plays an integral role in maintaining the health and diversity of many forest ecosystems. On the other hand, fire can have negative socio-economic consequences and can adversely impact public health and safety, property and natural resources.

As such, there is a constant demand for more effective fire management policies due to the human risks and the rising concern about global climate change (Rossi et al., 2009). The integration of geographic information systems (GIS) and environmental modelling has been widely investigated for more than a decade. However, such integration has remained a challenging task due to the temporal changes of environmental processes and the static nature of GIS.

As a result, the Orchidea Project developed a novel technology for land fire simulation. Our mathematical fire behaviour model consists of a set of equations whose solution gives numerical values for one or more variables such as the rate of spread, flame height, ignition risk or fuel consumption that change through time or space. In our wave propagation model, the fire front is propagated at specified time intervals as a continuously expanding fire polygon. This simulation criterion is based on the Huygens wave propagation principle. These models assume an

ellipsoidal shape for fire growth. In fact, the simple ellipse is the most common model for fire shape considering forest fuels, weather and topography.

The Orchidea Project software also converts results to *.gpx* format for GPS and *.kml* for Google Earth. We successfully tested our software on a wide area.

d. WIG (*What-If-GIS*)

Often, one should forecast the behaviour of an environmental system based on the modification of some variables.

Actual GIS technology allows this just in a static way, i.e. one should change input layers, make calculations once again and output the results. The Orchidea Project algorithm and related software allows for a dynamic simulation where the user may move a slide bar representing one, or more than one, input variables and immediately sees the results on the output GIS layers. First, our software requires the user to insert proper GIS layers, second it builds a neural model to link dependent and independent variables. Last, it allows the user to make what-if predictions.

The Orchidea Project software also convert results to *.gpx* format for GPS and *.kml* for Google Earth. We have already applied our technology to river courses in the province of Lucca (Italy) to forecast the suitability of such river traits for fish species depending on the modification of water quality parameters (Ferrarini et al., 2010 in press).

e. TG (*Timeline-GIS*)

Often one has several land cover layers of a study area at different time intervals (i.e., 10-20-30 years) and needs to forecast the likely direction of such area under present driving forces. To this aim, the Orchidea Project developed an if-then-else algorithm that extracts the transformation rules and projects them forward in time. Related software produces the shapefile (or raster version) of the likely landscape evolution and the user may use a timeline slide bar to see the results of the prediction at different time intervals in the future (i.e. 2020, 2030, 2040 etc…).

The Orchidea Project software also convert results to *.gpx* format for GPS and *.kml* for Google Earth. We have already applied our technology to two watershed areas in the Province of Parma (Ferrarini, 2005).

f. ITS (*Intelligent Traffic Simulator*)

The Orchidea Project developed a multi-agent systems technology in GIS environment to simulate how different traffic scenarios in urban areas may be managed by local stakeholders by, for instance: a) adding or removing traffic lights, b) changing traffic flow directions, c) changing speed limits, d) enlarging or decreasing street width and so on. Hence, our technology and related software allows for a rigorous and transparent optimised choice of traffic scenarios in urban areas.

Conclusions

Orchidea Project is a small indipendent bottom - up project. It tries to develop practical tools to foster the re-vitalizzation of athe Valceno area, a wanderfull and neglected territory. During

these years the group was able to overcame a number of difficulties and the project has been kept alive. Now fresh human and financial resources are allowing a further – decisive – step toward the development of a reusable knowledge integration system for rural communities. The authors hope to reinforce the project group by shareing these issues with other territorial or scientific communities.

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