

Multitasking in the Rural World: Technological Change and Sustainability

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Abstract

The rural world offers a heterogeneous picture caused by a rich past and varied responses to a diversity of socio-economic, demographic and political challenges. The present paper aims to trace new opportunities for rurality in the context of a metamorphosis of current production and consumption systems.

Addressing issues like diversification, local competition or networking, rural firms are adapting to new conditions by segmenting and moving towards less concentrated forms, in an attempt to integrate the marketing of non-market commodities as the most adequate strategies for consumers. Such strategies that presuppose skills based on a specific know-how and technological improvements also oblige locals to enhance their knowledge basis and learning capacities, thereby facilitating a more environmentally sustainable production model that simultaneously stimulates balanced development. The case of biotechnology in the region of Andalusia (Spain) was used as an illustration to map out the above complex force field.

The rural world suggests a new paradigm in which social participation is more needed and local and regional actors are encouraged to find meaningful compromises for the sustainable governance of natural resources and the advancement of social learning.

1. Introduction

The traditional urban-rural dichotomy is increasingly vanishing, although in many countries rural areas are still the domain of agriculture. History teaches us that the rural world has been our partner in most of the past processes of socio-economic development (Chenery, 1980). Even when the advantages of agglomeration resulting from urban life led to the organization of the labour supply and pushed workers from the primary sector into industry and services, rurality survived as a natural context for agricultural production, perfectly coping with the new urbanization in a complex interdependency (van Leeuwen and Nijkamp, 2006). At present, we still perceive rurality and agriculture as deeply interconnected, but this paper aims to shed some light on the probable future of the rural world and how it is opening to novel and challenging adjustments associated with a globalizing world.

Firstly, after the end of the Second World War, a new paradigm determined most of the European and American rural life and their respective environments: the intensification of agricultural activities was speeding agricultural specialization towards a new model, intensive, mechanized and stable, surprisingly, when considering the permanent decrease of agricultural prices. For the last 60 years, European agriculture has been driven by the priorities of a common policy aiming income stability (Daugbjerg, 1999). At a time when the United States embraced agribusiness, agricultural production reached levels far above national demands, exports boomed and the agro-food sector flourished, creating a biased concept of rurality.

Meanwhile, in Europe the understanding of the rural context could not be dissociated from the CAP (Common Agricultural Policy). Since its foundation, the CAP has promoted deep structural changes such as land use reforms, improvements in the efficiency of credit systems, development of cooperative structures, as well as a deep reorganization of the distribution, logistics, and marketing channels for agricultural production. Therefore, it is not surprising, that in the 1970s the choice of guaranteed agricultural prices could reinforce the success of the European agricultural sector, thereby creating a steady rural development towards new social, partially urbanized living standards in a significant part of the European rural world (Richardson, 2000). Still, CAP price-specific incentives created regional asymmetric support instruments which, from a long term perspective, determined considerable rural development differences across Europe, in particular, intensifying the north-south divide (Cappelen et al., 1999).

Studies have confirmed these arguments, as well as those relating rurality to diversification and complexity. By using samples at country level, Gülümser et al. (2008) selected rural indicators to apply a multidimensional classification technique and compared the different levels of rurality among the EU Member States and Turkey. After a reduction from 15 indicators to 5 main factors, the main variables of rurality

turned out to be the following: ‘population’, ‘employment’, ‘income’, ‘education’, ‘land use’ and ‘environment-energy’, following those of the OECD’s classification. Although some other important variables, such as innovation and exports or imports could not be included in this study because of lack of availability, the results indicate interesting differences in the scores achieved by each country. Also, the authors created a global score on rurality by combining all the factor scores: they were able to dissociate those indicators that contributed positively for rurality (such as demography) from those with a negative impact (higher education and industrialization). On such a basis, the authors concluded that northern and western European countries are not really rural; in contrast, southern and eastern European countries are. This position is independent of the fact that rurality is an important attribute for all these countries. The major contribution of this study is the important advance it brings to analytically justify both, rural diversity and the complexity of the rural world.

2. The Adaptation of Agriculture to Segmented Markets

Agriculture in Europe is a wide-ranging activity. A major factor to be considered when analysing European rurality and its different features is the close link between agriculture and the food industry through the increasingly important issue of human wealth. This link provides a justification for many changes when have occurred in rural land use. Mainly, they were due to changes in property structure resulting from new associative practices that helped to solve some of the natural tensions following-on from the growing vertical relations with industry. It may therefore, be important to address some key developments in the agricultural food market.

Profits for firms in the food industry have been analysed by Weiss (1974), who provided insights about how market power has consequences for industrial organization including the primary sector. Cotterill and Iton (1993) studied the structure-performance relationships within the food systems and concluded that concentration is one of the determinants of business profitability in this sector. Therefore, it is no wonder that for a long period much of the efficiency of the food supply chain has been driven by vertical coordination in production distribution, mainly characterized by a tendency for decreasing prices at producers’ level and increasing pressures for long-lasting payment conditions – which are, in general, advantageous for the distributors. In a scenario of market power that has also affected the international trade channels, price decreases have caused additional limitations for farmers, adding indirect restrictions to the rural development of many localities. Gadde (2004) discussed on this basis the growing tendency for the development of two marketing structures: the global and the local productive forms which may be differentiated by the simplicity of the marketing channels and the level of proximity that producers have with consumers. Later in this

paper other, more elaborate arguments, will confirm his view calling for the existence of two very distinct industrial models co-existing in our modern society.

The European market for butter, characterized by market integration, was observed by Hockmann and Vöneki (2008). This case-study is an excellent example to illustrate the kind of major pressures arising from the CAP in a food branch that may directly affect the rural areas of milk production. For a long time, the intervention prices set by the EU provided the 'market basic price', keeping the EU prices artificially higher than world market prices (Agrar Europe, 2005). After the CAP Reform in 2004, with the decrease of intervention prices, the gap between EU and world market prices started to reduce with the intention of removing a certain structural production surplus from the markets (Daugbjerg and Swinbank, 2004). Nowadays, the existing production excess is exported and submitted to a refunding applied after being calculated on the difference between domestic and world market prices, as was done until 2004, but now also after a calibration by other factors such as internal market stability, restrictions resulting from World Trade Organization commitments, or even future market trends. Indeed, it should be made clear that, for several key branches of the food sector like cereals, dairy products or wine, for example, and for many years, the CAP applied a very complex price support system that to a great extent influenced farmers in a way that was almost totally out of their control.

The relationship of European agriculture to industrial mass production and global markets is evident. Nevertheless, the lack of effectiveness in the agri-food system to allow permanent technical change is disrupting several long-established links and is orienting production towards diversification and flexibility (Boyer and Durand, 1998), a model which is oriented basically to local markets. Moreover, as reported by recent research, labour specialization in a context of local identity is convincing an increasing number of consumers with arguments related to quality and traceability, two attributes able to help sell more and better (Hinrichs, 2000).

Moreover, the flexible productive process may represent a solution to growing consumer concerns regarding the impacts of the uncontrolled industrialization of foods upon human and animal health. This awareness emphasizes the basis of what has started to be in the present, and will continue to be in the future, the new drivers for agricultural production: 1) food safety and human health; 2) the environmental long-term impact of industrialized agriculture; 3) agricultural welfare; 4) ethical animal use; and, finally, 5) issues related to fair trade on a world scale. These trends will certainly influence the future trends of rurality in Europe (Covas, 2007).

While accepting that other productive forms than mass production, based upon segmentation and networking are flourishing, a solid argument is provided in favour of the value of local production to strengthen the food systems. Such forms that are based on labour specialization and combine long-term learning processes can facilitate technological innovation to break through in less favoured regions or localities in a

process which may be crucial for the sustainability of some rural areas (Parrot et al., 2002).

This search for flexible production can, in fact, reach extreme situations of unorganized and very dispersed forms: a significant number of cases were observed and identified as 'alternative agri-food initiatives' (AFIs). They represent emerging structures of community-supported agriculture, farmers' markets, urban agriculture, and regional food labels. In practice, these efforts stand for new kinds of action linking consumers to the traditional focus on farmers and production (Vaz and Nijkamp, 2008a, b). In this new politics of food, activism is embodied in quotidian necessities and experiences, representing commitments able to join and motivate different interests and people throughout the whole food chain (Allen and Goodman, 2001).

While in Europe, agriculture has advocated a restricted concept of rural development (particularly in the northern and central parts), worldwide, however, rural areas have been the object of different development paths and have a much greater influence on the development of the urbanized areas. In South America, Africa or India where urban dynamics also depend on how rural small towns are managed, the rural lifestyle has guaranteed, so far, social security, indirectly facilitating the future growth and development of most countries (Hayami, 2007)

It is also important to note that in Asian countries as well the rural world is becoming subject to very significant changes. Mukherjee and Zhang (2007) describe the dynamic rural 'nonfarm' sector in China as a major contributor to the country's remarkable growth, in contrast with India, where the growth in the output and employment in this sector has been rather stagnant. The authors find that the differences in the rural 'nonfarm' development of these two countries result from their distinct institutional contexts: namely, their political systems, ownership structures, and credit institutions.

While the empirical evidence proves the existence of a diversified rural world, a major factor remains as its common bastion: the particular rural identity. Charged by the historical past, the rural identity is translated into a spatial profile for which precise sets of values reflect different *modis operandi* and specific contexts for tacit knowledge. With increasing globalization it could be interesting to discuss whether rural identities are tending to merge to a global and unique concept or, on the contrary, whether each rural context should preserve its local characteristics as positive contributions for regional and national competitive performances. To respond to these concerns three considerations are relevant:

- 1) First, taking into account that the existence of internal economies requires the increase of size or scope in productive activity, the role of competition and technical innovation should be understood as tools to frame or to expand them. At the limit, when diseconomies take place, the disaggregation of the productive system occurs as if the permanent need for innovation and segmentation of the production processes was a

natural occurrence in a physically saturated environment. To cope with segmentation small firms are the best elements, provided they are innovators, as they adapt fast solutions to the technical specificities of diversification.

2) Secondly, the culture of the firm and its level of embeddedness are of utmost importance to better understand the process underlying local competition. Farms and firms located in rural environments are generally small and tend to develop close links with nearby institutions. Such links, however, have an unstable nature and are a field of conflicting and contracting tensions. This is particularly valid if segmentation dominates the productive process. How to handle such difficulties depends on the organizational forms of the productive systems and how they are able to find adequate solutions for an effective and efficient coexistence. Amongst other things, innovation and regulation provide insights that bring positive results mainly in the area of cooperation and networking.

Many empirical studies illustrate the above-mentioned evolution: Spanish olive oil (Mili, 2008), Belgium beer (Avaermate and Vandermosten, 2008), Italian wine (Gatti, 2008), or Brazilian coffee (Urban and Vaz, 2008) are excellent cases of market segments, that earlier focused on mass production industries but today are choosing to adapt to new market conditions by segmenting and moving towards less concentrated forms, let us say, in a trial to integrate the markets, even the international ones, using an approach of non-commodity systems as the most adequate marketing strategies for consumers. The fact that such strategies impose certifications based on specific know-how and technological improvements compels local actors to expand their knowledge basis and learning attitudes, thereby facilitating the development of a more environmentally sustainable food production model, in other words, there is an emergent debate. Buller and Morris (2004) supply a general review of the fast expanding number of what are termed 'market-oriented initiatives for environmentally sustainable food production' (MOIs), in which the incentive for food producers to manage the environment positively comes directly through the market.

These and other initiatives are being expressed by an explosion of new private labels related to the rural environments. Because they increase consumers' confidence by engaging production in higher quality standards, food safety and environmental responsibility, these labels sell well. The effect of labelling upon the supply chain also reflects long-term contracts with upstream producers, probably one of the most important factors for innovation in the food chain. When Bazoche et al. (2005) analyzed the interest of producers to commit to such private labels and their effects on the spot market prices for meat and fresh vegetables in France, they concluded that the advantages resulted from market segmentation.

3) Finally, there is a generalized effort in educating and raising awareness about the dietary priorities in the population to favour healthier food; thereby consumers are ready to modify their consumption habits (Guptill and Wilkins, 2002). This exercise is

educating consumers to be alert for how food production, manufacturing and retailing occurs, and the discussion is acquiring a new ethical dimension which explores the best practices regarding, for example, waste management or sustainable energy use. See, for example, Gatti (2008), revisiting the wine sector as a case of international competition. The very detailed overview of the multiple actions taken in Emilia-Romagna to guarantee environmental sustainability in the region during the process of wine certification suggests that this fully matured traditional product for international markets can only profit from being classified as an environmentally friendly product, active in promoting environmental sustainability.

In a context of transition as described earlier, the coexistence of mass production and segmentation as productive forms exists and is expected to occur, eventually, at the same time and place (Vaz, 2008). Given the complexity of the interrelationships resulting under such conditions, business organization becomes unavoidable, particularly in what concerns the use of shared information to reduce uncertainty and risk: product traceability emerges as an essential solution to unify agents along the food chain, or public-private partnerships are formed to discuss and regulate food safety (Galizzi and Venturini, 1999).

Thøgersen (2008) proposes a method to explore the level of acceptance of consumers for new types of food products that correspond to global market trends. The author uses a survey in eight European countries to present a model of consumer decision making and behaviour with regard to organic food. He found that the justifications given and the reasoning behind choosing organic products are quite similar across countries, but that the behavioural intentions are predictive of kinds of behaviour that differ significantly between northern and southern Europe.

Simultaneously with the industrial segmentation of the agri-food sector, other alternative agri-food initiatives (AFIs) are taking place in a much less organized and much more dispersed form. These emerging structures represent a new kind of consumers' pro-active attitude, which distinguishes them from traditional farming and processing. Compared with the conventional food system, these forms are considered to be more equitable and environmentally less damaging; and they also seem to supply healthier food. All over Europe and the USA there are many examples of AFIs to be reported and their rate of expansion is increasing (Allen and Goodman, 2001).

In summary, the preservation of local identities in the rural world seems to be developing as a device connected to recent marketing strategies. This is due to consumers' growing awareness and their trust to find in the rural attributes food of healthier quality – a recent trend which may create the most satisfactory conditions to sell, providing local rural actors are able to integrate urgently all those requisites of technological change necessary to produce goods with certified quality.

3. Contributions to the Multitasking Choices for the Rural World

Besides agriculture, one of the other main activities taking place in rural areas results from traditional food production (Sonnino and Marsden, 2006). The many products, most of them addressing market segmentation and consumption niches are firms' best strategic alternatives for survival. In the particular case of food assets, and in spite of the existence of globalizing consumption patterns, consumer preferences are moving towards quality standards, as seen, frequently related to their memories in such a way that local cultural identity can remain as the protector of many local production systems in many regions across Europe.

Belonging to the low-tech sectors, most firms that produce traditionally, foods or other items, have to perform their activities restricted by the global constraints of increasing competition. Therefore, innovativeness is the only tool to guarantee firms' profits and consequent local prosperity. For rural small firms, often located far from the main commercial circuits and with no marketing skills, market quotas are frequently determined by proximity. It is not easy to reconcile technological apprenticeship, fast adjustment to modern business environments and the knowledge acquired in a historical-cultural past. Collective actions and network interdependencies need to be introduced to generate many new functions for rural firms such as research, selection, codification, transformation, control and other procedures independently from the kind of produced goods. Marsden and Smith (2005) reinforce this idea by exploring the *importance of specialised networks in shaping local responses to the deepening crisis of conventional agriculture in the EU, as well as potentially creating a more sustainable platform for rural development*. The authors confirm that those networks formed within a frame of *ecological entrepreneurship* are able to shape knowledge and create a competitive willingness to innovate. By using a combination of fragmentation, specialization and quality building strategies those firms are encouraging sustainable development in rural areas.

However, it should be noted that food processing, traditional or not, is far from being the only sector that is aiming to promote knowledge transfer into localities. Although these other sectors may represent a significant opportunity to generate knowledge and local incomes, other activities are emerging that are bringing new life to the rural scene. Multitasking choices for the rural developed world may open it to great opportunities and different life styles. Although several authors have raised this issue by mentioning the trends of a multifunctional agriculture, as in the case of Peterson et al. (2002) or van Huylenbroeck and Durand (2003), the future tendencies for European rurality should be perceived on a much broader basis: the multitasking of the rural world.

From a theoretical perspective, activities that accept dispersion and benefit from low prices of land are those that will settle in rural areas, provided there is good access.

Besides agriculture and food processing, naturally related to the rural areas, other activities could fit well into the rural profile: plants for alternative energy uses as is the case of heolic or biomass energy, the construction of lakes and dams which may contribute to the development of sports activity centres, many different forms of cultural and tourist festivities/activities such as some pop music festivals organized in large rural American and European spaces or even the integration of 'semi-urbanized' residents who are looking for a particularly peaceful lifestyle in the rural areas. For example, Szlanyinka (2008) describes the role of cultural gastronomic festivals to reinforce values in the rural development of Hungary. We can observe similar cases all over Europe.

4. Sustainability and the Consumption Function of the Rural World

So far, we have described determinants of changes in the rural world that were market mechanisms. Nevertheless, it is also important to consider that the ability to decide, adjust and regulate the existing agricultural land depends mostly on the competence and the efficiency of the governance systems, which go beyond the private sphere and become public political issues. How the institutional settings, as a whole, are able to work out market trends, such as those mentioned in Section 3 above, in order to create mechanisms for regional and local innovation systems to subsist presents another set of arguments. As explained by Neto et al. (2008), in the rural areas the potential for the private activities and entrepreneurship frequently depends on public initiatives and projects which are defined in the scope of regional policies; regulations and local organizations create the institutional environments for change frequently involving stockholders. They act and participate actively in policy making and decentralization processes such as land use planning.

Clearly, the arguments used so far to explain the welfare of the rural world have had a functional economic nature. However, as a result of emergence of the ecological consciousness, the consumption function of rurality has been accepted and the perspective of sustainability as intrinsic to the development process is nowadays fully established (van den Bergh, 1996). Also, consequently, land use and land planning have become factors that mostly contribute to ensure the sustainability of rural areas and help in environmental management and agricultural land use policy (Oltmer et al., 2008).

Because of a slow but steady conversion of natural areas into areas for agricultural, urban or industrial uses, today there is a general tendency towards a loss of natural land in favour of cropland. Population growth, food production, wood production and land tenure arrangements (Pearce, 1991) may be considered the factors responsible for an increasing demand for space and natural resources. Without countermeasures, this will necessarily lead to further pressure on land, to an increasing load on environmental

quality, and to an impoverishment of natural resource capital. The negative effects of land-use exploitation are manifested in soil erosion, loss of habitats, increased vulnerability of the soil, a decrease in the carrying capacity of land, landscape modification and loss of natural amenities (Beinat and Nijkamp, 1999). Thus, the sustainability of such natural areas relies significantly on the variety of agricultural land use policies, that are being developed to maintain a balance between economic efficiency and ecological quality.

The pressure for a very efficient use of the natural resources has meant that the concept of rural development should be oriented towards issues of sustainable development. Soil conditions and land use, as well as quality and tolerance of ecosystems and biodiversity necessary conditions to be analysed in this context. From an initial policy approach, rural development evolved to sustainable development and this has taken on a global dimension, not limited to specific regions (Pohoryles, 2007) and declared as a horizontal concern. In the spirit of the debate on sustainable development, land use change has recently become a new focal point of interest of both scientists and policy makers, e.g. in relation to deforestation (Chomitz and Gray, 1996); soil rehabilitation (Beinat and Nijkamp, 1998 and 1999; Nijkamp, 2000), or urban renewal (Finco and Nijkamp, 2000). The multidisciplinary character of land use combines issues of an economic, demographic, technological or physical nature and justifies regional level assessments (Giaoutzi and Nijkamp, 1994). Factors related to the degree of homogeneity found in regional institutional environments and those related to the better use of economic and ecological data suggest that studies related to rural sustainability should be developed preferably at a regional level.

5. Business and Technological Change as Key Factors for Rural Regions

Apart from the discussion we have had so far, which relates sustainability to environmental quality, the concept of sustainability also incorporates a dynamic sense of permanent change and growth in order to support the socio-economic system with balanced welfare and social justice. In the literature, three components ecology, economy, and welfare supply the required ingredients for the 'sustainability triangle': environmental responsibility, social responsibility and economic responsibility: three key-vectors in the concept. However, recent studies suggest a new element as a major tool to create conditions for sustainability: the governance system – which works as regulator, guarantor and provider of recognition and awareness in the democratic context. This recent theoretical input is an additional justification to better understand the decentralized nature that solutions for sustainable development should assume.

It has not been an easy task to find the correct compromise between economic efficiency and ecological considerations in the achievement of a sustainable rural development process. Recently, some authors have referred the need to include a

proactive participation of stakeholders to achieve a social equilibrium, which would reduce the degree of difficulty to accomplish any integrated target. Accepting that the three or four pillars for the sustainability of the rural world need to be built in a holistic form, how can policy makers, organizations, civil society and individuals maintain the tools for such a powerful construction? Which are those factors and activities that have direct influence in the rural world in promoting economic activity whilst avoiding the negative impacts of such activities upon the ecological balance?

5.1 How attractive are rural regions to business?

The contribution of technology to productive processes and labour specialization causes changes in both industrial and rural spaces. An example concerns those units of vertical large scale production that often lead to spatial specialization and are now progressively generating more segmented production lines which may move from a single geographical location to multiple geographical locations in various regions and countries. The example of horticultural firms producing at medium scale in different seasons in different parts of the world the same set of products in order to fully guarantee the supply chain of a narrow segment is illustrative. They represent complex productive systems spatially and internationally spread, which enlarged by the global scale, start to require management decentralization and wider integration in networking systems (Nicholls et al., 1996).

These dynamic and flexible systems are giving the local areas a geographical advantage in the building of active enterprises but demand major changes in spatial organization: small towns should be able to provide skills and access if the rural world is to be kept attractive for entrepreneurial activity. First, the cooperative consulting across the production chain may often lead to production systems that are regionally grouped. In the case of rural production, agricultural or not, the tendencies for grouping around a local identity is growing, as earlier discussed. But the rural world may also represent an advantageous site for those enterprises looking for locations for their manufacturing plants where it is possible to avoid competition in terms of labour.

Secondly, as more firms become involved in complex business networks, competitive efficiency becomes more important for individual firms, as they begin to trust other firms to provide specific productive tasks, and assembly costs are making way for new technologies in logistics, transportation and just-in-time measures with frequent emphasis on the importance of other activities such as research and development (R&D). The implications of such factors for the rural world will create different links between firms and may sometimes give rise to the birth of new knowledge centred development structures.

To illustrate what is meant, the work developed by Vaz et al. (2003) analyses the capacity of some rural regions to attract entrepreneurial activity, by sampling 43 South European regions located in Portugal, Greece, Spain and France. After having clustered

variables considered to be the main factors of regional dynamics, the study produced a selection on those factors which proved to be positive points of attraction to firms. The work included variables able to identify different degrees of regional development, as well as those identifying the geographical location of dynamic enterprises: the quantity and quality of access routes, workforce and workforce flexibility, personnel numbers, R&D expenditure and jobs, the level of regional Gross Added Value, and regional Gross Domestic Product, per capita. The results revealed how differently rural regions may attract business as well as the reasons for it. At least three groups were identified: a first group comprising Greek regions, except Attiki; the Spanish Balearic region and the Portuguese regions, except Lisbon and Vale do Tejo; a second group composed of the regions Attiki, Lisbon and Vale do Tejo; and the Spanish regions, except the Balearic Islands; and finally one representing the French regions. While the first two clusters were more related to the southern European rural world, the third cluster – the most attractive for business was clearly driven by the influence of large towns.

The first of these groups is the least, and includes regions with weak access routes, both in terms of motorways as well as railways, low population density and lack of urban centres. For R&D, more expenditures are made by the public sector than by private firms, though with lack of human resources. The inefficient use of human resources is also pointed out. In terms of education, in its various stages, the figures show that these regions maintain a low student population percentage with the exception of the primary school sector. As a result, education tends to lag behind in these regions. Another distinctive feature these lagging regions display is low per capita GDP and a GAV with a high percentage of the primary sector and an industrial structure that shows a proportion in the services sector twice as high as in industry. This is due to the fact that various regions are highly dependent on tourism, as is the case of the Algarve, Madeira and the Balearic Islands.

In contrast to this first group, the second cluster indicates the existence of good access routes as well as a higher population density. These regions have some larger urban centres and there is some R&D effort carried out, although R&D expenditures incurred by the entrepreneurial sector remained significantly low. The authors also discovered that public institutions are replacing those firms that do not yet have a strong capacity to invest in this area: namely, by developing technological centres. In terms of higher education, these regions display good results, even though the level of flexibility of labour remains weak.

This second group of regions should offer a rich observation field for a better understanding of the changing conditions in the rural world. Many regions that have been identified in this group are, meanwhile, moving from a peripheral less-developed state into a sustainable development phase. What attempts did they make to become winners in the competition for sustainable development? In Section 6, this paper

provides a case study about knowledge management in Andalusia, one of the regions identified in cluster two, as an exemplar case of the recent trends for the rural world.

5.2 Is technological change driving the modern rural world?

In both rural areas and urban spaces, innovation is accepted as being the motor of growth. Thus, it is no wonder that the knowledge economy and learning – the basic tools for innovative capacities – are in general central to both regional and industrial policies. For a long time, the most-used policy measures were shaped on the basis of a linear innovation model focused on R&D and technology diffusion. But this model proved to be inefficient, particularly in those regions lagging because of the absence of preconditions to innovate. The recently proposed more interactive models suggest following the best practices of successful regions as a means to obtain positive results from innovation policies, in the less favoured ones, a method which has been frequently applied unevenly across regions. However, empirical research has demonstrated that this is not yet an adequate solution when considering central, peripheral and old industrial regions, all so different in terms of technological pathways.

As Tödling and Trippl (2005) explain, in peripheral regions the major barriers for innovation are: the low level of R&D and innovation due to the dominance of SMEs in closed and traditional industries, weakly developed firm clusters, few knowledge providers, and a weak endowment of innovation support institutions. Such hindrances to innovate are related to the institutional context and the characteristics of the environment in which firms are embedded. The existence of a great variety of situations makes clear that differentiated policies of innovation are required, strengthening the arguments in favour of regional or local innovation systems.

To this view, Vaz and Cesário (2008) supply a contribution on the detection of specific innovation patterns of small firms within rural environments and the respective determinants. The authors argue in favour of very specific accompanying measures, if catching up is expected in such areas. From a general perspective, Tödling and Trippl (2005) are correct in stating that in the peripheral regions the key challenge for innovation policies is to reinforce and upgrade the regional economy by fostering ‘catching-up learning’. But what has been observed in the empirical research by Vaz and Cesário (2008) is that in such areas (and their study reports exclusively on rural regions) the kind of policies expected to be successful depend more on the specific characteristics of the detected groups of firms and on the way each of them interact with the respective environments. This happens independently from the specific goals in the minds of policy makers (attract external companies, to embed them into the region, to create links to external clusters, or to promote knowledge providers, and so on).

Another important particularity related to rural regions is related to the inequitable distribution of ‘knowledge capital stock’ referred to by Solow (1994) and Romer (1994). These authors were correct in accepting that knowledge capital differs from

other forms of capital because there are no diseconomies of scale, and knowledge production tends to centralize and create significant problems for all those regions excluded from the 'economic core of knowledge-rich regions'. Much of the hinterland fits in such circumstances and most of the rural regions lack the necessary knowledge resources to create agglomeration economies and be competitive in knowledge-based activities. Another problem is the natural propensity for knowledge capital to generate a cumulative effect, with a virtuous cycle adding *self-reinforcing* advantages for core regions and a vicious cycle *discouraging innovations in peripheries*.

Benneworth and Charles (2005) analyse the specific concept of university spin-off companies precisely as one of those facilitators of interaction between firms and the environment, and as tools for regional development. In exploring the economic benefits that such companies can bring, the authors favour knowledge accumulation and the 'building up' of 'territorial knowledge pools'. *A propos* the rural areas, it matters to know if, in the long run, these pools promote development or end up by moving out of the region to the more profitable core areas.

Although much has been argued in favour of the role of the university when nesting new booming research or service activities (Lester, 2006), it is not clear if university spin-off companies (USOs) do indeed represent a positive innovation policy measure or if the attractiveness of USOs to policymakers is more dependent on faith than fact (Malecki, 1997). On the one hand, empirical analyses of past experiences with science parks (Massey et al., 1992) show that they benefit excessively from regional policies which favour innovation. On the other hand, the promotion of new activities in the peripheral or rural areas needs much more efforts from government support to produce a much lesser effect. Arguments of this kind hardly help us to believe that there is hope in improving the economic performance of less successful regions. Still, in practical terms, there are almost no cases of USOs damaging their regional economies and, thus, there is a growing tendency to find less successful places that have accumulated knowledge capital through spin-off activities. A clear conclusion could follow only if researchers could more deeply investigate the dynamics of change in peripheries and rural regions by comparing the results of several decentralized initiatives of regions towards sustainable development.

The concept of a regional knowledge pool that is active and becomes relevant to other firms was used by Benneworth and Charles (2005) to describe the example of Twente, in the Netherlands, a rural region where many USOs facilitated activities that were able to improve the regional innovation environment. The reasons for this were supplied by Groen and Jenniskens (2003) who argued that specifically spin-offs in peripheral regions build entrepreneurial networks not previously present, in which others participate and hence derive benefit. University spin-offs act as a conduit for other firms to access the expertise and skills within universities, without those firms having to expend the effort in developing strong linkages back to the universities

themselves. This suggests a 'knowledge pool' builds up in the region, in which spin-offs make knowledge more accessible to other firms.

6. Rurality and Sustainability: Linking Actions to Knowledge

Although some drivers of change in the modern rural areas have been identified, much still remains to be understood about the kind of the developed links among stakeholders in the process of innovation and knowledge creation. This process may take place in any environment and the impact of knowledge on sustainability is uncertain. There is an urge for comparative case-studies in order to elaborate a better theoretical framework since, so far, the empirical research suggests very little concerning those links that make the rural areas grow into new paths of sustainability.

An exemplar case for this discussion is Andalusia which belonged to the group of those being a typical pro-active rural environment and might provide useful insights on the attributes that should be developed to encourage sustainable development. This last section provides a brief description of the pathways followed for growth in that region, the supportive governance system, and the new knowledge creation centres.

Basic indicators on its socio-economic performance (2003) show that Andalusia, (within an area of 87.597 km² and a population of 7,606 million inhabitants), has 11.3 per cent of the employees in the primary sector, 10.8 per cent in the industry, 14.4 per cent in the construction sector, and 63.4 per cent in services. The contribution of the primary sector to the regional product is about 6 per cent in a context of 99.93 per cent of small and medium-sized firms. There are about 304 large corporations in the region. About 19.8 per cent of the population has tertiary education and as a result of public and business expenditures in R&D, the region has begun to significantly increase its levels of patent applications as a contribution to regional innovation.

In Andalusia, the agri-food sector is considered to be one of the bases for regional development. Products like olives, olive oil, fruits, wine and vegetables take advantage of the climatic conditions and varieties of soils to grow in intensive agricultural productive units and exported to other Spanish regions or countries. Besides the employment in the primary sector already mentioned above, the agri-food industry represents 66 per cent of all the industrial activities. Biotechnology is becoming of decisive and growing importance for the region, and bioprocesses or bioreactors sectors represent 8 per cent of all the biotechnology R&D activities in the region; amongst the research groups devoted to biotechnology, 47 per cent are working for the agri-food sector. The recognition of this key sector is the basis for regional policy, and the creation of the Andalusia Institute of Biotechnology represents the main public initiative in the development of applications of biotech to the food industry.

The choice of biotechnology as a key sector for development has resulted from the implementation of the EU-funded Regional Innovation Technology Transfer System –

RITTS (1994-1996). The regional development agency (IFA) linked to the regional government and two private consultants has created a management unit whose main achievement was to join all interested stakeholders (business, interface organizations, researchers, governmental structures...) in drawing up a regional innovation policy. Today, this policy has resulted in a diversified and disperse scientific and technological environment composed of: 10 universities, 22 technology centres, 22 research centres and 16 laboratories in a total of 70 units dedicated to knowledge creation. Within such a context, mapping and monitoring the supply and demand in terms of innovation and technology transfer has been a major task of the CESEAND (Centro de Enlace para la Innovación del Sur de Europa). In addition, the Andalusian Innovation Network was formed with more than 100 SMEs in order to ease technology transfer amongst stakeholders. The governance system supporting the innovation policy is based on three strategic plans, which from 2001 to 2006 decentralized the competencies of different departments. Because of the lack of integrated goals in the different scientific domains, the new plan for R&D and innovation, from 2005 to 2008 (PAIDI), is promoting interdisciplinary scientific integration by the new Department of Innovation, Scientific and Business Policy and is assuming responsibility for the broader concept of regional sustainability for Andalusia.

Apart from the IAB (Instituto Andaluz de Biotecnología), which promotes the investment of public and private funds to carry out common projects between research groups and private companies, other tasks are being considered within the regional Andalusian innovation policy: training and dissemination of information. There is a significant interaction between training activities linking the educational sector and the scientific one, although there is a weak level of academic spin-off performance in the higher education institutions.

There are a large number of R&D groups and firms that have been created in recent years in the area of biotechnology, and the interaction between the scientific environment and productive sector can also be considered important and happening in both directions. Science and technology strength in international networking is focused on the participation in European projects through which facilities and human resources have strengthened the regional technological competences, although the trade in skills is still very weak. One of the major problems identified relates to the interaction between key players is the lack of links between the productive sector and the financial structures, making the development of new firms more difficult.

The growing R&D capacities in biotechnology can be recognized as a knowledge pool, which will eventually give birth to an embryonic cluster able to integrate a multitude of key players. But in the case of Andalusia as in many other regions, and considering the specific sector of biotechnology, in practice, its contribution to sustainable development is still an achievement yet to be attained. It is now commonplace to assert that actions towards sustainable development require a mix of

scientific, economic, social and political knowledge, and judgments (Kerkhoff and - Lebel, 2007). All those connections between research-based knowledge and actions like participation, integration, learning, and negotiation are still to be duly investigated as well as their input in the responsibility in the design of sustainable development.

A new paradigm is allowing us better assessment and management of the rural world and its natural resources (Rist et al., 2007). It includes space for wider societal debate and the possibility for actors such as scientists, experts, politicians and local actors to plan and establish the norms, rules and power relationships emerging from the existing local and regional use of natural resources. We are witnessing a smooth change in the development of rurality comprising both the alteration of sustainable management into the sustainable governance of natural resources and the advance of a social learning process involving both scientific and non-scientific knowledge.

7. Concluding Remarks

The rural world in a modern society hardly exists anymore. Whereas in the past rural areas were mainly coinciding with uncultivated land and later on with agricultural land – in both cases characterized by socio-geographical isolation –, nowadays rural land is subjected to the forces of globalization and openness. Markets have become open trading systems leaving little space for specific rural modes of production. Rural areas have in the mean time turned into multifunctional geographical areas with a mix of productive and consumptive assets, including technologically advanced products and services. Indeed, sophisticated service provision – e.g., consultancy services – has increasingly penetrated traditionally rural areas. Traditional cultures in rural areas have also been replaced by modern lifestyles, so that the difference between rurality and urbanity tends to vanish. Rural areas are nowadays mainly characterized by low population density, a relatively large distance to urban centres and a healthy and ecologically-oriented living environment.

In conclusion, our rural world has exhibited a very complex force field, in which many socio-economic tasks and challenges are concentrated. Rurality is also increasingly faced with the tension between an ecologically-benign environment and the consequences of a technologically-advanced and highly mobile society. The identification of a sustainable development path for rural areas may turn out to be very complicated and calls for effective knowledge to understand the underlying mechanism and to outline new pathways for a balanced development of our complex space-economy.

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