New Functions for Rural Space in Western Europe: A Challenge for Agricultural Techniques

Pascal Byé and Maria Fonte

Concentration of production in an ever more limited territory and urbanization have shaped the evolution of "industrial techniques" for agriculture in this century. Consequences of these processes are the *segmentation* of rural space, the *disappearance* of indigenous cultures and techniques, and the *depopulation* of vast areas. Dynamics of rural spaces are disconnected from agricultural development, because space is no longer the *physical place* where polyvalent forms of production and social organization are composed. Instead, food is produced in the *economic space* for optimal allocation of resources. The diffusion of industrial techniques in agriculture, while successfully increasing production and yields, nonetheless is limited in its ability to manage excess farmland and to guarantee an efficient reproduction of natural productivity and renewable natural resources. Economic and social crisis, as well as growing urbanization, have allowed new social demands for rural space to emerge, particularly for health and environmental protection and recreational activities. Even adjusted "Fordist" techniques do not seem able to satisfy them. Finally, the co-evolution of economic, social and technical factors may favor the emergence of a new *science-based* and *information intensive* technical paradigm, for the management of diversified and sustainable models of agricultural development.

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Introduction[1]

Two factors profoundly transformed the relationship between agriculture and rural activities: increasing productivity per unit of land on one hand, urbanization on the other (Jacomy, 1990). Concentration of production in an ever more limited part of the territory is considered an essential component of agricultural revolutions in Europe (Bairoch, 1989), and is accentuated as industrial inputs increasingly substitute for inputs traditionally mobilized in agriculture and in rural spaces. The use of renewable natural resources and the valorization of natural productivity of cultivated ecosystems are replaced by an external contribution of energy (Delucchi, 1990). Through constant improvement of land-using techniques any *spatial* constraint in agro-food production is overcome (Mendras, 1984), so that land progressively loses its character as a "limiting factor." Policies aimed at limiting supply by imposing a "quota of production" ratify, in fact, the success of land intensification. They reinforce the conviction that agriculture may continue to increase volume, while decreasing occupied land.

Concentration of production also accelerates the disappearance of indigenous cultures and knowledges, leading to *depopulation* of vast part of the territory on one hand (Gravier, 1960; CEC, 1987) and *rurbanization* on the other (Bayer and Roux, 1976). Space mobi-

lized by production systems, social organizations and cultures based on the valorization of the *ager*[2] (Mendras, 1984) are substituted by productive, social and cultural organizations linked to urban development (Chamboredon, 1985). Increasingly, the dynamics of rural spaces are disconnected from agricultural development, insofar as *space* is not anymore the physical place where polyvalent forms of production and social organization are composed at the local level and food is produced in the optimal allocation of the *economic space* of technical and social variables. Intensification of exchanges substitutes for optimal management of local resources.

Among the consequences of the diffusion of the industrial model of production in agriculture is, then, the inability of the economic system to guarantee the rational management of a vast part of the territory. The concentration of population in the urban-industrial areas raises, on the other side, new social demands, particularly in connection to health and environmental protection and recreational activities. All these demands imply a rehabilitation of nature and natural resources. (Leynaud, 1971; Maclouf, 1985; Kayser, 1990). The question we pose is concerned with the ability of the prevailing agricultural technical model to satisfy them[3].

The exposition of this article is organized in three parts. First of all, we would like to show how the social functions fulfilled by agriculture in the last forty years have brought about a *segmentation of rural spaces* in western Europe in general, and in France and Italy in particular. In the second part, we shall analyze the relationship between space segmentation and the evolution of industrial techniques, leading to an *increasing surplus of farmland*. Considerations in the third part are concerned with the emergent constraints of the diffusion of the "Fordist" model of production in agriculture. Finally, the problem of diversification and redefinition of agricultural techniques is posed.

Urban Growth and the Segmentation of European Rural Space

After decades of rural exodus, the demographic trend in Western Europe seems to indicate a new interest in rural areas. In France, the 1982 population census reveals that the rural population increased three times more quickly than the urban population (Chapuis and Brossard, 1986). But demographic and economic evolution in the rural counties are primarily a function of increasing urbanization, rather than being linked to the dynamics of agriculture (DATAR, 1988). The weak demographic growth of the "peripheral" areas--the more distant ones from the big metropolitan areas--where the small mixed farm is dominant, is contrasted with areas of "industrial" and "periurban" agriculture in which rates of growth are increasing (Jayet, 1988). Modes of articulation and integration into the economic system as a whole are the key variables in differentiating rural areas (Pernet, 1990; Fabiani, 1991), which are either under the influence of their industrial and urban environment, or in a process of marginalization.

Urbanization as an Element of Spatial Restructuring

The unequal access to modern agro-food production techniques and to the urban development model is the main criterion of differentiation of rural space in the EEC. The Commission of European Communities (CCE, 1988) distinguishes three groups of regions in its territory. The first group is defined as *under the pressure of modern evolution:* this area comprises the regions around metropolitan areas (the South-East of England, the Paris-Brussels-Bonn triangle), the large plains in

developed areas (the Po Valley in the north of Italy, East-Anglia, The Netherlands, Northern Germany, etc.) and the coastal areas, which benefit from high population density, diversification of employment and modern agriculture. A second group is in a situation of *rural decline*: agriculture is still an important economic activity, but farms are small and active populations emigrate towards urban areas so that the remaining population is older. The elderly farmers cannot find any complementary employment as a source of additional income. The third group is the extreme case of *particularly marginalized areas* , the less well-endowed mountainous areas and islands, particularly hit by depopulation and land abandonment.

Schmitz (1988; CEC, 1988) delineates, on parallel bases, three main axes of development in agriculture and forestry in the European Communities (EC). The first comprises staple food crops and bulk wood with a low value-added component, which are determined by the imperatives of mass industrial supply and the constraints of world competition. Procedures of intensification (mechanization, high yield) should continue to apply to them. The second axis of development will involve products with a much higher value-added component, and would include *quality* or *regional* food or non-food products. The potential areas for these products are located around the metropolitan areas, where the access to high-income consumers, who are ready to pay more for quality, is concentrated. This production is also largely based on intensive techniques. A third line of development involves site planning and development of sports, tourism, leisure activities and environmental preservation pursuits. In this area, industrial agro-food technology is not adequate for a strategy of development. It is, then, necessary to redefine strategies of natural resource preservation and management, which satisfy the new environmental and social functions.

The Marginalization of Agricultural Spaces

While in the dynamic agricultural areas we find a "modern, structured, competitive agriculture" (C.G.P., 1989)--which with the forecasted increases in productivity could in the short term provide the essential share of agricultural production--weak rural areas continue to expand. Estimates for western Europe show that "just a small fraction of agriculture has been modernized in the last twenty to thirty years, about 20% of the agricultural population providing about 80% of total production." Agriculture is no longer a dominant activity in any EC region. In only four regions out of sixty, does agricultural production represent more than 10% of the total regional added value (Schmitz, 1990; CCE, 1988 and CEC, 1988).

In France, demographic growth in the "deeply rural areas" (Pernet, 1990) is four times less rapid than in other rural areas. The phenomenon is cumulative and expands as these are the areas where farms are disappearing in greater numbers (SCEES, 1988). Moreover, agro-food industries are increasingly concentrating in industrialized areas. Bontron (1987) finds that, from 1975 to 1982, the evolution of employment in agro-food sectors in France reveals a re-location of these activities from peripheral areas to the west for dairy industries, to the central-northern regions for industrial crops and to the south-west for specialized crops. This spatial concentration of industrial plants is accompanied by the concentration of investment. Between 1983 and 1986, 60% of the investments in excess of 15 million Francs were concentrated in five regions[4].

Italian agriculture is differentiated in three main zones. In the northern regions, agriculture is specialized in milk, meat, cereal, grains

and industrial produce (Lombardia and Emilia Romagna, for example, produce 75% of the total Italian milk product; Piemonte and Lombardia almost all the rice, etc.) and is strictly integrated in the industrial upstream and downstream activities. In the *central area*, agriculture can be considered a complementary or integrated activity to the *industrial district*, socially characterized by a strong development of cooperative associations. In the *southern regions*, specialized mainly in Mediterranean products such as vegetables and fruit, wine, and olive oil, the marginalization of agricultural activity, correlated with an unsuccessful industrialization policy, had dramatic desertification and social disruption effects (Formica, 1975; Fabiani, 1991). This segmentation reproduces itself in a cumulative fashion, not only because EEC policies have always been more favorable to continental products, but because the technical, organizational, financial, marketing, preservation and transformation--i.e. the agro-industrial--capacities are increasingly concentrated in the most advanced regions of northern and central Italy (Mingione and Mottura, 1987).

In these conditions, the reproduction of agriculture in areas where family farms are dominant seems ever more difficult. Rural activities--trades, small firms, services--decline rapidly, following the decline of agriculture, which is the traditional base of the social and economic structure. However, the tendency towards the marginalization of agricultural space goes together with the development of an "interstitial agriculture", i.e. agriculture situated between rural and urban space, in the peri-urban areas.

Peri-Urban Agriculture: an "Interstitial" Activity of Urban Growth

The development of agricultural activities plays an important role in the urban area, in terms of the function of an urban consumption model. This type of agriculture, one that occupies the interstitial space around the metropolitan areas, adopts intensive industrial techniques and assumes new functions. Its development in Western Europe evolves in two forms: in the periphery of metropolitan areas, as a response to demand for fresh agricultural products and specific services (CEC, 1988); and in the industrial districts, articulated around a close network of small and medium enterprises for the production of *quality* food.

The first type of agriculture expands because of the close relationship between agriculture and final demand. "Rural economy ceases to be production economy, in order to become, as the others, services economy. Consumption services, themselves dependent on the level of population, predominate" (Drevet, 1988). It is possible to observe this phenomenon in the periphery of some European metropolitan areas. This agriculture is still supported by industrial production techniques, but innovations are permeating organizational, distribution and information techniques, with regard to models adopted in the specialized areas. It provides a very small part of global production, but is relatively more important in protected networks and niches. Relatively unaffected by global agricultural price policies, it is nonetheless very sensitive to variations in the prices of production factors (land, labor, water) and to environmental policies (regulations concerning the use of industrial inputs, etc.) which can progressively induce a change in its productive choices.

The second type of interstitial agriculture is based on systematic relations between agricultural and local knowledge (van der Ploeg, 1990). It is localized in specific industrial districts, producing traditional products which have recently met the new demand for quality under commercial labels. This is the case for wines in the *zone di origine controllata* in

France or in Italy, for the *prosciutto* in some areas of the North of Italy, for the parmesan in Emilia-Romagna, for the production of fresh vegetable and fruit in some agricultural areas, and for the development of agro-tourism and green tourism.

Definitely it is in the areas closest to cities that agro-food techniques are most diversified. But, currently, these techniques, even in the case of quality production, remain heavily dependent on urban market dynamics and do not have space management as an important goal. Consequently they cannot be transferred as a whole to marginal land, set in surplus by the progression of industrial techniques. In other terms, they cannot be the alternative to local traditional techniques elaborated in rural areas.

Spatial Concentration of Production and Farmland Surplus: The Role of Industrial Techniques

The diffusion of *industrial techniques* in agro-food production, substituting for *traditional techniques,* contributes at the same time to the process of rural space segmentation and to the production of surplus farmland. While these techniques were very successful in their objective of increasing production and yields, they nonetheless show their limits in their inability to manage excess farmland and to guarantee an efficient reproduction of natural productivity and renewable natural resources.

Traditional agricultural techniques constitute a heterogeneous set, strongly oriented at the local level and tightly linked to natural and social ecosystems, with which they co-evolve (Barrau, 1990; Mendras, 1972). They are the result of a long-standing process of elaboration, endogenous to the agricultural sector and the rural community, and constituted by a reiterative and continuous process of observation and experimentation. As such they are an integral part of traditional agrarian "systems" (Bloch, 1973) or "landscapes" (Sereni, 1972), which are used to differentiate--by endogenous characteristics--the "agrarian zones". The "piantata"[5] which characterized the Po valley in the North of Italy (Sereni, 1972), and the "sistema cerealicolo-pastorale" or the "sistema arborato" in the South of Italy, in the first half of this century (Prampolini, 1985; Rossi Doria, 1969) imply specific social--landholding structure, social and communal organizations--economic and technical relations, which are elaborated in different pedologic, morphologic and climatic contexts, utilizes the local potential of the ecosystem to the utmost. An important element in this environment is the relationship between the peasant community specialized in production and the rural community oriented towards the supply of goods and services upstream and downstream from agriculture. Herein lie the ideas of *coherence and interconnectedness* of local productive systems.

Traditional techniques evolve, integrate or adapt norms and processes elaborated outside their own history, as the adoption of new varieties testifies. *They are, nonetheless, unable to oppose the diffusion of industrial techniques when urbanization burdens agriculture with an expanded demand for food.* The unity, complexity and internal logic of traditional systems is then broken by the broad invasion of industrial techniques. Dependent on distant institutions for the generation of technological innovations as well as for the supply of production inputs, rural communities lose control over their production system (Altieri and Merrick, 1988). The farmer becomes the "recipient" of transferred techniques (Rogers, 1971; Benvenuti, 1990). Traditional skills and knowledge regarding the use of plants, the breeding of animals, the relations between

agrosystems and natural ecosystems become progressively and inevitably obsolete and useless for the aims and the evolution of the agro-industrial sector.

In the short term, the increasing homogenization of agro-food techniques is an important factor for the provision of food to expanding markets and the development of some agricultural regions; in the long term, however, it accelerates the destruction of rural space and its conversion into an "environment" (Mathieu and Jollivet, 1989) without agriculturalists.

Artificialization of Techniques and Spatial Concentration

The modernization of European agriculture in the last 20-30 years has created a sharp upturn in the productivity of both labor and land, coupled with marked concentration and specialization (CEC, 1988:70; Bairoch, 1990) and a global downturn in the area under cultivation. Arable land fell by 11 million hectares between 1961/65 and 1983 (CCE, 1988), while a 15-16 million hectare surplus of farmland is estimated for Western Europe in the year 2000 (CEC, 1988: 28). Everywhere in Europe, intensification has led to concentration of production in the plains and abandonment of the mountainous regions.

The increase in productivity stems from a technological model increasingly relying on industrial inputs: machines and high-yielding varieties very responsive to the use of chemical inputs (CEC, 1988). Yields have risen constantly, together with the use of synthetic fertilizers[6]. Therefore, the intensification of production is essentially the consequence of the substitution of traditional techniques, which are developed and improved in the rural space, with techniques which are the product of urban and industrial development. If "rural" and "urban" were once intended to represent a spatial division of labor between agriculture and manufacturing industry, the latter making a highly intensive use of space, the former an extensive one (Newby, 1980), this distinction is becoming progressively obsolete[7].

Agriculture radically transforms its cultural practices and its multi-purpose organization, as well as its priorities. Its main objective of the management and the reproduction of local agro-ecosystems is displaced by the production of standardized goods (commodities) in increasing quantities and at decreasing costs for the agro-food industry and the urban markets. Upstream and downstream, techniques in agriculture are shaped and directed by the agro-industry, which brings about a fragmentation of the agricultural production process, each segment being reconnected vertically in the "filiére", rather then horizontally in the rural space. The production process ultimately becomes *artificial*, using products and processes defined outside the agricultural space. It concentrates itself exclusively on the spaces where it can be competitive with respect to international pressures and urbanization processes, and marginalizes spaces whose use is not yet well defined by an increasing market demand[8].

The End of the Rural World and the Disappearance of its Traditional Techniques

Already in the '60s sociologists were talking of the crisis of the rural world (Gans, 1962; Pahl, 1966), as a socio-economic system characterized by the peculiarities of settlement patterns and contrasted with the urban way of life. In the previous sections we have stressed the "endogenous" expression of this crisis, i.e. the crisis of traditional agriculture, the main support for rural social and economic structure. Furthermore, industrialization, urbanization and state intervention break down any form of local autonomy and bring an increasing interdependence and interaction between "urban" and "rural" worlds, converting mod-

ern society into a standardized mass society, with a standardized way of life (Newby, 1980; Mingione and Pugliese, 1987).

Processes of concentration and intensification of agricultural production are related to this demographic evolution. Rural space which does not conform to the demands of industrial agriculture undergoes a process of *depopulation*[9]. Marginal rural areas may resist the diffusion of industrial techniques (Pernet, 1985), but are not able to compete with their efficiency with respect to market objectives. Depopulation and adoption of industrial techniques are then at the heart of the same process: the disruption of techniques and knowledges inherited with rural culture.

A reduction in the number of farms, primarily small marginal ones, leads neither to the consolidation of big farms nor the definite disappearance of small farms. But the social and economic organization known as the family farm, based on a proportionate growth of the family and the farm unit (i.e. consumption and production) loses any meaning. Because of the managerial characteristics of professional agriculture, the geographical mobility of the labor force and the diffusion of pluriactivity as inter-penetration of agricultural and other activities, the agricultural labor market no longer works according to relatively autonomous mechanisms. Labor is "individualized" (Friedmann, 1980), with professional profiles in agriculture, even in the case of peripheral areas --losing its specificity in respect to the other sectors of the economy (Mingione and Pugliese, 1988).

In accordance with the vanishing of their field of application (i.e. traditional agriculture, cf. Weber, et al. 1986), fragmentation of work in agriculture--which multiplies the number of worker categories--finally reinforces the gradual impoverishment and disappearance of knowledges and techniques at the base of peasant culture and practices.

New Functions for Rural Space and Limits of Industrial Techniques in Relation to Agriculture and the Environment

The effects of "Fordism" in rural areas appear more acutely in the context of a process of economic restructuring and social crisis. New "post-Fordist" social models are emerging characterized by the search for flexibility, diversity and sustainability.

Therefore, despite the ongoing process of homogenization of agricultural techniques for the production of commodities, a diversification of technical orientation emerges as a necessity in some areas. The multiplication of economic, technical and social constraints both in peri-urban agriculture and in the peripheral areas operates in favor of technical adjustments, which must take into account the modification of price systems, rising environmentalism, and unequal endowment of production factors. In any case, these adjustments continue to refer to a technical model idiosyncratically working for a constant alignment of empirical and diversifying processes within uniform industrial processes; therefore, rather than contrasting the industrialization of agro-food techniques, they reinforce it. For example, the operation of anti-pollution norms may induce an improvement of the utilization of phytosanitary products, without questioning their existence. Generated largely under industrial control, these adaptations of "Fordist" practices (Boyer, 1991) still retain their limits in relation to the solution of environmental problems and the management of natural ecosystems.

Currently, about 80% of the Western European population lives on less than 20% of the available territory, and this concentration seems set to continue. Therefore, we may start

asking whether industrial techniques which seem so pertinent to increasing agro-food production, will also be able to manage surplus farmland--freed from any productive constraint--according to the new functions of the "post-industrial" society, i.e. for a more efficient utilization of natural resources and better environmental management (Green and Yoxen, 1990; CCE, 1988; OCDE, 1988).

The Adjustment of the Industrial Paradigm

Under the pressure of economic crisis, health and environmental problems on the one hand, and new scientific developments on the other, many factors--increasing costs, instability of price systems, re-orientation of agricultural policies among them--have recently contributed to changes in the evolution of industrial techniques applied to agriculture, which seems to be reverting to a regime of diversification (Byé and Fonte, 1991). *Extensification* of production is, for example, promoted by agricultural policies as an immediate response to excessive intensification, commodity surpluses or environmental damage. Taken together the new practices give an impression of a widening in the range of techniques, which is interpreted by some authors (Pernet, 1982) as a check on the irresistible expansion of industrial techniques in the agro-food sector (Servolin, 1982).

However, this "reopening" is based on the very same *foundations* and paradigms which led to the artificialization of agro-food techniques and which contrast with the evolution of the natural ecosystem. Behind the improvement of the system flexibility, the principle aim is still mass production through standardization. Therefore, the multiplication of technical adjustments gives strength to industrial techniques and the actors who promote them, obeying the very same productivist principles.

Thus, the industrial paradigm still persists, despite a multiplication of technical practices. It may give a prompt response to problems of agro-food provisioning, improving, for example, regularity of supply, homogeneity of products and food quality. However, as long as this paradigm is not based on renewable sources of energy, continues to produce an excess of farmland and food, and destroys the possibility of local forms of production, it does not solve the most fundamental contradiction between the techno-sphere and bio-sphere, i.e. the problems linked to the conservation and management of renewable natural resources (RNR). Similarly, the extensive practices recently encouraged by EEC policies are based on the simple extensification of industrial intensive techniques, i.e. on the simple principle of "less industrial input." Within a long-term perspective these practices seem unable either to maintain and valorize natural ecosystems or to re-integrate marginalized areas in the social and economic development process. Techniques elaborated by the logic of increasing production through an increasing utilization of industrial inputs can not be easily transformed into techniques aimed at the management of rural space and diversity of species, the improvement of food quality or the maintenance of natural productivity. The disappearance of agro-rural communities, which were in the past able to guarantee the RNR reproduction (Ceron, 1987), endangers the survival of traditional techniques, which have often acted in the past as a buffer against the negative impact of industrial techniques in agriculture.

New Functions for Agriculture and New Science-Based Techniques for the Management of RNR

While still directing technical choices towards land-saving practices, the growth of urbanization--with its attendant problems of pollution, overcrowding, and social conflicts--also generates new needs, which could transform models of territory use and induce a change of

paradigm in the framework of a *multi-purpose* model of space management (CEC, 1988). Rural space becomes the main source for the provision of services (immaterial goods or "non-product" demand) and production factors which are relatively less commodified: air, water, recreational activities, health goods, and other "secondary" products. Marginalized in its productive role by the expansion of urbanization, it may be re-evaluated and may acquire new roles, which can be re-composed around four general functions:

1) *reproduction functions* of ecosystems and societies. Space is the main support on which natural and cultivated ecosystems reproduce themselves. Its degradation--due to desertification and artificialization of techniques--menaces the conditions of this reproduction, exactly when the conservation of preserved ecosystems becomes a public good and one of the main sources of biodiversity. This biodiversity is the base of food security, ecosystem stability and a necessary resource for the development of new plant biotechnology.

2) *a deconcentration and circulation function* of material and immaterial goods. Desertification increases the costs of managing residual rural communities and traditional agriculture, as well as the economic, social and environmental costs related to an increasing concentration of people in urban areas; unemployment, pollution, and social conflicts are expressions of these costs.

3) *recreational and health functions*. The use of rural areas is commodified, through the development of leisure activities and services (natural parks, sport sites, rural accommodation structures and infrastructure), which contributes to the satisfaction of the urban consumer's new needs: fresh products, relaxation from urban stress, direct contact with the food producer, and a return to nature.

4) *security function*. Freed from agricultural and rural activities, space constitutes an uncontrolled area where risks of fire, pollution and natural catastrophes are accentuated. These increased dangers are in contrast with the need for "security" that emerged from urbanization. This need is expressed in the over-organization of all spaces reintegrated in the urban sphere: holidays, tourist or leisure centers. Costs of guaranteeing security increase with desertification and with the "professionalization" of the functions linked to management and supervision of "nature."

The emergence of these new functions for rural space reveals both the inadequacy of agro-food techniques, and the social and economic unsustainability of lifestyle derived from the industrial-urban culture. Up to now these new functions of space utilization have been satisfied either through the valorization of residual, traditional techniques or through specific investments and techniques, elaborated and adopted in order to cure or repair inconveniences deriving from the large scale adoption of Fordist techniques. Examples of this sort are therapeutical substances directed towards consumers' protection, animal antibiotics, applications of biotechnologies in order to solve problems of salinity or to induce pest resistance in plants (Buttel, 1989), and promotion of extensive techniques. But norms and regulations increasingly become a necessary instrument of control and a substitute for more environmental/health-friendly techniques. Actually, industrial societies lack a common base of knowledge and techniques able to give an adequate answer to these new demands, in particular the management of space and territory. The challenge for today's science and technological research is then the redefinition of a technical paradigm, integrating three main axes:

1) a modification of the *organization of agro-food production*, from specialized filiéres centered on a single product, towards multi-purpose, polyvalent systems, where the production of goods is associated with the production of services and integrated into new consumption and reproduction goals. Flexibility aimed at the *management of diversity* is the requirement of a technical system in this case.

2) a modification of the *consumption system*, integrating objectives of food quality with new forms of utilization of natural spaces for health and recreational (leisure, sport and touristic) activities. The development of low impact, diversified techniques for agriculture, agro-forestry, and agro-tourism must be integrated into a restructuring of markets, which allows the articulation of global and local forms of consumption.

3) a modification of the *reproduction system*, that is a new model of utilization of natural resources (air, water, and landscapes), which takes into account their transformation into *public goods*. The management of complex systems in a context of *market failure* must be taken into account from a technical point of view.

In general, policies must then be directed toward the implementation of diversified forms of production, consumption and distribution, which also implies taking into account both *market and non-market* objectives. In the specific case of science and technology policies, a re-orientation of science and research is required towards *science-based, information intensive* technological systems, aimed at the management of diversity.

Conclusion

In the context of the post-Fordist crisis of Western Europe, various economic and social factors may favor the emergence of a new technical paradigm in the domain of agriculture and natural resources management. In this article we argue for the relevance, in this respect, of the management problem of surplus farmland created by the industrial model of agricultural development.

The existence of factors supporting a new technical paradigm is a necessary, but insufficient, condition for its emergence. We can see today the future of agriculture in Western Europe as an alternative between two different paths of development. The first valorizes the "inertia" effects of the Fordist model, often referred to as a neo-Fordist model;, it is based on segmented global markets (bulk or commodity markets, quality markets and natural reserves or "environment") and perpetuates the segmentation of rural space--almost a negative image of the "three fields" agriculture of feudal memory. Input-intensive industrial techniques, mainly geared towards the objective of production, is still the *technical reference*, while the *technical challenge* is to increase the sustainability of industrial agro-ecosystems on one side, while elaborating new techniques for the management of rural space on the other. The question we raise with respect to this path relates to the possibility of successfully facing these challenges without radically changing the premises of the industrial model of development.

The second, more radical, path would imply moving towards diversified, *multipolar* agro-food models of development, in which objectives of production are strictly linked to objectives of natural resources re-production. Sustainability is in this way incorporated in the technical model as a *goal*, rather than a constraint, which implies moving toward a re-

conciliation of the techno-sphere and the bio-sphere, taking into account the characteristics of the local agro-ecosystems and rehabilitating their natural productive potential. From a technical point of view, agro-food technical systems would respond to the same logic as the techniques geared to the management of natural ecosystems. The technical challenge in this case refers to the possibility of guaranteeing high levels of food production inside the functioning logic of "natural" (as opposed to "artificial") agro-ecosystems.

Surely an important task for social scientists in the immediate future is to consider the social and economic conditions that would make the full emergence of the new technical paradigm possible. By restricting our attention to science and technology, we can, however, underline the relevance of this with respect to the transformation of research policy and research methods geared towards the rehabilitation of natural productivity and the management of agro-ecosystems diversity[10].

Notes

1. This article is an extensively revised version of a paper presented at the 36th Annual Meeting of the American Sociological Association, in the special session: *Social Change in Rural Economy and Society in the Late Twentieth Century: Comparative Perspectives*, organized by Prof. Frederick H. Buttel, Cincinnati, Ohio - August 27, 1991.

2. "Ager", the Latin word for countryside, is part of the etymological root of "agriculture".

3. These general considerations in particular concern more industrialized countries, where increases in agricultural production rest mainly on increases in yields. They apply only partially to Third World countries, where often the increase in production is reached through the extension of cultivated land. Nonetheless, even in these countries, depopulation of regions in which traditional agriculture dominates can be observed.

4. They are: Rhône-Alpes, Bretagne, Pays de Loire, Nord-Pas-de-Calais, Lorraine.

5. It was a system of large fields interrupted by trees. In the fields, crop rotation practices were particularly long-standing. The main form of farm management was sharecropping.

6. Between 1969-71 and 1983 the average increase for Western Europe of fertilizer consumption per hectare was: +67% for nitrogenous fertilizers; +15% for phosphate and +19% for potash (CEC, 1988: 15).

7. While the area of utilized farmland decreases, agricultural production increases constantly in Western Europe, with an annual average growth of 2% in volume in the '80s. Since agricultural demand increases only by an average of 0.5% per year (CEC, 1988), agriculture faces a double challenge: the management of agricultural surplus, mainly through the development of foreign trade, and the management of intersectorial and interindustrial relations.

8. As a result of this process, today we observe a European agriculture which is radically different from the '50s. Judging by the capital input per work unit and by labor productivity, it resembles heavy industry; it is publicly financed and highly dependent, both downstream and upstream, on industrial development (CEC, 1988; CCE, 1988) and divided into many differentiated and specialized productive sectors (Mingione and Mottura, 1987). On one hand there are big intensive farms, using the best available technology, which specializes in cereal production in Eastern England (forage grain) and the Parisian Basin (breadmaking wheat), dairy production in Western France and Ireland, milk and soil-less (hydroponic) crops in the Netherlands, (CEC, 1988: 21). On the other hand, we have different forms of pluriactive and marginal farms, which, though they have little economic relevance, represent a very widespread social phenomenon.

9. Agricultural population decreased from 21.1% in 1961 to 7.8% in 1988 (CEC-12). According to CEC estimates, in 1985 about 10 million people carried out their main activity in agriculture (CEC, 1988: 18), though 18 million lived on farms. In rural areas, farmers may be divided into three cate-

gories: rich "professional" farmers, a high proportion (50%) of whom live on "flourishing" farms of the "central" zone (CEC, 1988: 20); subsistence farmers, who live in the peripheral areas (mainly the Mediterranean regions) and, finally, an "intermediate" group of farmers, who live in a "median" zone, situated between the central zone and the Mediterranean regions (CEC, 1988: 20).

Recent works in France confirm the existence of a "population threshold", located at about 8 inhabitants per km^2, under which any form of social life becomes problematic and any economic investment too costly.

10. With regard to biotechnology development, for example, this process would imply a move away from using science and technology as technological instruments for increasing productivity and toward improving the performance of their utilization as tools for the comprehension of the workings of natural ecosystems; i.e. a shift from applied to generic science.

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RESUMEN

Las Nuevas Funciones del Espacio Rural en Europa Occidental: Un Reto Para las Técnicas Agrícolas

La concentración de la producción en una ahora más limitada parte del territorio y la urbanización han conforma la evolución de las «técnicas industriales» de la agricultura en este siglo. Consecuencia de estos procesos son la *segmentación* del espacio rural, la desaparición de los cultivos y técnicas autóctonos y el *despoblamiento* de grandes áreas. Las dinámicas de los espacios rurales están desconectadas del desarrollo agrícola en la medida en que en espacio deja de ser el *espacio físico* donde las formas polivalentes de producción y la organización social están ordenadas a un nivel local y el alimento es producido en el *espacio económico* de asignación óptima de recursos. La difusión de técnicas industriales en agricultura, exitosas en cuanto a su objetivo de aumentar la producción y los beneficios, muestran a la vez su incapacidad para manejar el exceso provocado de terrenos aptos para el cultivo y garantizar la reproducción eficiente de la fertilidad natural y los recursos naturales renovables. Hoy en día, bajo la presión de la crisis económica y social y la expansión de la urbanización emergen nuevas demandas de espacio rural, particularmente en cuanto a salud, protección ambiental y actividades recreacionales. Aún con ajustes las técnicas «fordistas» no parecen satisfacer estas exigencias. Finalmente, la co-evolución de los factores económicos, sociales y técnicos puede jugar un papel importante en favor del surgimiento de un nuevo paradigma tecnológico, *basado en la ciencia e intensivo en información* para el manejo de modelos diversificados y sostenibles de desarrollo agrícola.

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