Prospective analysis of the agriculture in Castilla y León (Spain)

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Abstract— **The objective of this paper is to carry out a foresight analysis of the agricultural sector in Castilla y León (Spain) for 2020. The methodology used to build the various scenarios is prospective analysis. We first performed a structural analysis in order to identify the key driving forces that characterize the evolution of the sector in this region (agricultural production, demand for agricultural products and institutional framework). We then carried out a morphological analysis that generated a range of "partial scenarios" from which we finally built four "global scenarios". These last scenarios characterize the possible trends in the variables of change previously identified. Lastly, the common key parameters of each global scenario were quantified by means of the Delphi method. The characterization of scenarios has a double practical interest. First of all, they can explain the cause-effect relationships of the processes of change that affect agriculture in this region of Spain. Secondly, they are a powerful tool to stimulate an in-depth reflection of how the design and implementation of current agricultural policies will affect the already fragile agricultural sector of Castilla y León. This study thus aims to support decision-making processes at regional level.**

Keywords— **Prospective analysis, Scenario building, CAP.**

I. INTRODUCTION

In the course of recent decades, the changes in the European agricultural sector have identified new directions. Current processes have become more complex. Nowadays, they affect not only productivity (food security) and the economic efficiency of farms (improvement of agricultural income), as in preceding periods, but also include a new vision of agriculture as a multifunctional activity. The agricultural sector becomes interpreted as a source of social welfare rather than of food and raw materials, as it can also provide society with environmental and social public goods and services. This fact underscores the strategic interest that underlies performing foresight studies of the agricultural sector [1], especially in a region like Castilla y León, where the multifunctional character of agriculture is particularly obvious [2,3].

The focus of this paper is an exploratory analysis of the future of agriculture in Castilla y León. This is performed by developing a range of scenarios for the agricultural sector of this region for a time horizon referred to 2020.

According to Godet [4], foresight studies should not be considered as an end unto themselves but as means of encouraging and fostering strategic decision-making. Obviously, then, successful foresight studies should not merely be technically advanced and capable of generating large amounts of scientific knowledge about the future. They must also transfer their results to relevant stakeholders in order to guide their actions in the here and now. This study is thus more than a mere academic exercise, and should rather be regarded as an effort in this latter direction. It aspires to be a useful and necessary reflection tool that can help guide the performance of the various agents of the agricultural sector in Castilla y León (farmers' organizations, policy-makers, etc.) towards an uncertain future.

Given the practical objectives of the research proposed, its main result is the construction of alternative future scenarios for agriculture in Castilla y León. For this purpose a previously developed and widely accepted methodology (prospective analysis) has been employed. It is thus worth noting that although this work lacks methodological innovation, it can be regarded as innovative on terms of its scope. Foresight studies found in the literature have seldom focused on the agricultural sector, and such few studies have been developed at international or national levels [5]. In fact, to the best of our knowledge, no study of the future of agriculture has actually been performed at regional level. This paper is organised as follows: First, it presents the theoretical framework of the concept of foresight studies (Section 2), followed by a summary of the methodology

employed in this study (Section 3).Thereafter, it briefly describes the future scenarios developed as the main result of this study (Section 4). Finally, it concludes with a series of reflections on the usefulness of these scenarios (Section 5).

II. FORESIGHT STUDIES IN AGRICULTURE

A. Prospective analysis as a methodological approach to foresight studies

Foresight analysis emerged in the United States during the 1950s, with the *long range planning* technique. It consisted of a rationalist planning approach based on the development of operational research techniques. However, as later emerged, the most important drawback of this technique was precisely the starting assumption on which it was based: that the future could be considered as a unique and predictable path derived from currently available information. Such a mechanistic vision of the evolution of systems was discredited in the seventies, given the massive failure of *long-range planning* methods to predict the future, especially in the field of the socio-economic sciences [6,7].

In Europe, due to the failure of *long-range planning*, an alternative approach to the scientific study of the future, called *prospective* was developed in parallel. This approach was developed mainly in France on the basis of the seminal contributions of Berger [8,9] and Jouvenel [10]. The prospective analysis is the art of the conjecture *par excellence*, and as a discipline, its primary purpose is the exploration of the future in the context of the social sciences. It parts from the current status of analysed systems to study the economic, social, scientific and technological circumstances in which they occur, in order to predict and imagine situations that could arise from the combined influences of such circumstances.

In the seventies, Godet and other authors gave a new impulse to the development of prospective analysis, which still presented a philosophical and literary shape, turning it into an investigative technique of the future truly applicable to real cases. Prospective analysis has thus been formalized through a variety of quantitative methods (structural analysis, analysis of the strategies of the agents, morphological analysis, etc.), which together make up a toolbox for the implementation of this analytical method, based on the construction of scenarios [11,12,13]. Thanks to the development of tools of this sort, prospective analysis is now a widely used technique, particularly by public-sector organizations.

Since prospective analysis is capable of answering questions regarding public and social issues in foresight studies, we decided to adopt this methodological approach to develop the survey discussed here [14].

B. Prospective and scenario analyses

All modern prospective studies consider the future as a set of possible alternatives to be explored, rather than a single empirical forecast reality. Each of these alternatives is a possible "scenario". Scenarios should thus be understood intuitively as descriptions of archetypal images or alternative visions of the future, which can be represented through narratives and indicators. In any case, it must be emphasized that the analysis of these scenarios is not a tool to "predict" the future. On the contrary, the main purpose of these scenario-based methods is to "explore" the future in order to guide current decision-making processes [15].

Furthermore, the scenarios can be defined as "hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision-points" [16]. Thus, the concept of "scenario" should be linked to a series of key points. First, the scenarios must describe *processes* (they represent sequences of events that take place over a certain period of time). Secondly, the scenarios should be *hypothetical* in describing possible paths for the future. And finally, the scenarios must contain *elements that can be judged* accordingly to their importance and/or desirability.

Given the above discussion, it is easy to understand why, irrespective of their methodological approach, all current foresight studies are based on the design and analysis of scenarios [17]. Indeed, scenario analysis is currently the only valid instrument capable of undertaking the task of rationally studying the future. In any case, for this analysis to be truly useful, the construction and selection of scenarios must be done carefully, pursuing the following characteristics: relevance, coherence, plausibility and transparency [18].

Now that "scenario" has been defined, it is also worth pointing out that there are many different kinds of scenarios. Following the typology developed by van Notten *et al*. [19], scenarios can be classified according to three main criteria: *why* they have been developed (project goal), *how* they have been built (project design) and *what* results can be obtained (scenario content). As might be expected, therefore, the scenarios developed in this paper have the following features:

1. The objective of this foresight study is double: a) to explore the possible future of regional agriculture and b) to support strategic stakeholders' decision-making processes. The scenarios to be developed therefore need to be descriptive (no norms are considered), to offer forecasts (taking the present day as their starting point) and to deal with a "short-term" (less than a generation) perspective.
2. The methodology followed is "formal"; scenario building has been regarded as the result of a rational and analytical exercise based on the use of qualitative and quantitative information, as the prospective method suggests (see section 3). For the implementation of the formal methodology adopted, both desk research (statistical analysis and literature review) and a participatory approach (expert consultations, see [20]), have been adopted.
3. Scenario content characteristics are as follows: a) temporal nature: "snapshot" (like photos, scenarios only describe future situations, not the path of development), b) nature of variable: "heterogeneous", c) nature of the dynamics: "trend" scenarios (considering scenarios as linear trajectories), and d) level of deviation: "alternative" scenarios (future scenarios can differ significantly from each other).

C. Background

Given the special nature of foresight studies and the practical interest they arouse, a number of applications based on the empirical scenario analysis have been developed in the course of the past two decades. However, the implementation of prospective studies in the agricultural sector is a relatively new area. This can be demonstrated by the fact that only 8% of the scenario analyses listed in the database of the European Foresight Monitoring Network (EFMN) directly or indirectly address the future of the agricultural sector. In this field, the most important contributions are:

- "*Ground for choices*" [21]. This study can be regarded as the first foresight study focused on the agricultural sector. It was commissioned by the Dutch Council of Ministers with the Scientific Council for Government Policy (WRR) to generate knowledge about the future of agricultural and forestry sector within the European Community by 2015. A methodology based on scenario development was used. These scenarios were built considering different alternative policies that pursued a range of economic, social and environmental objectives.
- "*Agricultural Futures and Implications for the Environment*" [22]. This analysis was carried out by a research group at the University of Cranfield in the UK on behalf of the Department of Environment, Food and Rural Affairs (DEFRA). The study explored long-term (horizon 2020) scenarios for the UK, on the basis of global scenarios developed by the UK Foresight Programme [22,23].
- "*EURURALIS*" [25]. This foresight study was contracted by the Netherlands Ministry of Agriculture, Environment and Food Quality to a group of experts from the University of Wageningen and the Netherlands Environmental Assessment Agency. The objective of the study was to analyse various futures for rural areas in the enlarged European Union. For this application the horizon adopted was 2030.
- "*FFRAF Report - Foresighting Food, Rural and Agri-Futures*" [26]. This report was requested by the European Commission and the European Council of Ministers from the Standing Committee on Agricultural Research (SCAR). The primary objective was to analyse alternative futures of European agriculture 20 years into the future, in order to support public decision-making regarding European agricultural science and technology policy.

- "*SCENAR 2020*" [27]. This study was contacted by the European Commission to a large consortium of researchers specialising in agriculture. Its objective was to identify the trends and drivers that will determine the future of the agricultural sector and rural areas in the EU ahead to 2020. The results of this research have been used as input for decision-making in the current CAP reform, called "Heath Check".
- "*Agriculture 2013*" [28]. This foresight report was drawn up by the French Institute for Agricultural Research (*Institut National de la Recherche Agronomique*, INRA) in order to construct a range of scenario for French and European agriculture for 2013. This scenario development particularly considered external drivers as major determinants of agriculture in the future: agricultural trade liberalization, world food demand, social environmental awareness and global economic development.

Of course, all of these studies can be regarded as valuable experiences in order to implement new foresight studies about agriculture like the one presented now. Nevertheless, it is worth mentioning that no prospective studies are being carried out that deal specifically with the Spanish agricultural sector, nor there is any published foresight studies focused on agriculture at regional level. These facts underscore the novelty of this research.

D. The agricultural sector in Castilla y León[1]

The autonomous community of Castilla y León is one of the larger regions in the European Union, with an area of 94,224 km^2 (18.6% of Spanish national territory) and 2.45 million inhabitants (5.8% of the Spanish population). Situated in north-western inner Spain, the region covers a wide plateau with an average altitude of 800 metres. The climate is continental, characterized by long cold winters followed by short, hot, dry summers.

The agricultural sector in Castilla y León is relatively important economically, accounting for 5.8% of regional Gross Value Added (GVA), while in Spain and the EU the corresponding percentages are 3.8% and 1.9% respectively. This sector is also relevant from a social point of view, employing 8.5% of regional workers (5.3% in Spain and 4.6% in the EU). Obviously, this primary sector is highly significant in rural areas, where it generates more than a third of local GVA and employment. This key role of agriculture in rural areas is especially important from a territorial perspective in this region, where rural depopulation is a major problem (rural population density is already below 20 inhabitants/km^2).

Agriculture productivity in Castilla y León is low, without noticeable improvements during the past few years. The final value of agricultural production came to € 3,513 million in 2005, of which 58.2% was due to animal production, with pigs (17%), sheep (14%) and cattle (10%) and dairy (9%) production the most valuable sectors. The most important crops are cereals (21%), sugar-beet (8%), potatoes (3%) and wine (2%). All these outputs are produced by 98,052 agricultural holdings that cover 5.45 million hectares (51.2% of regional territory). Thus, the average size of regional farms is 55.6 ha, much higher than Spanish (23.1 ha) and EU (11.9 ha) averages. In any case is worth noting that the lower productivity of agriculture in Castilla y León means that the average farm in this region generate a profit only slightly higher than its Spanish and EU counterparts.

This summary picture of the agricultural sector in the region can be completed by mentioning that farm production is highly dependent on CAP (Community Agricultural Policy) subsidies. In fact, the financial support of this common policy represents 33.1% of the regional agricultural income (€ 854 million out of € 2,580 in 2005). This explains how any CAP reforms are capable of radically influencing regional agriculture.

III. METHODOLOGY

As mentioned above, the methodological approach adopted in the construction of the scenarios for the agricultural sector of Castilla y León to 2020 was the *prospective* method systematized by Godet [4,11,12].

In summary, this method is based on the three main stages listed below:

[1] All these statistics are referred to year 2005, found in Junta de Castilla y León [29] and European Commission [30].

1. Structural analysis.
2. Morphological analysis: partial and global scenarios building.
3. Quantitative characterization of the global scenarios.

The following section offers a brief explanation of the development of each phase of the methodology.

A. Structural analysis: the driving forces

The structural analysis is a systematic method that identifies the interrelationships among the variables that characterize a system. To this end, the following activities have been developed:

1. *Identification of variables*. We built a list containing the 75 variables which best characterize the agricultural sector in Castilla y León. They distinguished between "internal" variables (those which characterize the subsystem analysis) and "external" variables (those which represent the context). The variables were identified on the basis of the "*Libro Blanco de la Agricultura y el Desarrollo Rural*" ("White Paper on Agriculture and Rural Development") by the Ministry of Agriculture, Fisheries and Food of Spain [31].
2. *Construction of the structural analysis matrix*. This is a symmetrical double-entry 75 x 75 table that determines the existence of interrelations among the variables.
3. *Search for the key variables.* We employed the MICMAC method [11] to identify the most important variables: we identified the driving variables among the external variables and the dependent variables among the internal variables.

These steps enabled us to identify 12 key driving variables that will determine the future of agriculture in Castilla y León:

1. *Development of agricultural techniques*: biotechnology (GMOs), chemical (new slow-release fertilizers) and mechanical technology (new tilling techniques), new information and communication technologies (precision agriculture), new farming systems (organic farming and integrated farming).
2. *Environmental conditions:* quantity and quality of available natural resources for agricultural production (climate change and pollution levels).
3. *Energy availability*: fossil fuel reserves, developments in nuclear energy and the development of alternative removable energy sources (bio fuels and bio mass productions).
4. *Demography*: Population growth, ageing, migration, rural population, etc.
5. *Macroeconomic situation*: rate of economic growth and international distribution of wealth.
6. *Consumer preferences*: demands of agricultural private (security and food safety, functional foods…) and public (conservation of the natural environment for leisure, revalorization of culture and rural heritage, etc.) goods.
7. *Life style and welfare level*: availability of public and private services in rural and urban environment, urbanization model, lifestyle, leisure and so on.
8. *WTO agreements and others:* EU agreements at the World Trade Organization (WTO) and other trade agreements (Euro-Mediterranean agreements, GSP schemes and political cooperation with developing countries).
9. *Enlargement and institutional organization of the EU*: adoption of the *acquis communautaire* in the new member states, further enlargement of the EU (Balkan republics, Turkey, former Soviet republics and Morocco), changes in the process of implementation of European construction and financial guidelines.
10. *Agricultural policy and rural development*: European budget allocated to agricultural subsidies (CAP), distribution of CAP budget between direct payment to farmers (first pillar) and rural development and environmental measures (second pillar), degree of subsidiary ("renationalisation" of the CAP) and national implementation of European legislation.
11. *Environmental policy*: agro-environmental schemes and other environmental policies with impact on agriculture (Water Framework Directive, Nitrate Directive, Habitat Directive).
12. *Energy policy*: measures to cope with the increase in demand for energy, such as promoting the use of biofuels and other renewable energies.

Table 1 The structure of drivers

		DRIVING VARIABLES
PRIMARY DRIVERS *(Exogenous to the agricultural sector)*	***Supply drivers***	*Development of agricultural techniques* *Environmental conditions* *Energy availability*
	Demand drivers	*Demography* *Macroeconomic situation* *Consumer preferences* *Lifestyle and welfare level*
SECONDARY DRIVERS *(Partially exogenous to the agricultural sector)*	***Public policy drivers***	*WTO agreements and others* *EU enlargement and EU institutions* *Agricultural policy and rural development* *Environmental policy* *Energy policy*

Subsequently, in order to simplify the analysis of the driving variables, these were aggregated into three "driving forces", or simply "drivers" (see Table 1).

The structural analysis was completed with an individualized analysis of each of the drivers, realized through the input data obtained from a panel of experts in the individual driving variables.

B. The morphological analysis: partial and global scenarios

Once the most relevant drivers were selected, the next step was the construction of the "partial scenarios". To this end, we established several future alternatives for each of the drivers selected in the previous stage for the 2020 horizon. Such possible alternatives make up a partial scenario derived from the corresponding driver. Each partial scenario has been formalized through a relatively detailed narrative description of its essential features, the so-called *story-lines* in the terminology of the prospective.

The first scenario proposal was submitted to public discussion with the external experts from the previous phase (the structural analysis) and with a representative group of economic and social actors related to the agricultural sector in the region (producer organizations, environmental groups, governments and other groups). The outcomes of these deliberations formed the basis of the review of the initial scenarios. In this way, they defined the final partial scenarios to the three drivers considered.

The scenario-building process ended with the development of the "global scenarios" derived from all the feasible and logical combinations of the different partial scenarios. As usual in such exercises, the final number of potential global scenarios proved to be very high: 36 possible global scenarios were obtained from the combinations of the partial ones (3×3×4). In order to facilitate their analysis, we selected those highlighted by their internal consistency (plausibility) and analytical interest. Finally, we remained with only four global scenarios that could be regarded as truly representative of the future development of the agricultural sector in the region of Castilla y León.

C. Quantitative characterization of the global scenarios

The global scenarios generated from the morphological analysis were substantiated in short narratives (*story-lines*) that describe their main characteristics. However, these qualitative results were not enough. The operability of the scenarios for their subsequent modelling requires the complementation of these narratives with the quantification of certain key variables or parameters. For this purpose, we applied the Delphi method [32,33]. The panel of experts was

composed of academic researchers and technical experts from the regional administration.

First, the members of the panel were sent a questionnaire asking about the changes they believe that different variables will suffer in each scenario in the future. Specifically, they were asked about foreseeable values with respect to: a) the prices of agricultural products b) farmers' income c) costs d) farm structure e) types and amounts of public subsidies to the sector f) the legal requirements for the development of agricultural activity (cross compliance). Secondly, the statistical results of the first round of the questionnaire were presented and discussed at a private seminar that included all members of the panel. The purpose of this discussion was to achieve a consensus on the answers with a high level of heterogeneity. Finally, we obtained accepted values for each of the analyzed variables for each scenario.

IV. RESULTS: FUTURE SCENARIOS

A. Partial scenarios

The partial scenarios obtained as a result of the morphological analysis and the respective alternatives for the future of each of the drivers are shown below in Table 2.

The respective *story-lines* are not included in this study for reasons of space. In any case, their characterization will be summarized in the descriptions of the global scenarios.

Table 2 Partial scenarios

Partial scenarios for the driver "supply"	**Partial scenarios for the driver "demand"**	**Partial scenarios for the driver "institutional framework"**
1. *Abandonment for leisure purposes*	1. "*Baseline*	1. *Baseline*
2. *Productive commercial agriculture*	2. *Global Consumerism*	2. *Liberalization*
3. *Multifunctional family agriculture*	3. *Responsible consumption*	3. *Regionalization*
		4. *Strengthening*

Table 3 The global scenarios

DRIVERS	**PARCIAL SCENARIOS**			
Agricultural production	Abandonment for leisure purposes (1)	Productive commercial agriculture (2)	Multifunctional family agriculture (3,4)	
Demand of agricultural products	Baseline (1)	Global consumerism (2)	Responsible consumption (3,4)	
Institutional Framework	Baseline (1)	Liberalisation (2)	Regionalisation (3)	Strengthening (4)
	GLOBAL SCENARIOS			
	Baseline (1)	**Triumph of the market (2)**	**Regional sustainability (3)**	**European sustainability (4)**

B. The global scenarios

The four global scenarios generated from the outcome selection of the partial scenarios combinatory are listed in Table 3.

In accordance with the previous scheme, the four global scenarios selected can be characterized as follows:

1. "Baseline" scenario

This global scenario assumes a continuation of current trends in regional agriculture by the year 2020. The agricultural production of Castilla y León continues to languish slowly, given the lack of competitiveness of its production in an increasingly global environment and the sluggishness of its old-fashioned rural society. In 2020, the professions of farmer and rancher tend to be unprofitable and carry little social prestige. There is a widespread lack of generational replacement and most farms ceased their activity when their last owner retired. In such cases, the priority use of the land is environmental conservation or the leisure activities of the predominantly urban society.

The sector most affected by the abandonment is livestock (sheep and cattle in extensive techniques), which becomes almost residual. Other traditional farming activities (cereal crops, vines, fodder etc.) only remain in the most productive areas. Intensive livestock production is concentrated in the neighbourhood of logistics centres in order to reduce supply and distribution costs.

Farms without generational replacement placed in areas where agricultural productivity has proved to be marginally profitable (e.g. the irrigated areas) are purchased by other producers who maintain production by achieving economies of scale. The survival of such farms is also possible through the adoption of more extensive production techniques and GMO crops.

Regional agricultural production declines in physical and economic terms. This leads to a reduction in economic activity in rural areas. Only larger villages can maintain an active population throughout the year, as the smaller ones turn into population deserts.

As a result of the situation already described, the self-sufficiency quotient in Castilla y León falls to less than 75%,making it necessary to import large quantities of food from the rest of the world, leaving food sufficiency at regional level seriously compromised.

Most consumers are not concerned by either the form of production (the aspects related to the environment or the social conditions of the producers) or the origin of the product, so that purchasing decisions are mainly determined by price. Health security is the only condition required for food consumption. There is a change in the pattern of food consumption that is reflected by increasing sales of prepared and fast food, to the detriment of traditional homemade food. Thus, both secondary industrialization companies (processed foods) and the distribution sector grow in importance, significantly increasing their participation in the food supply market.

In 2020, such new trends in production and consumption are being developed within the EU's institutional framework. However, the EU still does not reach a consensus regarding its political unity. The Union is economically stronger, but does not make further progress in the social and political fields, thus perpetuating the differences among member states. This heterogeneity is even greater after the annexation of the Balkan countries and Turkey. In this context, the operability of the Union is disturbed by the diversity of interests within its institutions.

The changes in the Common Agricultural Policy (CAP) proceed slowly, given the difficulty of obtaining approval of the Commission's initiatives by the Council of Ministers. Such a situation of relative immobility is facilitated by the absence of external pressures in favour of its reformulation, since there is no international trade liberalization agreement within the World Trade Organization (WTO). The changes that have recently taken place in the CAP tend gradually towards: a) a reduction of its budget b) growing environmental awareness of its instruments (cross-compliance is extremely demanding) c) a transfer of funds from the first pillar (market policy and farm income support) to the second pillar (rural development policy).

In terms of markets, the EU agrees the implementation of completely decoupled payments from production and the strict application of modulation modulation to enable reductions in its budget. With regard to rural development policy, the budget rises, due to a greater co-financiering from the member states, enabling alternative economic activities for agriculture to be encouraged in the areas most affected by abandonment.

2. "Triumph of the market" scenario

This scenario is the result of a mercantilist vision of economy and society. It is based on a broad agreement at international level, within the WTO framework, that aims to liberalize the world trade in agricultural products. In Europe, this liberal policy justifies further enlargements of the EU (Balkan countries, Turkey, etc.) in order to expand the common market. However, since this amplification is performed without an institutional restructuring of the Union, it tends to slow down integration at socio-political level.

In this context, protectionist policies such as the CAP remain at a secondary level. In 2020, the CAP budget is minimized. The protectionist policy has been progressively dismantled until subsidies to the agricultural sector and tariff barriers have been completely eliminated. The world market determines what food is produced and how, and how to pay farmers and ranchers for their produce. The role of the CAP is limited to the provision of minimum standards for the implementation of rural development policies in the member states, without the imposition of restrictions on crop or animal production.

At this new stage of globalization of the markets, agricultural production is passing through a process characterized by the concentration of activity in large farms that are capable of guaranteeing economies of scale necessary to compete at international level. Small or medium-sized family farms are replaced by large agricultural companies on an individual or cooperative basis, as in other economic sectors. The new production model is characterized by the rapid introduction of new cost- and labour-saving technologies (like conservative and precision agriculture, GMOs, etc.) and by its ability to increase the added value of products through industrial transformation and direct sales. This model is favoured by the relaxation of environmental and social barriers, in order not to hamper the competitiveness of local products.

In this dynamic, regional agricultural production increases (crops and intensive cattle farming), although the macroeconomic importance of agriculture remains limited. In 2020, the large-scale production concentrated in few companies excludes the majority of small and medium producers from the production process. Due to losses of rural population and the abandonment of farms, agriculture occupies less than 2% of the regional workforce. On the other hand, although overall employment is reduced, this situation creates new job opportunities for technically qualified specialists.

This mercantilist future also affects the demand side. Given the new demands of life in big cities, most consumers prefer processed foods at low prices. In this model of consumption, supermarkets and fast-food restaurants are the major players in the agro-food value chain. They can influence both the demand and the supply side on the basis of their own interests. Product quality is associated with brand, regardless of their mode of production or their ingredients. Environmental and social choice criteria scarcely influence consumers' purchasing decisions. The international protocols regarding food quality and traceability guarantee product safety.

3. "Regional sustainability" scenario

In contrast to the previous scenario, this third global scenario represents a future in which the environmental and social aspects of agriculture are particularly prized, according to the priorities set out by regional society. Within this scenario, the changes produced in the agricultural sector are guided by the concept of "sustainability". Besides the purely economic aspects, environmental and social factors are also taken into account in guiding agricultural production. It is assumed that by 2020, agriculture will be a plentiful multifunctional activity that contributes to social welfare through the provision of products with quality, and non-tradeable environmental and social goods and services. Food production is paid for directly via the market. The provision of environmental and social goods and services is

compensated for via public subsidies specially designed for this purpose.

The new interpretation of the agricultural process sustains farm profitability and favours the continuity of the small and medium-sized family farm model. Agricultural production adopts new "clean" technologies, which attempt to integrate farms into their local ecosystems. The authorities encourage the adoption of the new technologies via a range of economic instruments (agro-environmental subsidies, green taxes, quantitative restrictions on the use of inputs, etc.), thus promoting a moderate extensification of production. The use of GM crops is also very limited. Ecological agriculture and cattle farming rapidly expand. Other farms adopt the concepts of conservation and/or integrated agriculture (minimum tillage or direct sow).

Under this new productive approach, the regional agricultural production is reduced in physical terms, but it produces greater added value, thus enhancing the contribution of agriculture to rural development. In this scenario, agricultural activity not only helps to maintain rural demography but also plays a vital role in the maintenance of the environment: traditional agricultural landscapes, support for rural tourism activities, ensuring water quality, and so on.

The development of this "new" multifunctional agriculture should be understood as a result of the social demand for quality agricultural products (considered to be the combination of food safety, environmental standards and social attributes). For 2020, this scenario assumes that food is seen as a cultural value of the utmost importance. Concerns regarding food safety increase. Consumption decisions are driven by production methods and indications of quality (especially those related to the origin: protected origin denomination - POD, protected geographical indication - PGI, etc.) rather than purely by prices. Products that certify compliance with strict environmental and social parameters are the largest outlet. Furthermore, this pattern of consumption is determined by the application of climate change regulations and control taxes. These last lead to increases in the transportation and food conservation costs (cold chain), which minimize imported products competitively in favour of local products.

At the institutional level, this scenario assumes a failure of the WTO negotiating rounds, which leads to an unregulated international trade. It also assumes that the EU suffers from an institutional paralysis caused by the lack of internal agreement about the process of political and social integration (no approval of new treaties in the EU). The absence of international agreements that consider non-trade concerns related to agriculture forces the EU to readopt a protectionist position, increasing tariffs barriers and technical restrictions (quality requirements) on imports of agricultural products. However, the political paralysis of the Union prevents other measures in common agricultural policy issues to be agreed. For this reason, the principle of agricultural financial assistance is widely applied to issues related to the CAP. Each society (nation or region) will be responsible for determining the form of "governance" of its agriculture, designing and funding its own agricultural policies. As a result, the CAP budget drops, and member states must compensate for this by self-financing their own agricultural policies.

In general, the first pillar is maintained through partially decoupled payments (which are up to each country and sector) and the principles of cross-compliance and modulation modulation are strictly applied. Some voluntary territorial contracts are developed at regional level for those farms that adopt greater environmental and social responsibilities. Subsidies are primarily aimed at those that produce more non-commercial services and goods. The second pillar is also strengthened through the maintenance of the European Agricultural Fund for Development (EADF) budget and additional national/regional financing.

4. "European sustainability" scenario

The final scenario is a variant of the previous one. It characterizes a future in which the environmental and social issues related to agriculture are also important, but from a common perspective for the whole EU. This scenario is thus similar to the third one in terms of the supply and demand agricultural model, as it relies on the same drivers, based on the concept of "sustainability". The characteristic that sets them apart is the different kind of institutional response they use to publicly manage the new multifunctional

agriculture. In this case, unlike the previous one, in a global environment also characterized by the lack of agreement at the WTO (international trade without rules), the European response involves strengthening the EU building process, in order to tackle common challenges with new criteria. Thus, in 2020, it is assumed that the EU has ratified and put into operation its constitutional treaty. In this way the Union is strengthened and made more cohesive in economic, social and political terms.

In this new reformed political context, the EU budget is strengthened, in particular in order to finance the new common agricultural and rural policies. In comparison with the classical agricultural policy, which was traditionally utilised to stabilize markets and maintain agricultural incomes (the first pillar), this new CAP prioritizes rural development (the second pillar).

With regard to the first pillar, there is a new simplified CAP, based on a single common market organization (CMO) with regionalized payments (all agricultural areas are subsidized to the same extent). These regionalized payments are subject to strict cross-compliance and modulation requirements, in order to ensure that environmental and social goals are met. As to the second pillar, the empowerment of the EADF allows rural development actions to be intensified. Rural areas are seen as pluriactive territories, where agricultural complementary activities are increasingly developed, in order to generate goods and services that improve the welfare of the entire population, both rural and urban (rural tourism, etc.).

C. Quantitative characterization of the global scenarios

As mentioned in Section 3, the final stage of the development of the scenarios was the quantification of the differences in the key variables that will condition the future of the agricultural sector in Castilla y León, in order to obtain the input variables that feed a mathematical simulation model capable of reproducing the changes undergone by each scenario, based on the values adopted by agricultural endogenous variables (crop area, production level, employment generation, existence of positive and negative externalities, etc.). The consensus values obtained through the implementation of the Delphi method are captured in Table 4.

Regarding specifically the quantitative characterization of the global scenarios, we must point out that our study was carried out at the end of 2007. At that time, it was becoming obvious that in 2006-2007, international prices of agricultural commodities and some agricultural inputs (mainly fertilizers and fuels) were suffering increases of a magnitude never previously forecast by any of the international institutions that produce reports of market prospects [34].

Faced with this unprecedented situation of uncertainty, the panel of experts consulted based its quantification of agricultural commodities and input prices departing from the present situation produced by the price level in 2007 and opted to interpret the economic conjuncture as a timely shock to the market. They were therefore asked to estimate this level of prices in the context of each global scenario considered.

Basing on this premise, experts consider that *"Baseline"* and *"Triumph of market"* scenarios assume that prices of the main commodities will never reach the record high price levels of the past year. Obviously, the *"Triumph of market"* scenario assumes major decreases of prices as a consequence of market liberalisation and improved farm competitiveness. The *"Regional sustainability"* scenario reflects an important increase in prices, while the last scenario, *"European sustainability"*, shows minor increases of prices, in as far as the PAC reforms carried out in this period would contribute to keep only the more competitive farms in business. Furthermore, it is worth highlighting that agricultural products like potatoes, alfalfa and legumes will fall in price in all the scenarios, due to a general fall in demand for these products. On the other hand, yields of agrarian crops improve in all scenarios, rising more in the *"Triumph of market*" and *"Baseline"* scenarios (15 and 8% respectively).

Table 4 Quantitative characterization of the global scenarios

	SCENARIOS				
	Present: Year 2007	***Baseline***	***Triumph of the market***	***Regional sustainability***	***European sustainability***
AGRICULTURAL PRICES					
Cereals	100	73	58	84	80
Sugar beet	100	90	72	104	99
Oil seeds	100	96	77	110	106
Legume	100	84	67	96	92
Alfalfa	100	84	67	96	92
Potato	100	90	72	104	99
Other vegetable	100	105	84	121	116
Milk	100	110	88	127	121
Cattle	100	80	64	92	88
Sheep	100	105	84	121	116
Pigs and poultry	100	105	84	121	116
YIELDS					
Crop yields	100	108	115	100	104
Livestock yields	100	110	118	103	105
INPUTS					
Seeds	100	103	100	100	100
Fertilizers	100	110	100	108	120
Pesticides	100	120	100	108	125
Animal feed	100	103	90	95	105
Zoo-sanitary products	100	115	104	102	120
Machinery	100	100	100	100	105
Energy	100	120	120	120	138
Labour	100	110	103	113	115
Hired services	100	105	103	100	115
Management costs	100	100	108	80	110
PUBLIC SUBSIDIES					
Crop-coupled payments	100	0	0	0	0
Sheep-coupled payments	100	50	0	50	50
Cattle-coupled payments	100	50	0	50	50
Farm Single Payment base	Individual	Individual	Individual	Regionalised	Regionalised
Farm Single Payment amount	100	83	50	90	100
Compulsory Environmental Set-aside	0%	0%	0%	3%	10%
Subsidies of agricultural insurance	100	100	50	100	100
“Capping” (maximum subsidies)	No	No	100 000 €	200 000 €	200 000 €
Subsidies decrease <50 000 €.	5%		0%	0%	0%
Subsidies decrease 50 000 – 100 000 €.	5%		50%	25%	25%
Subsidies decrease 100 000 – 200 000 €.	5%		100%	50%	50%
Subsidies decrease >200 000 €.	5%		100%	100%	100%
Environmental programme budget	100	110	100	125	150
CROSS-COMPLIANCE*					
Agrochemicals constraints	3,0	3,5	2,0	4,0	5,0
Rotation constraints	3,0	2,8	2,0	3,0	4,0
Tillage restrictions	3,0	3,0	3,0	3,8	4,0
Livestock density constraints	3,0	3,1	2,0	3,8	4,5
Animal welfare constraints	3,0	3,8	3,0	4,0	5,0

* Measured on a Likert scale (from 1 to 5), where "3"·means the current cross-compliance, "1" means a drastic reduction in cross-compliance requirements and "5" means a great increase in cross-compliance requirements.

Focusing on the cost of inputs in agriculture, it is important to point out that these will increase in all scenarios as a consequence of fuel prices rising. However the rises in inputs prices are less significant in the "*Triumph of market*" scenario, being even zero in the cases of seeds, fertilizers and animal feeds, as a result of the drop in prices of raw materials like cereals and oil seeds mentioned above. The "*Regional sustainability"* scenario shows a general increase in input costs (averaging 15%) but not greater than the "*Baseline*" and the "*European sustainability*" scenarios (averaging 20%).

Current CAP subsidy schemes assessed through the Delphi analysis include both coupled subsidies based on direct payment to farmers and decoupled subsidies under the single farm payment (SFP) scheme. Nowadays, coupled subsidies are larger for livestock because this is regarded as a vulnerable sector for social and environmental reasons. Developments in CAP subsidies put up with total decoupling in all scenarios and a decrease in the level of SFP; however, livestock premiums are maintained in the "*Baseline*", "*Regional sustainability"* and "*European sustainability"* scenarios. In the last two cases the SFP are assigned on the basis of the territorial base rather than the historical payments received by farmers – which is the system applied up until the present– and are reduced to only 10% in the "regional sustainability" scenario and maintained unchanged in "European sustainability". The priority for agri-enviromental aspects would be higher in both scenarios as well, so the funds obtained from capping of payments (an upper limit for the total amount of payments received) would be used to finance their budget, rising by 25 and 50% respectively.

In the "*Baseline"* scenario, SFP would fall by 13% and no capping of payments would be established. Furthermore, in this scenario the budget devoted to agri-enviromental programs would increase by 10%. The "*Triumph of market"* scenario is based on the total elimination of coupled payments including livestock premia, and a 50% reduction in decoupled subsidies. In this context, subsidy capping is introduced regressively, establishing an upper limit for subsidies of €100,000 per farmer. The budget devoted to agri-enviromental programmes would be similar to the current one, but reduced environmental concerns would imply the removal of the environmental set-aside requirement.

The final block of the questionnaire was devoted to assessing future trends in cross-compliance, that is, the more or less environmental requirements that farms would be forced to apply as a condition of receiving agricultural subsidies. All the scenarios assume an increase in environmental requirements, except for the "*triumph of market*" scenario. The "*European sustainability*" scenario is the most demanding in terms of environmental requirements, in order to achieve the goal of sustainable agriculture. Animal welfare and constraints on agrochemical use are particularly emphasised in all the scenarios.

Is it worth pointing out that this approach, which quantifies the main drivers in Castilla y León agriculture for each of the scenarios considered in this study, does not take into account the recent foresight studies developed by main international institutions involved in these issues [35,36], whose prognosis is that agricultural and inputs prices will remain high (20 to 50%) in the medium term (the next decade 2007-2017) because the elements that explain current price increases (structural factors related to the increase in demand for agricultural products in emergency economies, rising oil prices and the use of agricultural areas for crops suitable for biofuel production) will still be feasible in the future. This unexpected situation could be interpreted as a *turning point* or a new trend in the agricultural sector at global, national and regional levels, that could force us to reconsider the scenarios presented in this paper for Castilla y León in 2020, in the sense that agriculture in this region could be a profitable activity, particularly for large farms that are able to guarantee economies of scale, as their technological infrastructure will enable them to adapt to emerging global economic challenges.

V. CONCLUDING REMARKS

Scenario development lies at the heart of futures studies. As the above discussion makes clear, scenario techniques have a long history but their application to strategic planning in the agricultural context is a relatively new phenomenon. This fact, along with the observation that the growth in popularity of scenarios has happened for practical rather than theoretical

reasons, may explain the current confusion about what exactly scenario development is, and how futurists actually produce scenarios. The real significance of this study thus lies in its utilisation of the scenario-building technique known as Prospective Analysis to the agricultural sector on a regional scale. Although the Prospective school has been paid considerably less attention in the literature on scenario planning when compared to other techniques, our application of this methodology on such a small scale has generated four consistent global scenarios, which we consider to be the most likely evolutionary development of the future of the agriculture in the Autonomous Region of Castilla y León in Spain, with a view to improving the effectiveness of regional policy and strategic decision-making.

With regard to the global scenarios we have described, it should be pointed out in the first place that these are stereotyped images of the future of agriculture in Castilla y León. In this regard, it should be clear that although they constitute "extreme" global situations, they can also be regarded as truly possible future options. However, logically enough, any intermediate situation is equally possible. Everything will depend on the intensity of change produced by the drivers analysed, such as the current unexpected commotion in agricultural prices and petroleum-derived agricultural inputs. In any case, we believe that these scenarios are of a practical interest to the extent that they enable us to reflect in some depth on the design and implementation of policies that affect the agricultural sector.

It should be noted that from the scenario analysis presented here nothing can be concluded with respect to the probability of any given scenario. Indeed, the future represents a social construction under continuous development, and there is no way of establishing which of the infinite number of future situations is most likely to happen. The outcome will depend on the individual and collective decisions undertaken at present and in the near future. Futurists thus often remind us that the purpose of thinking about the future is not to predict what will happen but rather to consider alternatives.

A better understanding of what is likely to happen should enable us to make better decisions in the present and make judgments about the assumptions that underpin our near future. From a strictly technical point of view, however, no preferences can be established regarding the global scenarios we have analyzed. We believe that this type of comparative analysis from a policy perspective is the responsibility of those directly related to the agricultural sector, whether private (producers), public (regional authorities) or regional society. To this end, we hope that this study can make some contribution to the decision-making process, encouraging the development of strategic actions by the economic agents involved in the defence of their legitimate interests. We also hope that it may serve especially to establish political lines capable of channelling the agricultural sector into a desirable future.

Finally, we would like to emphasise that our study should be regarded as a starting point for further research. Indeed, the scenarios we have generated should be submitted to further analysis in order to quantify the changes that may be experienced in a range of key variables that can be regarded as endogenous to the sector (crop area, production level, employment generation, existence of positive and negative externalities, etc.), by means of mathematical modelling [37]. This new information will certainly provide a powerful framework for testing the credibility of potential futures. It will also make an additional contribution to the decision-making process, since it will facilitate our ability to judge the pros and cons of each of these scenarios in our near future.

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REFERENCES

1. Schoonenboom IJ (1995) Overview and state of the art of scenario studies for the rural environment, in J.F.T. Schoute, P.A. Finke, F.R. Veeneklaas, H.P. Wolfert, (Eds.) Scenario Studies for the Rural Environment. Kluwer Academic Publishers, Dordrecht, pp.15–24
2. Kallas Z, Gómez-Limón JA, Arriaza M (2007) Are citizens willing to pay for agricultural multi-functionality? Agricultural Economics 36:405–419

3. Gómez-Limón JA, Gómez-Ramos A (2007) Opinión pública sobre la multifuncionalidad del regadío: el caso de Castilla y León. Economía Agraria y Recursos Naturales 7:3-25
4. Godet M (1987) Scenarios and strategic management. Butterworth, London
5. Gavigan JP, Scapolo F, Keenan M et al. (2001) A Practical Guide to Regional Foresight. Institute for Prospective Technological Studies (ITPS)–European Commission, Seville
6. Godet M (1979) The Crisis in Forecasting and the Emergence of the Prospective Approach. Pergamon Press, Massachuset
7. Bradfield R, Wright G, Burt G et al. (2005) The origins and evolution of scenario techniques in long range business planning. Futures 37:795-812
8. Berger G (1964) Phénoménologie du temps et prospective. PUF, Paris
9. Berger G (1967) Etapes de la prospective. PUF, Paris
10. de Jouvenel B (1972) L' art de la conjeture. Sédeis, París
11. Godet M (1993) De l'anticipation à l'action. Manuel de prospective et de stratégie. Dunod, Paris
12. Godet M (2001) Creating Futures: Scenario Planning as Strategic Management Tool. Economica, London
13. Lesourne J, Sfoffaes C (1996) La prospective stratégique d'entreprise. Concepts et études de cas. Intereditions. Paris
14. Bishop P, Hines A, Collins T (2007) The current state of scenario development: an overview of techniques. Foresight 9:5-25
15. Börjeson L, Höjer M, Dreborg K et al. (2006) Scenario types and techniques: towards a user's guide. Futures 38:723-739
16. Kahn H, Wiener A (1967) The year 2000: A framework for speculation on the next thrity-three years. MacMillan, New York
17. Gordon TJ, Glenn JC (2003) Futures Research Methodology. Version 2.0. The United Nations University, New York
18. Greeuw SCH, van Asselt MBA, Grosskurth J et al. (2000) Cloudy crystal balls. An assessment of recent European and global scenario studies and models. European Environment Agency, Copenhagen
19. van Notten PWF, Rotmans J, van Asselt MBA et al. (2003) An update scenario typology. Futures 35:423-443
20. Gómez-Limón JA (2007) El futuro de la agricultura en Castilla y León. Itagra.ct–Caja España, Palencia
21. WRR, Netherlands Scientific Council for Government Policy (1992) Ground for choices: four perspectives for rural areas in the European Community. Sdu uitgeverij, The Hague
22. Morris J, Audsley E, Wright IA et al. (2005) Agricultural Futures and Implications for the Environment. Cranfield University, Bedford
23. OST, Office for Science and Technology (1998) Environmental Futures. DTI, London
24. DTI, UK Department of Trade and Industry (2002) Foresight Futures 2020. Revised scenarios and guidance. DTI, London
25. Klijn JA, Vullings LAE, van den Berg M et al. (2005) The EURURALIS study: Technical document. Alterra, Wageningen
26. SCAR, Standing Committee on Agricultural Research (2007), FFRAF report: foresighting food, rural and agri-futures. SCAR, Brussels
27. EC, European Commission (2007) Scenar 2020–Scenario study on agriculture and the rural world. European Commission, Brussels
28. MAPA, Ministère de l'Agriculture, de la Pêche et de l'Alimentation (2007) Perspectives pour l´agriculture française et la PAC. MAPA,Paris
29. Junta de Castilla y León (2007) Anuario estadístico de Castilla y León 2007. Junta de Castilla y León, Valladolid
30. EC, European Commission (2007) The agricultural situation in the European Union. 2005 Report. Office for Official Publications of the European Communities, Luxembourg
31. MAPA, Ministerio de Agricultura, Pesca y Alimentación (2004) Libro Blanco de la Agricultura y el Desarrollo Rural. MAPA, Madrid
32. Linstone A, Turoff M (1975) The Delphi Method: Techniques and Applications. Addison-Wesley, Reading
33. Adler M, Ziglio E (1996) Gazing into the oracle: The Delphi method and its application to social policy and public health. Jessica Kingsley Publishers, London
34. Atance I, García Álvarez-Coque JM (2008) La evolución de los mercados agrícolas internacionales y su influencia en los precios de los alimentos. Boletín Económico del ICE 2935:1-15
35. FAPRI, Food and Agriculture Policy Research Institute (2008) U.S. and World agriculture outlook. FAPRI, Iowa USA
36. OECD-FAO, Organisation for Economic Co-operation and Development and the Food and Agriculture Organisation of the United Nations (2008) Agricultural Outlook 2008-2017. OECD and FAO, Paris

37. Fontela EG (2000) Bridging the gap between scenarios and models. Foresight 2:10-14

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