Involving stakeholders in the exploration of sustainability perspectives and farming system innovations: A case study from Latin America

Caterina Contini[a], Manuela Gabbai[a], Luigi Omodei Zorini[a], Belén Pugh[b]

[a]*University of Florence, Italy; caterina.contini@unifi.it, manuela.gabbai@tin.it, luigi.omodeizorini@unifi.it*
[b]*INTA, Chubut Experimental Station, Argentina, bpugh@chubut.inta.gov.ar*

Abstract: *This paper describes a study aimed at constructing scenarios based on narrative to complement models in the exploration of the long-term future of cherry production in South Patagonia. The study is part of the European EULACIAS project on Co-innovation of farming systems in Latin America. Our approach involves stakeholders in the analysis of present states and the identification of driving forces; finally, the impact of drivers on the farming sector is projected through the Delphi technique which enables the structured elicitation of experts' judgement. The results describe three possible scenarios for the next 10 years: "Opening to new markets", "Quality" and "Regional market".*

Keywords: *sustainability, scenario analysis, Delphi method, cherry production, South Patagonia, Argentina*

Introduction

Farming system sustainability is the result of a complex interaction between environmental, economic, social and technological dimensions which has to be evaluated in relation to the present and future needs of society. In this context, promoting sustainability has two main requirements: on the one hand it implies including economic and social issues, besides ecological assessments; on the other hand it necessitates the adoption of a long-term perspective.

From a procedural point of view, tackling complexity calls for the crossing of certain boundaries separating academic disciplines (Hirsch Hadorn et al., 2006); it also needs measures providing the right conditions to promote the communication of different perceptions and knowledge on the part of local stakeholders. Thus, participation becomes a key element, not only because it involves context specific bodies of understanding and enables the identification of present and future needs, but, mainly, because it provides more effective implementation of decision making by the interactive engagement of local actors (Patel et al., 2007; Walz et al., 2007).

This paper describes a study carried out within the European EULACIAS[1] project on Co-innovation of farming systems in Latin America. EULACIAS aims to identify sustainable development tracks by implementing co-innovation by researchers, farmers, extensionists and local policy makers. The process combines qualitative analysis with quantitative system models in order to assess the consequences of changes in system management in terms of income and resource use. These assessments are used as the "bright idea" marking the beginning of the innovation process. Subsequently, participatory activities allow local stakeholders to co-develop the innovation, interacting with researchers in structuring, testing and improving the suitability of alternative options with regard to farmers' objectives.

Models can help decision-making when the dynamics within the system are well understood and accurate data are available. This is more feasible in the short term; however, when the time horizon is extended, the relationships between human and environmental features can change and systems can trace various pathways. In this context, uncertainty becomes a key point and effective tools which include this feature in system analysis have to be implemented (Swart et al., 2004).

[1] EU FP6-2004-INCO-dev-3; contract nr 032387 ; http://www.eulacias.org/

In this paper we illustrate scenario analysis as a tool in helping to manage inherent uncertainties in the decision-making process and discuss this aspect using as an example the cherry farming system in the provinces of Santa Cruz and Chubut in South Patagonia.

Scenarios are based on the assumption that the future is unlike the past and cannot be forecasted. Consequently, scenarios are not predictions, but tools with which to reflect upon possible future developments; they identify different images of the future and examine possible strategies (see Postma et al., 2005). In other words, as Rotmans et al (2000) claim, "*the only relevant question that scenarios can address is not whether an event will happen but what we could do if it did happen*". Godet and Roubelat (1996) define scenarios as the "*description of future situations and of the course of events which allows one to move forward from the original situation to the future situation"*. This definition contains an implicit assumption that scenarios are not static images of the future but describe a dynamic course of events and actions. In those terms, scenarios consist of driving forces, events, consequences and strategies that are related. Rotmans et al (2000) present an operational classification that identifies different kinds of scenario:

- *exploratory* and *backcasting* scenarios, according to the temporal dimension of the starting assumptions and the direction of the sequence of events following the initial statements. Thus, exploratory scenarios start from present assumptions and examine their future consequences, while backcasting scenarios identify a future state and analyse the course of events that lead to this situation.
- *descriptive* and *normative scenarios*, according to the presence of objectives, linked to specific values. Normative scenarios are constructed to reach precise goals, while descriptive scenarios are constructed regardless of preferences.
- *quantitative* and *qualitative scenarios*, according to the type of information included in the scenarios. Quantitative scenarios often result from modelling and refer to well known systems. They offer structure, discipline and rigour but can fail in capturing the complexity of the system when state descriptions are uncertain, causal interactions are not well understood and non–quantifiable issues are significant (Swart et al. 2004). On the other hand, qualitative scenarios can provide a better understanding of values, behaviour and institutions.

The scenarios presented in this paper aim at analysing future opportunities and threats for the selected farming systems, in order to complement models in the exploration of the long-range future of socio-ecological systems and identify recommendations on farm resource allocation. In other words, our scenarios represent alternative conditions in which different system management should be assessed by means of models: the better the decision does across the set of scenarios, the more robust the option is to future uncertainties.

According to the above classification, our scenarios are exploratory, descriptive and qualitative; they start from the analysis of present states, identify driving forces and explore future consequences on sustainability conditions with no regard for preference.

Methods

The first part of the research consists in the analysis of present state and the identification of drivers of change which are defined as external forces, not directly controlled by local stakeholders. In this phase, the researchers' perspective was integrated with the local stakeholders' point of view. On the one side, the review of the literature made it possible for the research team to gain a general understanding of key elements and trends within the context as well as of the institutional, social and economic factors which may influence farming systems. On the other side, participatory workshops, organized by the "co-innovation research group" of the EULACIAS project with the aim of involving local stakeholders in the definition of problem trees, provided insights on those issues which impact on sustainability in the selected region. The approach used for developing the problem tree was based on work by Renger and Titcomb (2002), the drawing of the problem tree was carried out by various stakeholders representing producers, policy makers, researchers and technical advisors. These activities took place between March and August 2007.

The review of the literature and the problem tree led to the identification of a first list of drivers. Key elements were then selected from this list during a participatory workshop carried out in February 2008. Participants included the researchers and technicians of the INTA (Istituto Nacional de Tecnologia Agropecuaria), private technical advisors and producers.

After a brief presentation of our objectives, key concepts (i.e. scenarios and drivers) were defined and drivers identified during the previous phases were illustrated. Then, participants were divided into groups: one group of farmers and the other of researchers, technicians and private advisors. Priorisation was carried out using a double entry matrix, participants were requested to compare the drivers two by two, selecting the one most relevant for the future of the cherry farming system. At the end of the activity the final score was calculated, counting the number of times that each driver was selected. Finally, participants were asked to explain their rationale in the evaluation process.

The second part of the research consists of the projection of the possible evolution of key drivers on the sustainability of the cherry farming system. This phase was carried out using the Delphi technique, which is based on experts' knowledge and is considered particularly useful when accurate information is not obtainable for all the factors that influence a multifaceted phenomenon (Rikkonen et al. 2006; Garrod et al., 2005; Dinar et al., 2004; Ilbery et al., 2004; Padel et al., 2004). Delphi is defined as "*a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem*" (Turoff et al., 2002). It consists of anonymous judgements made in two or more rounds by a group of heterogeneous experts who receive feedback between rounds (Adler et al., 1996). Each participant receives equal input and speculates individually; the researcher controls the interactions among the participants by processing the information. At every round, the respondents are allowed to revise their initial position, should they wish to do so.

Feedback and anonymity are considered to be key features of Delphi; the former serves to highlight new ideas within the panel; the latter helps to prevent bias caused by position, status or dominant personalities, while enabling the maintenance of participant heterogeneity within the panel which confers validity to the results (Veen-Croot et al., 2000).

The main steps involved in designing a Delphi survey are (Shon and Swatman, 1998):
1. identifying, contacting and recruiting participants;
2. designing and circulating the first-round questionnaire;
3. analysing the results of the first round and producing feedback;
4. designing and circulating the second-round questionnaire;
5. analysing the results;
6. presentation of the results to the participants.

In our case study, the Delphi was conducted in two rounds by electronic means which facilitated the involvement of participants from disparate geographical areas. The first round explored different groups of opinions; while the second round was aimed at producing meaningfully cohesive alternative futures with regard to major factors affecting the cherry farming system to be used as input for EULACIAS models.

Below is a description of how the Delphi was carried out in the study case according to the steps listed above.

Identifying, contacting and recruiting participants
The panel was composed of stakeholders coming from different backgrounds. They were chosen on the basis of their knowledge of the farming system, the supply chain, the key drivers and rural context in the study cases. The selection of the participants was based on the need to diversify the expertise, thus allowing the panel of respondents to contribute to the scenario construction from various points of view. The panel consisted of 26 experts, including the following categories that were equally represented: 1) representatives of public institutions 2) representatives of farmers 3) consultants and researchers 4) entrepreneurs involved in the supply chain. Participants were divided into 2 groups from the very beginning. One group was asked to answer the questions from an

optimistic standpoint for the cherry sector; the other group was asked to adopt a pessimistic approach. This is because asking the panel to describe the future from different perspectives ought to help the experts spread their mental model out of conventional thinking. The recruitment of the panel was made in person or by telephone, explaining the objectives of the project and inviting the experts to collaborate with the research. Once the experts had accepted the invitation to participate, the questionnaire was sent by electronic mail.

Designing and circulating the first-round questionnaires
The first-round questionnaire had an open-ended structure, designed on the basis of the drivers identified during previous phases of the research. In the questionnaire we asked our experts to imagine how they thought that each driving force could evolve in the next 10 years. The questions were introduced by brief presentations providing relevant information on the drivers. Inputs from the previous phases allowed us to formulate hypotheses which are the keys to the future. Indeed, a clear formulation of the hypotheses proves to be fundamental when building scenarios which include all relevant dimensions and in which all relevant interconnections between the various processes are considered. The questionnaire was sent by e-mail, together with a letter containing a presentation of the questionnaire and some instructions on how to fill it in.

Analysing the results of the first round and producing feedback
From the 26 experts recruited, 22 questionnaires were completely filled in by 8 producers, traders and packing house owners, 7 policy makers at a regional and local level, 4 researchers and 3 private advisors. Analysis of the first-round data was finalised to compare opinions and find points of agreement and disagreement. This part of the analysis represents a key aspect of the research because in this phase the experts' knowledge and perception should emerge. We proceeded to analyse the questionnaires with Nvivo (Sage Publications), a software for qualitative research that enables the coding of the text. Coding is a process for both categorising qualitative data and describing the implications and details of these categories. The use of the software made it possible to store ideas and categories, creating references from the questionnaires to nodes. Then, the software allowed us to establish each nodes' degree of relevance based on recurrence in the text. It also made it possible to highlight connections between nodes so as to explore the relationships between the nodes.

The analysis highlighted 7 key themes: labour, the price of cherries, agrochemicals, cherry supply, cherry demand, quality, fiscal regime.

Two different feedbacks (one for the optimistic group and another for the pessimistic group) were written on the basis of the results of the analysis of the first-round questionnaires. The feedbacks were delivered together with the second-round questionnaires. In this way, the context in relation to which experts had to express their judgements was made clear.

Designing and circulating the second-round questionnaire
The second-round questionnaire had the aim of quantifying the main factors affecting the cherry farming system (i.e. cost of labour, price of agrochemicals, price of cherries) in the various scenarios, to be used as inputs for EULACIAS' models.

Analysing the results of the second round
19 questionnaires returned to us completely filled in; 11 of them were written from an optimistic point of view, while 8 were written from a pessimistic angle.

The Delphi ended with the *presentation of the results* to the participants.

Results

Literature review showed that a major characteristic of the study area is a very low population density, with values ranging from 9.2 inhabitants/km² (in the towns) to 1.6 inhabitants/km² (in the countryside). Main factors of change for the future of the cherry sector were related to the demand side. In this regard, statistical data point out that at present, 45% of the production is sold abroad,

primarily in Europe as fresh fruit; another 45% is allocated on the home market, again as fresh fruit; the rest (10% of the total production) is processed by the agro-industry. On the other hand, local stakeholders paid great attention to input provision.

During the participatory workshop, researchers and extensionists emphasised the role of international demand and linked the competitiveness of the sector to fiscal regime and quality standard requirements. On the farmers' front, attention was drawn to the shortage of labour which was related to low population density, unfavourable labour market policies and competition with other sectors. Farmers also stressed the importance of the cost of pesticides and fertilizers. At the end of the workshop the participants agreed on the most relevant drivers for the future of the cherry farming system. Following, we report the key drivers and the rationale that brought to their selection:

Global demand for cherries: Main opportunities for the future development of the cherry farming system are identified as exportation to the Northern Hemisphere, where cherries are sold as fruit out of season. This condition allows Patagonian cherries to fetch higher prices than on the home market. In addition to the traditional European market, there are other emerging markets, such as Russia and Asia. Both traditional and emerging markets could play a crucial role in the development of the sector.

Fiscal regime: In the Southern Hemisphere the countries competing with Argentina are Australia, New Zealand, South Africa and Chile (the most important). Currently there is a duty of 10% on export prices that limits the competitiveness of Argentinean cherries compared to the other countries, especially Chile. The reduction or removal of the duty could have an impact on exports and, consequently, on the final demand for cherries.

Competition with other sectors for labour: Because of the low population density, there is a low availability of labour in the study areas, which is responsible also for the high cost of labour. Moreover, the development of the oil sector, with higher labour productivity, has determined a significant rise in wages in the Chubut province. In Santa Cruz high wages are linked to the growth of other sectors competing with agriculture for labour, such as government social assistance or the building industry.

Price of energy and petrol: The price of energy and petrol affects the development of the oil sector in the Chubut province that competes with agriculture for labour. This factor also affects the price of fertilizers and pesticides used as inputs for cherry production which currently accounts for 25% of production costs.

The Delphi results confirm that labour is a major concern; experts agree that the availability of labour for the farming sector will increasingly diminish due to the presence of other sectors with higher labour productivity that can offer higher wages than agriculture. Consequently, the level of agricultural salaries will increase, even though it will remain lower than in the competing sectors. "*The productivity of the petrol sector cannot be compared with that of the cherry sector, for this reason it is impossible for us to compete for labour with the petrol sector [...] I think that cherry sector will suffer the shortage of labour which will heavily affect also the production costs."* Some experts have identified two opportunities that could improve labour availability in the area. The first consists of recruiting seasonal labour from other regions, while the second opportunity is represented by broadening the scope of female labour, such that women could be involved not only in packaging but also in harvesting and in other field areas.

The second issue affecting the cherry farming sector is represented by agrochemicals. Experts agree that agrochemical costs will increase, following the rising trend of energy and oil. Additionally, many experts recognize that the diversification of production in terms of the ripening season will represent a real opportunity for producers; this factor, together with an improvement in methods of preservation, may contribute to extending the harvesting and selling season.

With regard to market outlets for cherries, experts have identified various possible evolutions:

- *Emerging market*: Asia (mainly driven by China and India) and Russia. The demand for cherries in these areas will be growing strongly, following the general increase of food demand. Competition is very high in this market; the major competitor will be Chile, which has relevant advantages due to the lower tariff regime on exports. However, with regard to Asia, also Australia, New Zeeland and South Africa could represent a real threat, because of their proximity to the area. Quality requirements will be linked to mainly organoleptic characteristics (i.e. taste, appearance, consistency).
- *Traditional market*: Europe and USA. In these areas the demand for cherries will remain stable. The main competitor will be Chile which has a lower tariff regime. However, it is possible to envisage in this market an interesting niche characterised by a demand for high quality products. Here quality is associated not only with organoleptic aspects but also with the productive process (i.e. environmental friendly practices or food safety) and with the product's origin. In this niche those producers who are able to offer high quality products will be favoured.
- *MERCOSUR market* (mainly driven by Brazil): The demand of this market is rising. The trade agreement within MERCOSUR, which promotes the fluid movement of goods, places Argentina and Chile on the same competitive level. Quality is mainly based on organoleptic characteristics.

The uncertainty shown by our experts with regard to market outlets brought to the construction of three scenarios with a 10 year time horizon. Each scenario is characterized by different opportunities and threats for the cherry sector as follows:

"Opening to new markets" scenario: Regional policies supporting farm exports through tax concessions and regional public aid for commercialisation will increase the competitiveness of the sector in the emerging market, thus opening an important outlet for cherries. "*I believe that special attention should be paid to markets with high purchasing power, such as China, where cherries are a luxury good, mainly because they are sold out of season*" In the next ten years this market will become the main market for Patagonian cherries. Competition will be based mainly on prices.

"Quality" scenario: The main opportunity for producers will be represented by a niche market where competitiveness is based on quality. "*If we produce high quality cherries and have good market strategy we can sell our products to market niches with higher prices*". In this scenario the creation of a Patagonian label of origin will fetch higher prices insofar as the image of the territory will be linked to process (i.e. ecolabel) or product characteristics (i.e. local varieties with a particular taste, flavour or colour). In this scenario no policy that supports the cherry sector will be put into place. *" ...we should focus on quality, promote the "Patagonia" label and obtain the product certification which is required by the market"*.

"Regional market" scenario: The tariff regime on exports and the difficulties in making a product with a higher quality value will limit the competitiveness of Patagonian cherries within the international market. "*Our competitors are working seriously, they are increasing their market share within the international market. Their products have more competitive prises as a result of more favourable tariff regime on export*." Thus, the main outlet market for cherries is represented by MERCOSUR, characterised by a rising demand for cherries "*It would be worthwhile exploring the possibility to sell our product in the MERCOSUR market, considering Brazil's growing importance as cherry consumer".*

Finally, future prices trends of the major factors affecting the cherry farming system in South Patagonia are identified as follows:

Price of agrochemicals

Experts expect a considerable increase in the price of agrochemicals. Indeed, over half the panel anticipates a rise of over 60%. Notwithstanding a certain dispersion of the answers, the respondents show two main visions; the first (representing 26% of the panel) is centred on an increase in agrochemical prices between 20% and 40% of the current price, while the second (representing 37% of the panel) is centred on an increase between 60% and 100% (figure 1).

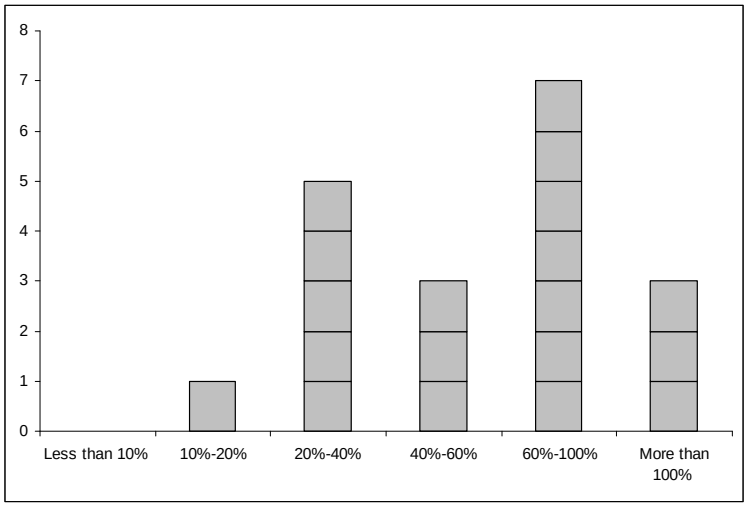

Figure 1. Distribution of the answers given by the panel with regard to the increase in agrochemical prices over the next ten years, compared to current prices.

Cost of labour

Almost 60% of the respondents thinks that there will be an increase in the cost of labour, around 40%. No one has considered the possibility of an increase lower than 10% and an increase of less than 20% seems improbable (figure 2).

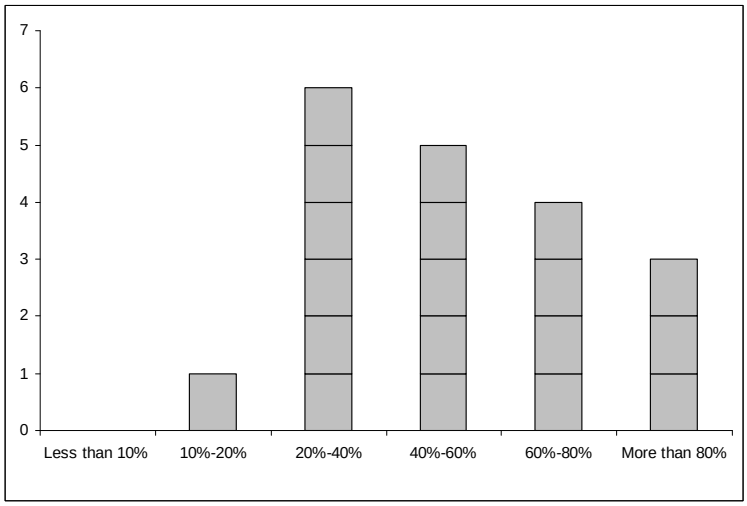

Figure 2. Distribution of the answers given by the panel with regard to the increase in labour costs over the next ten years, compared to current costs.

Price of cherries

With regard to cherries sold in *emerging markets*, the answers of the experts (45% of the total number) are clearly oriented to considering an increase in prices between 20% and 40% (figure 3).

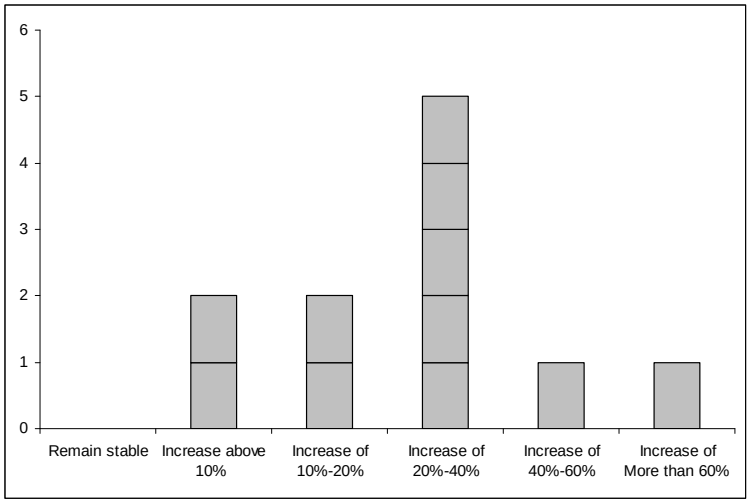

Figure 3. Distribution of the answers given by the panel with regard to the increase in the prices of cherries sold in emerging markets over the next ten years, compared to current prices.

73% of our experts think that over the next ten years, the prices of *high-quality cherries* sold in so-called traditional markets will increase between 10% and 40% of the current price (figure 4).

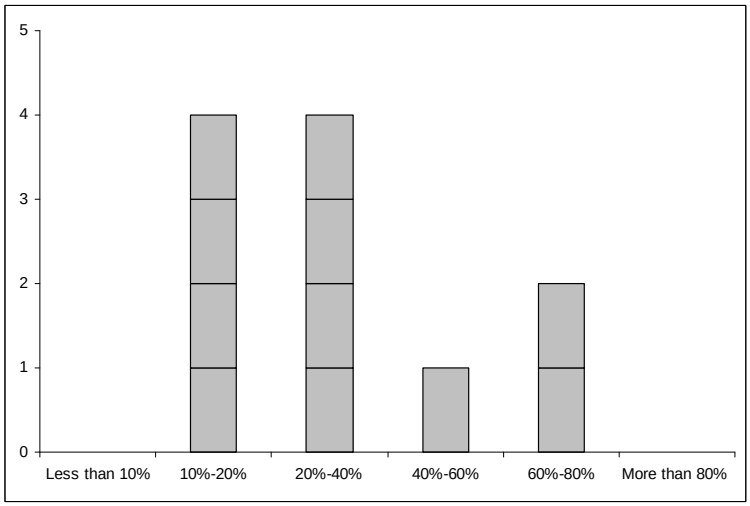

Figure 4. Distribution of the answers given by the panel with regard to the increase in the prices of high-quality cherries sold in traditional markets over the next ten years, compared to current prices.

With regard to the prices of cherries sold in the *regional market*, the answers of the experts take a bi-modal distribution; a group of more pessimistic respondents (33% of the total number) thinks that cherry prices will decrease above 10%, while a more optimistic group (representing 33% of the total number) thinks that the price will increase under 10%. No one has considered the possibility of a decrease over 10% or of an increase over 20% (figure 5).

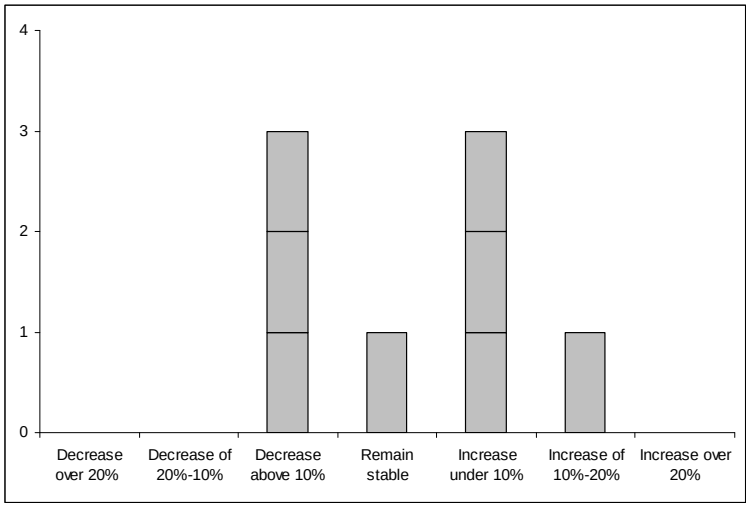

Figure 5. Distribution of the answers given by the panel with regard to the increase in prices of cherries sold in the regional market over the next ten years, compared to current prices.

Discussion

The present work illustrates an instrument for the creation of a process aimed at enabling innovation in the cherry farming system of South Patagonia, adopting a long-range perspective. In particular, our instrument aims to manage future uncertainty through the construction of scenarios used to assess the consequences of changes in system management through a process of co-innovation.

This methodology allows us to identify the drivers of change, starting with an analysis of the present state and of past trends. This phase takes place by integrating the results of a bibliographical research conducted by researchers with the context specific bodies of knowledge, the result of participatory activities like the creation of the problem tree and the ranking of the main drivers by local stakeholders. The participation of local stakeholders was useful in enriching knowledge about the system under study, through the exchange of ideas and discussion. This initial phase represents a point of fundamental importance for the construction of scenarios which are effectively relevant for the decional process inasmuch as they allow the identification of issues which are the key for the future, on the basis of which to articulate the questions for the development of the next phase.

The application of the Delphi method has led to the construction of three possible scenarios that take into consideration a wide range of interconnecting factors, like international markets, policies and the labour market. These scenarios were constructed thanks to the evaluations made by experts during an exercise that was organized in two rounds and that was carried out using questionnaires distributed electronically. The Delphi made it possible, moreover, to identify the future trends of various key elements of the cherry farming system (price of labour, price of agro-chemicals and price of cherries) to be used for the evaluation of innovative practices made through the use of models and of joint learning by scientists, farmers and other relevant stakeholders. During this phase the involvement of local actors made it possible to include in the results the knowledge of the people involved, this being particularly useful in grasping socio-economic, political and cultural dynamics. The participation also allowed the introduction into the scenarios of considerations relating to the interests at stake. However, the main advantage of this participation can be seen in the involvement of local stakeholders in the decisional process, a fundamental element in achieving capacity building which in turn is at the basis of development sustainability. In this sense, the instrument presented by us is merely the beginning of a path which, through continual interaction between researchers of various disciplines and local actors, leads to the development of sustainable development tracks.

References

Adler, M. and E. Ziglio (1996) *Gazing into the Oracle: the Delphi Method and its Application to Social Policy and Public Health*. Kingsley Publishers, London.

Dinar A., Balakrishnan T.K. and J. Wambia (2004) Politics of institutional reforms in the water and drainage sector of Pakistan, *Environment and Development Economics* 9(3): 409-445

Garrod B. and A. Fyall (2005) Revisiting Delphi: the Delphi technique in tourism research", in Ritchie B.W., Burns P., Palmer C. (eds), *Tourism research methods: integrating theory with practice, Wallingford*, UK: CABI Publishing: 85-98.

Godet M. and F. Roubelat (1996) Creating the future: the use and misuse of scenarios. *Long Range Planning* 29(2): 164-171.

Hirsch Hadorn G., Bradley D., Pohl C. and D. Rist (2006) Implications of transdisciplinarity for sustainability research. *Ecological Economics*, 60:119-128.

Ilbery B., Maye D., Kneafsey M., Jenkins T. and C. Walkley (2004) Forecasting food supply chain developments in lagging rural regions: evidence from the UK, *Journal of Rural Studies* 20: 331–344.

Padel S., Foster C. and P. Midmore (2004) Expert perspectives on the future of the organic food market: results of a pan-European Delphy study, in Hopkins A. (ed), *Organic farming: science and practice for profitable livestock and cropping,* Proceedings of the BGS/AAB/COR Conference, Newport (UK). Reading, UK: British Grassland Society: 39-42.

Patel M., Kok K. and D.S. Rothman (2007) Participatory scenario construction in land use analysis: An insight into the experiences created by stakeholder involvement in the Northern Mediterranean. *Land Use Policy* 24: 546–561.

Postma T. J. B. M. and F. Liebl (2005) How to improve scenario analysis as a strategic management tool? *Technological Forecasting and Social Change* 72(2): 161-173.

Renger R. and A. Titcomb (2002) A Three-Step Approach to Teaching Logic Models. *American Journal of Evaluation* 23 (4): 493–503.

Rikkonen P., Kaivo-oja J. and J. Aakkula (2006) Delphi expert panels in the scenario-based strategic planning of agriculture. *Foresight*, 8 (1): 66-81.

Rotmans J., van Asselt M, Anastasi C., Greeuw S., Mellors J., Peters S., Rothman D. and N. Rijkens (2000) Visions for a sustainable Europe. *Futures* 32: 809-931.

Shon T.-H. and P.M.C. Swatman (1998) Identifying effectiveness criteria for Internet payment systems. *Internet Research: Electronic Networking Applications and Policy* 8 (3): 202–218

Swart R.J., Raskin P. and J. Robinson (2004) The problem of the future: sustainability science and scenario analysis. *Global Environmental Change* 14:137–146.

Turoff, M. and H.A. Linstone (2002) *The Delphi method: techniques and applications*. New Jersey's Science and Technology University. <http://is.njit.edu/pubs/delphibook/>

Veen-Croot van D.B. and Nijkamp P., Bergh van den J. C.J.M. (2000) *A scenario study for investigating the implications of globalisation on international transport and the global environment*, Research Memorandum 2000-3, Amsterdam: Wjje Universiteit.

Walz A., Lardelli C., Behrendt H., Grêt-Regamey A., Lundström C., Kytzia S. and P. Bebi (2007) Participatory scenario analysis for integrated regional modelling. *Landscape and Urban Planning* 81: 114–131.