Participatory scenarios for exploring the future: insights from cherry farming in South Patagonia

Caterina Contini, Manuela Gabbai, Luigi Omodei Zorini and Belén Pugh

Abstract: *This paper describes a study to construct narrative-based scenarios to complement models for exploring the sustainability of cherry production in South Patagonia. The study is part of a European-funded project (EULACIAS) which focuses on the co-innovation of farming systems in Latin America. The authors' approach involves stakeholders analysing the present state of the farming system and then identifying driving forces for change. Finally, the impact of drivers on the farming sector is assessed via a Delphi exercise to capture expert opinion. The outputs from this exercise describe three possible future scenarios, representing 'opening to new markets', 'quality' and a 'regional market'. The characteristics of each of these are described in the context of cherry production.*

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

Caterina Contini (corresponding author), Manuela Gabbai and Luigi Omodei Zorini are with Dipartimento di Economia, Ingegneria, Scienze e Tecnologie Agrarie e Forestali, University of Florence, Piazzale delle Cascine 18, 50144 Firenze, Italy. E-mail: caterina.contini@unifi.it. Belén Pugh is with Grupo de Fruticultura, Estación Experimental Agropecuaria Chubut, Istituto Nacional de Tecnología Agropecuaria, Trelew, Argentina.

The sustainability of farming systems is usually the result of complex interactions between environmental, economic, social and technological dimensions. In this context, promoting sustainability has two requirements: first, it involves the inclusion of economic and social issues, along with ecological assessments; second, it necessitates the adoption of a long-term perspective. From a procedural point of view, tackling complexity requires crossing certain boundaries separating academic disciplines (Hirsch Hadorn *et al*, 2006); it also requires taking measures that provide the right conditions to include different perceptions and knowledge from local stakeholders (White *et al*, 2008). This is a challenging route in terms of time, and it is also one that academics, researchers and agricultural businesses must confront (Tress *et al*, 2007). The main obstacles are the necessity for constant dialogue and agreement in the various phases that make up the research, from defining the objectives and methodologies to interpreting the results and their application (Buller, 2008). In this context, the possibility for all participants to communicate assumes priority, which is to say that they must use a shared language in a relationship of equality and reciprocity (Sillitoe, 2004). The catalysts of this process must be traced back to motivations and self-awareness, the capacity to be open towards new approaches, flexibility and willingness to be questioned by others (Bracken and Oughton, 2006). Another fundamental aspect is trust in each other's institutions, which makes it possible to establish cooperation within the working group (Harris *et al*, 2008).

With regard to the sustainable management of natural resources, the participation of local stakeholders is critical. It enables expanding the field of knowledge, including context-specific bodies of understanding as indispensable elements to guarantee a solid knowledge base (Olsson *et al*, 2004; Berkes, 1999). Moreover, participation constitutes a prerequisite for identifying the goals and needs of all the actors involved. This also constitutes a platform for comparing different and often contrasting views and interests (Rist *et al*, 2006; Röling and Wagemakers, 1997).

Participation can contribute to the transformation of relationships between the different actors, developing a relationship of trust and reciprocal understanding for different positions (the basis of cooperation), and it provides the opportunity for the more effective implementation of decision making (Reed *et al*, 2009; Patel *et al*, 2007; Walz *et al*, 2007).

This paper describes a study carried out within the EU EULACIAS1 project (FP6-2004-INCO-DEV3-032387) on the co-innovation of farming systems in Latin America. The EULACIAS project aims to identify sustainable paths of development by implementing co-innovation among 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, at which point stakeholders co-develop innovation, interacting with researchers in structuring, testing and improving the suitability of alternative options with regard to farmers' objectives (Douthwaite, 2001; Rossing *et al*, 2010).

Models can help decision making when the dynamics in the system are well understood and accurate data are available. This is more feasible in the short term. However, when the time span is extended, the relationships between human and environmental features change, and systems can follow various paths. Dealing with uncertainty then requires tools to compare and identify contrasts among different possible future paths (Swart *et al*, 2004). In this paper we illustrate the use of participatory scenario analysis as a tool to assist in the management of inherent uncertainties in the decision-making process, taking as our example cherry farming 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 forecast. Consequently, scenarios are not predictions, but tools to reflect on possible future developments; they identify different images of the future and examine possible strategies (see Postma and Liebl, 2005). As Rotmans *et al* (2000) state, '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 instead describe a dynamic course of events and actions. In these 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* are based on 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, whilst backcasting scenarios identify a future state and analyse the course of events that lead to this situation.
- *Descriptive and normative scenarios* are based on the presence of objectives linked to specific values. Normative scenarios are constructed to attain precise goals, while descriptive scenarios are constructed without regard for preferences.
- *Quantitative and qualitative scenarios* are based on the type of information included in the scenarios. They often result from modelling and refer to well known systems. They offer structure, discipline and rigour, but can fail to capture the complexity of the system when descriptions of state are uncertain, causal interactions are not well understood, and non-quantifiable issues are significant (Swart *et al*, 2004). Conversely, qualitative scenarios provide a better understanding of values, behaviours and institutions.

This paper presents the process that has led to the realization of scenarios designed to aid reflection on future opportunities and threats faced by cherry farming in South Patagonia. In particular, our scenarios are intended to serve as complementary models in the exploration of the future of socio-ecological systems and identify recommendations on farm resource allocation. They represent alternative conditions in which a different system of management should be assessed. A decision faring well across the set of scenarios indicates a robust option in the face of 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 for sustainability conditions without regard for preference.

Study area

The study area covers the territories of South Patagonia where cherries are cultivated. This includes Valle 16 de Octubre (42°55'S), the Valle Inferior del Rio Chubut (43°16'S), the Valle de Sarmiento (45°35'S) and land near Comodoro Rivadavia (45°42'S), all in the Province of Chubut, and the Valle de Los Antiguos (46°32'S) in the Province of Santa Cruz (Figure 1). Cherries constitute one of the most important crops of South Patagonia. In recent years there has been a marked increase in the area cultivated, from 176 ha in 1997 to 578 ha by 2006 (Cittadini, 2007). Its success is largely tied to the price the produce fetches on the international market where the cherries are sold as out-of-season fruit. Nearly half (45%) of the production is sold abroad as fresh fruit; another 45% is allocated to the home market as fresh fruit, and the remainder is processed by the agro-industry.

Major elements of uncertainty include future international demand, national policies of support for agriculture and exports, trade agreements and the price of production. The risks for cherry farming are amplified by the fact that the cherry tree is a perennial requiring considerable investment. Consequently, adjustments to external changes are difficult and slow. Using scenarios is a useful means of taking into account the risks the sector may confront in the near future and to reflect on the most appropriate measures to promote sustainable development.

Figure 1. Location of the study area.

Methods

The first part of the research study consisted of analysing the status quo and identifying drivers of change, defined as external forces not directly controlled by local stakeholders. In this phase, the research perspective was integrated with local stakeholders' perspectives. A review of the literature enabled the research team to identify key elements and trends in the context of the institutional, social and economic factors that might influence the farming system. Participatory workshops organized by the EULACIAS project, involving local stakeholders in defining problem trees, provided insights into those issues that impacted most on sustainability. In developing the problem tree, we began with the main issue of concern – the lack of sustainability in intensive systems in sweet cherry production in South Patagonia – and asked, 'Why is this problem happening?' The same question was repeated to identify underlying causes that the EULACIAS project could then act upon. The approach used to develop the problem tree was based on work by Renger and Titcomb (2002). The problem tree was drawn by stakeholders involved in cherry production, including producers (13), researchers (6) and technical advisers (5). These were joined by policy makers (3), with a view to providing a different perspective on the sector's problems, setting them in the broader context of rural development. Stakeholders were chosen by the local partners who had been involved in cherry farming through applied research and extension. These activities took place in 2007.

A review of literature and the problem tree led to the identification of an initial list of drivers. Key elements were selected from this list during a participatory workshop in February 2008, to which all relevant stakeholders were invited. The participants included nine researchers and technicians from Istituto Nacional de Tecnologia Agropecuaria (INTA), three private technical advisers and thirteen producers. They were divided into two groups – one group of farmers and the other of researchers, technicians and private advisers. Drivers were prioritized using a double-entry matrix; participants were requested to compare the drivers two by two, selecting the one most relevant to the future of cherry farming, and then were asked to explain their rationale in the evaluation process.

The second part of the study consisted of projecting the possible evolution of key drivers on the sustainability of cherry farming using a Delphi technique. This is based on expert 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 and Fyall, 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 and Linstone, 2002). Anonymous judgments are made in two or more rounds by a group of heterogeneous experts, receiving feedback between rounds (Adler and Ziglio, 1996). Each participant receives equal input and speculates individually; the researcher checks the interactions among the participants by processing the information. At each round, the respondents are allowed to revise their initial position. Feedback and anonymity are 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 six steps involved in designing a Delphi survey (Shon and Swatman, 1998) are (a) identifying, contacting and recruiting participants, (b) designing and circulating the first-round questionnaire, (c) analysing the results of the first round and producing feedback, (d) designing and circulating the second-round questionnaire, (e) analysing the results, and (f) presenting the results to the participants.

In our study, the Delphi process was conducted electronically in two rounds, to allow involvement of participants from different geographical areas. The objective was not so much to seek consensus as to facilitate the emergence of different perceptions about the future and to bring in the elements of uncertainty, an

important issue for decision making. This was pursued by modifying the classical Delphi procedure, which involved dividing the experts into two groups from the outset. One group was asked to answer questions from an optimistic standpoint; the other was asked to adopt a more pessimistic approach. Asking the panel to describe the future from these different outlooks should help experts expand their mental model beyond conventional thinking. The key stages are summarized below.

Identifying, contacting and recruiting participants

The panel was composed of stakeholders chosen on the basis of their knowledge of the farming system, the supply chain, the key drivers and rural context in the study cases, drawing on expertise from the local partners in the EULACIAS project. The panel consisted of 26 experts, including policy makers, farmers, consultants and researchers, plus entrepreneurs involved in the supply chain. Policy makers were selected for their expertise in the social and economic ambit, in relation to labour policies, support to agriculture and international trade. Farmers were selected for their technical competence in the cherry production system. Consultants and researchers were selected for their technical knowledge of the environmental, economic, social and technological aspects of cherry farming, and entrepreneurs were selected for their experience in cherry packaging, transport and commercialization.

Delphi analysis

The first round of the Delphi questionnaire had an open-ended structure, designed on the basis of the drivers identified during previous phases of the research. The experts were asked how they thought that each driving force might evolve over the next decade. Input from previous phases allowed us to formulate hypotheses regarding the future. The questionnaire was sent via e-mail, together with a supporting letter explaining the process.

From the 26 experts involved, 22 questionnaires were completed (eight producers, traders and packing house owners, seven policy makers, four researchers and three private advisers). The analysis of the first round of data involved comparing opinions and finding areas of agreement and disagreement. This part is critical, allowing the experts' knowledge and perceptions to emerge. Questionnaires were analysed using Nvivo (Sage Publications) software for qualitative research that enables the coding of text. Coding is a process for categorizing qualitative data and describing the implications and details. This made it possible to store ideas and categories and to create references between the questionnaires and nodes. The software allowed us to establish each node's degree of relevance based on its recurrence in the text and to highlight connections between nodes, so as to explore the relationships between nodes.

The analysis highlighted seven key themes: labour, cherry price, agrochemicals, cherry supply and demand, quality, and tariff regime. Two different types of feedback were recorded based on the analysis of the first round results. This feedback was circulated with the second-round questionnaires. For the 'optimistic' experts, the feedback proposed two possible views. The first concerned the consequences of a more advantageous tariff regime for exports and of public help for commercialization in relation to the sector's increased competitiveness in the Asian market. The second concerned the impact of certifying products from Patagonia on the European market. For 'pessimistic' experts, reflection instead centred on the consequences of concentrating the offer of cherries within the Mercado Común del Sur (MERCOSUR), given the greater competitiveness of other countries in the international market. In all, 19 questionnaires were completed and returned; 11 were written from an optimistic point of view, and eight from a pessimistic perspective. The Delphi analysis concluded with the presentation of the results to the participants.

Results

The literature shows that a major characteristic of the study area is its very low population density, ranging from 1.6 to 9.2 inhabitants/km² (reflecting urban and rural settlements). The main factors for change in the future of the cherry sector are related to demand. During the participatory workshop, researchers and extension workers emphasized the role of international demand and linked the competitiveness of the sector to the tariff regime and quality standard requirements. Farmers drew attention to the shortage of labour, which is 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. The drivers and rationale that led to their selection are summarized below:

- *Global demand*. The main opportunities for future cherry farming include export to the northern hemisphere, where cherries are sold out of season. This 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.
- *Tariff regimes*. In the southern hemisphere, Argentina's competitor countries are Australia, New Zealand, South Africa and Chile (most important). Currently, a 10% duty on export prices limits the competitiveness of Argentinean cherries compared with other countries, especially Chile. The reduction or repeal of the duty would have an impact on exports and, consequently, on demand for cherries.
- *Competition for labour*. Due to the low population density, there is a low availability of labour in the area, which results in a high cost for labour. The development of the oil sector, with higher labour productivity, led to a significant rise in wages in Chubut province. In Santa Cruz, high wages are linked to the growth of sectors competing with agriculture, such as government service or the building industry.
- *Cost of energy and oil*. The cost of oil affects the development of this sector in Chubut province, which competes with agriculture for labour. This affects the price of fertilizers and pesticides used in cherry

production, which currently account for 25% of production costs.

The results of the first round Delphi questionnaires confirm that labour is a major concern; all stakeholders agreed that the labour availability would diminish due to the presence of other sectors that can offer higher wages. Consequently, agricultural salaries will increase, even though they will remain lower than competing sectors. 'The productivity of the oil sector cannot be compared with that of the cherry sector, for this reason it is impossible for us to compete for labour with the oil sector [...] I think that the cherry sector will suffer the shortage of labour which will heavily affect production costs.' (SH 2) Some stakeholders identified two opportunities that could improve labour availability in the area: first, by recruiting seasonal labour from other regions, and second, through the opportunity presented by broadening the scope of women's labour, so that women could be involved not only in packaging but also in harvesting and in other field duties. Other stakeholders pointed out how improvements in agricultural working conditions could contribute to attracting labour from other sectors.

The second issue affecting cherry farming is agrochemicals. Experts agreed that agrochemical costs would increase, following the rising trend of energy and oil. In addition, most stakeholders recognized that the diversification of production in terms of the ripening season would represent a real opportunity for producers; this factor, together with an improvement in methods for preservation, may contribute to extending the harvesting and marketing seasons.

Quality is considered to be of central importance and was identified by all stakeholders. The farmers principally identified the aspects that concern production, particularly those that can reduce dependence on external inputs and production costs. The replies from farmers also showed a marked interest in certification, particularly when tied to the local territory. The attention of researchers and consultants mainly focused on labour, in terms of availability and cost as well as working conditions. Commercialization was also an important factor. Analysis from the first-round Delphi questionnaires led to three possible scenarios:

(1) *Emerging markets:* Asia (driven by China and India) and Russia. The demand for cherries in these areas will grow strongly, following the general increase in food demand. Competition is very high, the major competitor being Chile, which has considerable advantages due to its lower export tariffs. However, Asia, Australia, New Zealand and South Africa could also represent a major threat because of their proximity. Quality requirements will be linked to mainly organoleptic characteristics (taste, appearance, consistency).

(2) *Traditional markets:* Europe and the USA. In these areas, the demand for cherries will remain relatively stable. The main competitor will be Chile. However, an interesting niche for high-quality products is envisaged in this market – associated not only with organoleptic aspects but also with the process of production (environmentally friendly practices and/or food safety) and with the product's origin. Producers who are able to offer high-quality products will be favoured.

(3) *MERCOSUR* (mainly driven by Brazil): here, demand 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 highlighted by the experts with regard to market outlets led to building three scenarios with a 10-year time horizon. Each is characterized by different opportunities and threats:

- *Opening to new markets*. Regional policies supporting farm exports through tariff concessions and regional public aid for commercialization will increase the competitiveness of the sector in emerging markets, 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, mainly because they are sold out of season.' (SH 7) In the next 10 years this will become the main market for Patagonian cherries. Competition will be based mainly on price.
- *Quality*. 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 a good market strategy, we can sell our products to market niches at higher prices.' (SH 9) In this scenario, the creation of a Patagonian label of origin is likely to fetch higher prices insofar as the image of the territory will be linked to process (that is, eco-label) or product characteristics (that is, local varieties with a particular taste, flavour or colour). In this scenario, no policy that supports the cherry sector will be enacted: '. . . we should focus on quality, promote the "Patagonia" label and obtain product certification that the market calls for' (SH 18).
- *Regional market*. Export tariffs and the difficulties in achieving a product with a higher quality value limit the competitiveness of Patagonian cherries within the international market. 'Our competitors are working seriously hard to increase their market share within the international market. Their products have more competitive prices as a result of more favourable tariff regimes on export.' (SH 6) Thus, the main outlet market for cherries is MERCOSUR, which is characterized 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 a cherry consumer.' (SH 13)

Finally, the second-round results indicated the future trends and where experts felt prices could be most affected; these included the price of agrochemicals, labour and cherries.

Price of agrochemicals. Experts reported on a considerable increase in agrochemical prices, with over half the panel anticipating a rise in excess of 60%. The respondents demonstrated two main visions: the first (26% of panel) centred on an increase in price of between 20% and 40%, while the second (37% of panel) centred on an increase of between 60% and 100%.

Cost of labour. Almost 60% of the respondents felt that there would be an increase in labour costs of around 40%. No-one considered an increase lower than 10%, and an increase of less than 20% seemed unlikely.

Cherry price. With regard to cherries sold in emerging markets, nearly half of the experts (45%) felt that an increase in price of between 20% and 40% was likely. Nearly three-quarters (73%) of experts thought that over the next 10 years, the prices of high-quality cherries sold in traditional markets would increase by between 10% and 40% of the current price. With regard to the price of cherries sold in the regional market, the more pessimistic respondents (33%) felt that cherry prices would decrease by more than 10%, whilst the more optimistic group (33%) felt that the price would increase, but by less than 10%.

Discussion

The methodology adopted in this study identified the drivers of change, starting with an analysis of the present state and of past trends. This involved integrating the results from the literature, participatory activities and ranking the main drivers. This initial phase is of fundamental importance in the construction of scenarios that are relevant in decision making to identify the issues likely to be crucial in the future. Within this framework, the participation of stakeholders proved useful in providing local knowledge on cherry production. Our findings agree with those of Walter and Stützel (2009), who showed the importance of checking results from the literature with farmers and other interested groups to identify the relevant issues of complex systems, such as land use. They also support the findings of García-Barrios *et al* (2008), who reported that participatory scenarios helped stakeholders to identify the real drivers of change.

Subsequently, the Delphi method led to the construction of three possible scenarios, taking into consideration a wide range of interconnecting factors, including international markets, policies and the labour market. In this context, the participation of local actors made it possible to include knowledge of the stakeholders – useful for capturing the socioeconomic, political and cultural dynamics. The Delphi method made it possible to identify future trends of various key aspects of cherry farming in a situation where objective evidence was previously missing. This allowed scientists, farmers and stakeholders to evaluate innovative practices through the use of models and of joint learning.

Finally, the Delphi method proved effective in bringing different ideas to the attention of participants and giving everyone an opportunity for input. It stimulated communication among participants, thus improving understanding of the farming system. In this regard, we agree with Sandker *et al* (2010) and Vennix (1996), who emphasize that the process is the most valued aspect in participatory environmental decision making. Indeed, the main strength is its capacity to promote information exchange and strategy discussion, contributing to the development of the learning capabilities of resource users. This is a fundamental element in building capacity, which, in turn, is the basis for promoting adaptive management in the farming system.

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