



SOLINSA
Support of Learning and Innovation
Networks for Sustainable Agriculture

Agricultural Knowledge Systems In Transition :
Towards a more effective and efficient support of Learning
and Innovation Networks for Sustainable Agriculture

solinsa.net

APPLE-PRODUCING FAMILY FARMS IN SOUTH TYROL:

SOLINSA SHOW CASE REPORT

Author: Julien DeMeyer, FAO

September 2013

Project Number: 266306
FP7 – KBBE – 2010 –4



Funded by the
European Union



SEVENTH FRAMEWORK
PROGRAMME

This report only reflects the views of the author(s).

The Community is not liable for any use that may be made of the information contained therein.

Project funded under the Seventh Research Framework Programme of the European Union		
Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Partners in the Solinsa projects are :

- Heidrun Moschitz, Robert Home, Research Institute of Organic Agriculture (FiBL), Switzerland
- Gianluca Brunori, Adanella Rossi, Antonella Ara, Elena Favelli, University of Pisa, Italy
- Julie Ingram, James Kirwan, Chris Rayfield, Nigel Curry, Damian Maye, CCRI (University of Gloucestershire and University of West of England), United Kingdom
- Dirk Roep, Laurens Klerkx, Frans Hermans, Wageningen University, The Netherlands
- David Bourdin, Kim Anh Joly, Niels Rump, Pierre Praz, AGRIDEA, Switzerland
- Dominique Barjolle, Loredana Sorg, Federal Institute for Technology, Switzerland
- Talis Tisenkopfs, Sandra Sumane, Ilse Lace, Baltic Studies Centre, Latvia
- Anne-Charlotte Dockès, Delphine Neumeister, French Livestock Institute, France
- Volker Hoffmann, Simone Helmle, Stefan Burkart, University of Hohenheim, Germany
- Gusztav Nemes, Judit Kis, Viktória Tési-Páll, Agnes Varga, Zoltan Bakucs, Institute of Economics of Hungarian Academy of Sciences, Hungary

Abbreviations used in the text

AKIS	Agriculture Knowledge and Information System
CAP	Common Agricultural Policy [of the EU]
DCA	Dynamic Controlled Atmosphere
EU	European Union
FAS	Farm Advisory System
GAEC	Good Agricultural and Environmental Conditions
GAP	Good Agricultural Practice
IFP	Integrated Fruit Production
IP	Integrated Production
IPM	Integrated Pest Management
LINSA	Learning and Innovation Network for Sustainable Agriculture
SMR	Standards of Management Requirements
VI.P	Federation of cooperatives of the Val Venosta
VOG	Federation of cooperatives of the Bolzano Valley

Contents

1. Summary	1
2. Introduction	1
3. Overall aim of this analysis	4
Factors that influenced the development of the system	4
4. Methods	6
5. Results of the analysis	6
6. Conclusion	18
References	20

1. Summary

In Northern Italy, the autonomous province of South Tyrol has the biggest single area producing apple trees in Europe. The 19 000 ha of apple production area in South Tyrol supplies up to 50% of the national Italian apple market, 15% of the European and 2% of the global apple market. Apple production has been able to flourish and has consistently responded to market demands and competition in the European and global markets.

Since the end of the Second World War and continuing, the various stakeholders involved in apple production and marketing have organized themselves in an efficient and effective Learning and Innovation Network for Sustainable Agriculture (LINSA). It is a highly sophisticated and adaptive network involving producers, their cooperatives and associations; research; agricultural advisory services; and other public and private actors, all collaborating in a network of linkages that functions due to the high level of understanding and co-operation amongst all stakeholders.

The most important components of the LINSA are the apple producer cooperatives and their strict adherence to the basic principles of self-help, self-administration, self-responsibility and member's promotion, as defined by Friedrich Wilhelm Raiffeisen.

The other factors that influenced the nature of this system are many. Historically, socially and culturally, the nature of the province and of its inhabitants fostered the creation of a geographical cluster where people and institutions had to co-evolve and innovate to survive and thrive. In recent decades, the province has had a stable political landscape with a strong pro-agriculture policy that complemented national government policies and the Common Agriculture Policy of the European Union, providing a good enabling environment for innovation. Economically, the diversification of income of the 8000 family farms belonging to this LINSA contributed to the resilience of this innovation system.

The network's development was influenced by formal and informal mechanisms with a strong social learning component. Formal mechanisms can be found at policy, institutional and individual levels. Social learning aspects permeate the system. Learning in South Tyrol is linked to an outside and inside dynamic, both at individual and at collective level. The social capital created in this geographical cluster allows the development of the system by absorbing existing knowledge from others and creating knowledge.

The Agriculture Knowledge System accompanied and supported the LINSA. The research and extension system as well as the education system, have evolved and supported the innovation process with capacity development initiatives, with the provision of rural advisory services or by inventing or adapting technologies relevant for the producers.

The apple producers in South Tyrol have created a LINSA guided by human relationships, trust, common vision and interest where information and knowledge are transferred easily, with fast and collective action for innovation is the rule.

2. Introduction

Northern Italy has been in the business of producing apples since at least the 16th century, when couriers from the South Tyrol region around the Adige River brought fresh and preserved fruits to the courts of the Austrian and Russian monarchs (VOG, 2013). Since 1945, and despite political and economical shocks, South Tyrol has been able to develop its production and marketing system to the extent that it provides the livelihoods for 8000 farming families.

Today, the 19 000 ha of apple production area in South Tyrol supplies up to 50% of the Italian apple market, 15% of the European and 2% of the global apple market. Apple production has been able to flourish since the end of the Second World War and has consistently responded to market demands and competition in the European and global markets.

The many characteristics of this situation provide a good example of a Learning and

Innovation Network for Sustainable Agriculture (LINSA)¹. It is a highly sophisticated and adaptive system involving producers, their cooperatives and associations; research; agricultural advisory services; and other public and private actors, all collaborating in a network of linkages that functions due to the high level of understanding and co-operation amongst all stakeholders. The producers and their cooperatives are at the centre of the system, and the producers' innovativeness and their will to stay competitive are key drivers of success.

South Tyrol is a region with a strong identity that stems from its stormy history. Italy annexed the region from Austria-Hungary in 1919 under the treaty of Saint-Germain. The inhabitants of South Tyrol then had to live through the Italianization programme of Mussolini. The fascist regime sponsored the move of Italian-speaking migrants from other parts of Italy to South Tyrol, increasing the proportion of Italian speakers from 7% in 1914 to 35% in 1943 (Fedele, 2008). The Second World War and the German-Italian option agreement of 1939, where the German-speaking population of South Tyrol was given the choice to emigrate to neighbouring Austria and Germany or stay in Italy and accept complete Italianization, further divided the population. The emigration of German-speaking south Tyrolean further weakened the economy.

The end of Second World War brought the first Statute of Autonomy, which proved unsatisfactory for the province because of the connection to the province of Trento (Alcock, 2001). The crisis in South Tyrol Autonomy culminated in a violent movement, with activists throwing bombs in 1956. The referral of the dispute to the United Nations in 1960 led to the re-opening of negotiations between Austria and Italy, which resulted in the Second Statute of Autonomy in 1972. This struggle for autonomy and the specific features of the province as a multilingual mountainous community with a majority of non-Italian speakers reinforced its isolation but, at the same time favoured the creation of a geographical cluster for innovation.

This introduction would not be complete without a short description to the culture of cooperativism that is prevalent in South Tyrol. The basic principles of self-help, self-administration, self-responsibility and member's promotion as defined by Friedrich Wilhelm Raiffeisen (Wülker, 1995) are the anchor of the LINSA. The cooperative movement started in the last decades of the 1800s, when Tyrol underwent a vast agrarian reform, which included the introduction of the closed farm system, the creation of the Raiffeisen rural credit banks and the establishment of agricultural cooperatives (Rizzo, 2009). Today, the members of the apple producers cooperative—which represents 95% of all producers in the province—are the financial owners, holding decision-making power based on the principle of 'one person, one vote' and are the main recipient of the services delivered by the cooperative. This gives the producers a powerful voice to ask for services and the power to sanction unsatisfactory performance. This governance system, coupled with strict and regular financial auditing processes, provides robust checks and balances for the LINSA.

Finally, the apple producers in South Tyrol make the system truly unique. They are attached to their culture and traditions and at the same time true innovators. They have embraced the most modern storage and marketing mechanisms and are always looking for new ideas to be more efficient and effective. They have adopted, sometimes only after lengthy and healthy discussions, new technologies and new processes and established new institutions when and where needed. At various times in their history, they have taken the risk to change and adapt to new conditions. Their innovativeness and resourcefulness is the main driver for the success of this LINSA. Table 1 presents a list of the most important actors in the LINSA.

¹ As a broad definition, a LINSA is any knowledge network that exchanges or develops new knowledge or works on innovations (Hermans, Klerkx and Roep, 2010).

Table 1. Who is who in South Tyrol – Some of the more important actors in the innovation network.

Name and Aim	Other information
AGRIOS (Workgroup for Integrated Fruit Production in South Tyrol)	
AGRIOS is responsible for managing the quality, the law and regulations for integrated management.	Founded in 1977, AGRIOS is a private company with non-profit status. It is losing a little of its influence as the directives for integrated management are now dictated from Rome (or from the buyers in the case of GlobalG.A.P.), and the quality control function has now been separated and is being implemented by a not-for-profit company (Konsortium 'Südtiroler Qualitätskontrolle').
Bauernbund	
Farmers' association of the province, with the aim of strengthening the farming community in economic, social, cultural and political terms, and to represent the interest of its members	Founded originally in 1904, had to be re-established in 1919 when Sud Tirol became Italian and has continued to evolve since then. It today has 21 000 members. The majority of the association's income is derived from their services.
Beratungsring	
They offer a private and independent extension system.	Rural advisory service provider established in 1957. Budget of € 3.2 million, with 70% of the budget coming from the farmers and 30% from local government. Some 90% of the local farmers are members, and they work through 31 consultants.
Cooperatives	
Their aim is to store and market apples for their members.	There are 23 cooperatives for apple production in South Tyrol that cover 95% of the growers. The first cooperative for apple production was created in 1893 (Algund), and today includes VOG Product – Europe's largest fruit processing company. The primary aim of the cooperative is storage, processing and commercialization of the fruit delivered by the members.
Federation of cooperatives	
Two (The Association of South Tyrolean Fruit Growers' Cooperatives (VOG) and Vi.P co-op. soc. Agricola) federations of cooperatives are present, for marketing and for invoicing.	Vi.P and VOG are producer organizations in the sense of the EU legislation. VOG was founded in 1945, it has 1558 employees and is composed of 16 cooperatives with 5200 members and 10 700 ha. VOG sells 735 000 tonne of apples per year with a turnover of €433 million. Vi.P was founded in 1990. It has 700 employees and is composed of 7 cooperatives with a total of 1750 members and 5110 ha. Vi.P sells 284 000 tonne of apples per year with a turnover of €225 million.
Industry and services	
A vibrant industry is attached to the apple production in the province. It was built to provide the necessary tools for apple production, but many small enterprises have evolved to become leaders in their field.	One such company is Isolcell, that is now a 50-year-old company based in Bolzano and is at the forefront of apple conservation techniques, marketing the Dynamic Controlled Atmosphere (DCA) process developed with the Laimburg Research Station. DCA is the most widely-known and used method for optimising controlled atmosphere storage conditions. It is marketed by Isolcell Italia S.p.A. and it is used around the world in commercial apple production (Zanella, Cazzanelli and Rossi, 2008; Prange, Delong and Harrison, 2005).
Laimburg Research Station	
Research Institute addressing all fields of applied and basic agricultural research in South Tyrol.	Founded in 1976, it has 20 branches, 200 employees, and over 400 projects. The local autonomous government funds about 40% of the budget, the rest is covered by cost recovery on services provided to farmers and cooperatives, and selling their own apples. It has an estate of 250 ha.
Landes Konsortium für den Schutz vor Witterungsunbilden	
This cooperative implements initiatives for its members to support any active and passive defence against weather adversities.	This cooperative was established in 2004 and has a membership of 95% of the apple producers and 75% of the vine producers.
Producers	
Apple-producing farmers. There are 8000 land owners with orchards in South Tyrol, of which 5000 are active growers of apples.	South Tyrol has a long tradition of fruit growing. As far back as the 16th century, couriers from the region around the River Adige brought fresh and preserved fruits to the courts of the Austrian and Russian monarchs.
South Tyrol (Autonomous province)	
The provincial administration has competences for social and economic factors, including with regard to agriculture and forestry. The second autonomy statute gave the province extended power to decide its own future.	The province was founded with the annexation by Italy in 1919, included in the Regione Trentino Alto Adige with the first autonomy statute, and acquired extended powers with the second Statute of Autonomy in 1972

Name and Aim	Other information
<p>Trade and Knowledge Fairs</p> <p>The aim of the fairs are to present the latest innovations and to exchange knowledge</p>	<p>Various organizations in the province regularly organize fairs, the most important one being the biennial <i>Interpoma</i>, a fair about everything to do with apples. In 2012, it had 364 exhibitors from 17 different nations, with 16 017 professional visitors from over 60 different countries.</p>
<p>Tree Nurseries</p> <p>The nurseries are part of the services provided by private companies to the growers. Their aim is to provide virus-free and good quality planting material of the varieties requested by the growers.</p>	<p>Konsortium der Südtiroler Baumschule (KSB) is a union of nurseries that was established by provincial law, with responsibility for the propagation and distribution of propagation material. They ensure that only the best genetic varietal material goes to the apple growers and that it is clean in phytosanitary terms.</p> <p>These include GRIBA, a cooperative founded by four fruit growers of Gries, Bolzano. Today it has 14 members and produces over two million fruit trees a year. Total production from the south Tyrolean nurseries is between 8 and 10 million trees a year.</p> <p>Bund Sud Tyroler Baumshule (BSB) is a centre for all information and studies, not commercial, just education.</p>
<p>Variety Innovation Consortium (SK)</p> <p>SK's objective is to test, introduce and promote new varieties. It is the variety information arm of VI.P and VOG.</p>	<p>Established in 2002, it is a not-for-profit entity, with its objective being to find good varieties for the region, promoting them and directing growers, in collaboration with Laiburg research station and Beratungsring, to the best varieties through the cooperative group.</p>

3. Overall aim of this analysis

The aim of the analysis is to understand the local innovation processes in South Tyrol and specifically to try to understand the constraints and opportunities for the LINSAs. The last 50 years of the LINSAs' history will be scrutinized, highlighting the enabling environment, the support provided by the Agriculture Knowledge and Information System² (AKIS), as well as the drivers and triggers for innovation. Local knowledge and scientific processes are discussed, as well as imitative processes based on observations from technologies or practices developed outside South Tyrol, and how they are the source of knowledge being put into use.

Factors that influenced the development of the system

The factors that influenced the nature of this system are historical, cultural, social, political and economic.

The history of the province described briefly in the introduction has shaped some of the process, the results of which can be witnessed today. The preservation of the local culture has been a collective struggle for the South Tyrolese, who had to work together to maintain their way of life. There is a strong belief, at least among the majority of people interviewed, that the individual flourishes better within the framework of a group. The way they interact is also a legacy of their history, as recorded by Alcock (2001): "In order to survive and adapt, the South Tyrolean society required on-going co-operation rather than confrontation", and they established a dynamic process for their development based on trust, learning and mutual respect.

The geographical specificities of the province influenced its LINSAs. The province benefits from a humid continental climate with variation in air flow temperature that is particularly suited for apple production, and the 300 days of sunlight every year guarantee a good production environment. This productive environment is located in an isolated and mountainous environment where people have a shared language, culture, social and cultural

² An Agriculture Knowledge and Information System links rural people and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information. The system integrates farmers, agricultural educators, researchers and extensionists to harness knowledge and information from various sources for better farming and improved livelihoods (FAO/World Bank, 2000).

values that are different from neighbouring Italian regions. This isolation contributed to the creation of a dense network of relationships within the province and created a geographical cluster where the human relationships, trust, common language and belief allowed a fast transfer of information, easy knowledge sharing and the creation of social capital (Carbonara, 2004; Putnam, 1993). People and institution had to co-evolve. As will be seen in the following chapters, this co-evolution then supported the development of an innovation system, with fast transfer of knowledge in a dynamic self-teaching system (Juma, 2011).

Socially, apple producers have a high social status. Culturally, people in the province are traditionally innovators. For example, it was a pharmacist from the province, Mr Ludwig Comini, that in 1857 pioneered the use of sulphur on fruit trees and vines as a method to control powdery mildew – a method used worldwide and still in use today (Leonardi, 2009).

The last decades of pro-agriculture policy at state, national and European level created a good enabling environment for the LINSAs. The province also has a specific rural development policy. In the words of the Governor of the Autonomous Province of South Tyrol:

“The development of rural areas cannot and should no longer depend solely on agriculture. To promote the potentials and at the same time the sustainability of rural communities and a balanced relationship between urban centres and rural areas, there is need to diversify both within agriculture and forestry, as well as outside of it.”

From a political perspective and since its autonomy status was declared, South Tyrol has had only three governors and one majority political party, the *Südtiroler Volkspartei*. This political stability and pro-agriculture and rural development policy formed the stable basis for the development of the innovation system.

Economically, the productive units are a mix of family farms of different sizes: 34% of the farms have between 0.1 and 1 ha – they should be considered part-time farmers; 31% are between 1 and 3 ha; 20% are between 3 and 5 ha; and the rest are >5 ha (K. Werth, pers. comm.). The various people interviewed for this report agreed that a farm of about 3.5 to 4 ha could provide enough income from fruit production for full-time farming. Thus many apple producers owning less than 3.5 ha of land need an additional source of income. This diversification of income supported the resilience of the LINSAs.

In general, a family farm is composed of different parcels of land that can be located far apart. However, the further fragmentation of agricultural land as well as the formation of large land estates and the merging of small farms were avoided with the re-introduction of the Closed Farm System legislation into provincial policy in 1954, which excluded agricultural property from traditional division by inheritance (*Maso Chiuso*). With this policy and in accordance with the custom of the 'hereditary farm', land cannot be fragmented or divided but should be handed down to one of the children to preserve the continuity of a single farm. This permitted conservation of viable production units. According to the last census (2000), South Tyrol had 26 600 farms (including the 8 000 apple-producing farms), of which about 12 500 were declared 'closed farms'.

Since its inception, the cooperative system has focused on the economic interests of its members. Cooperatives operate like businesses with a sole focus on storing and marketing their members' apples and providing them with the best possible selling price. There are three fundamental elements that hold the system together: (i) the rule of one member – one vote, with no regards to social status or farm size; (ii) the member's duty to deliver the totality of their harvest to the cooperative; and (iii) the cooperative's duty to accept the full harvest.

Finally, yet importantly, the research, extension and education systems are present and strong, with 922 students enrolled in South Tyrol agricultural schools. A 50-year-old association, *Beratungsring*, provides rural advisory services, and the Laimburg Research Station is an established and recognized research institution. These organizations have established strong linkages nationally and internationally.

A few factors could be considered weaknesses of the system. Key informants commented that an excessive cooperative attitude might be damaging to the entrepreneurial spirit of individual

producers. In addition, the monoculture production of apples is an ecological and economic risk and has to be managed properly.

4. Methods

A systematic review of the literature was undertaken on the operation of the innovation network in South Tyrol. It included reviews of policy and professional literature, as well as academic work. Telephone contact was then established with research and extension personnel based in South Tyrol in order to fill the gaps in basic information. Two experts, Kurt Werth, former rural Advisory Service Advisor, and Josef Dalla Via, former director of the Laimburg Research Station, were interviewed to complement the data found during the literature review, and to discuss the preparation of a field mission in South Tyrol to interview key informants. With the help of the provincial government, a short questionnaire was distributed to 50 farming families to collect data on linkages and communication patterns. The data collected was compiled in an internal FAO report (Nicod *et al.*, 2013). Finally, in July 2013, a field mission of 5 days was conducted in South Tyrol to meet and interview various actors in the innovation system.

5. Results of the analysis

Emergence and evolution of the various organizations and establishment of linkages

The LINSAs in South Tyrol had to adapt and respond to triggers to first become and then remain competitive. The evolution of the LINSAs can be seen as five phases, and the discussion attempts to explain the emergence of organizations and linkages within each period, to provide a better understanding of the system.

1945 to 1960 – Strength in unity and independent advisory service

South Tyrol emerged from the Second World War as a poor province with a divided population. In 1945, only a few wine and apple producer's cooperatives were still operating, having survived the fascism period and the war. Apple marketing was in the hands of private traders. Usually, apple producers would hand over the majority of their apple production to private traders, who would then sell it and earn a commission from the sale. No sale price was agreed between the producer and the trader from the onset, and the producer would be paid only after his produce was sold and would not know their income until that time. This was a non-transparent marketing mechanism and unsatisfactory for the producer. On 24th August 1945, nine fruit growers' cooperatives linked together under a new federation of cooperative, VOG, with as its guiding principle the motto 'Strength through unity'. By such linking, cooperatives extended the principle of self-help³ and increased their capacity for competition and promotion, while retaining a direct link with the members. In addition to this new federation, at least 12 new apple-producer cooperatives of between 250 and 400 members were created in this period, each with the objective of storing and marketing apples on behalf of their members. The trigger for this change was the awareness of producers of the need to unite.

1945 saw also the re-establishment of the Bauernbund, which is still today the most prominent association in South Tyrol at the political level, and re-organized the agricultural sector in the province (Gatterer, 2007).

The production system was traditional. Fruit pickers harvested tall apple trees using traditional ladders. Apples were placed in a bag hanging on the side of the pickers, and then stored in wooden crates (see Photographs 1 and 2). Orchards had a plant density of around 300

³ People in the same or a similar situation join forces, raise the necessary financial means for a joint cooperative undertaking and are prepared to give mutual support. They expect that membership in the cooperative compensates for lack of access to the market and the capital in competition, improving one's own market position and better satisfying economic needs. They expect, in the broadest sense, access to markets, and access to capital (Wülker, 1995).

trees per ha (Dalla Via and Mantinger, 2012), and it took more than 1000 hours of work per ha to produce at most 25 tonne of fruit (K. Werth, pers. comm.). Apples were hand sorted in the cooperatives into two qualities: those for retail sale and those for other uses. Of the varieties being planted, a large majority of the 191 named varieties sent to the world expo in Vienna in 1873 are still present in the province (Oberhofer, 2007). The most popular varieties were *Kalter Bohmer* and *Champagner Renette*, accounting for nearly 50% of the production.

The introduction of the anti-frost irrigation system was a major technological innovation to note. A farmer from South Tyrol, Mr B. Holler, read about it and in 1949 ordered the first irrigation system to fight against frost. After some trial and error testing, the system was used successfully for the first time in 1950 (Christanell, 2012). By 1958, 4000 ha of apple orchards were protected with this type of active protection against frost. The LINSAs were in their infancy and used mainly an informal system for sharing ideas and knowledge. The use of this technology spread successfully in the absence of a strong research and extension system in a province experiencing the violence of agitation for South Tyrolean independence.



Photographs 1 and 2. Storage of apple in small wooden crates (left) and harvesting time in South Tyrol (right) (Photographs courtesy of K. Werth)

A major institutional innovation occurred in December 1957, when fifty fruit producers decided to create an independent rural advisory service. The trigger for this innovation was the fact that producers had been receiving extension advice from the sellers of agricultural inputs, with the associated possibility of bias. The fruit producers invested their funds to create a not-for-profit association that would provide them with timely, independent, up-to-date technical advice and professional inputs for their needs. This marked the creation of the *Beratungsring fur Obst- und Weinbau* (hereafter called *Beratungsring*) that would become a key player in the LINSAs.

The EU Common Agricultural Policy (CAP) dates from 1957, and its objectives then were to ensure a fair standard of living for the agricultural community and to assure the availability of food supplies at reasonable prices. For the next 50 years, the CAP would be the most important common EU policy (Hermans, Klerkx and Roep, 2010) and influence the evolution of the LINSAs.

1961 to 1971 – Intensification, integrated production and storage

Since the 1950s, out-migration from the province to neighbouring countries took place to varying degrees. The emigration peak occurred in the 1960s, when each year approximately one thousand South Tyroleans moved north. Because of migration, South Tyrol suffered from a shortage of labour in the agriculture sector, and thus incurred higher labour costs. The specific problems of the province were exacerbated by the crisis in the European horticulture sector between 1966 and 1979, where decreasing demand coupled with apple overproduction led to a reduction in apple prices at a time when labour costs were increasing. This combination was threatening apple production in the province, as under these conditions the traditional production system could not provide a fair standard of living for apple producers.

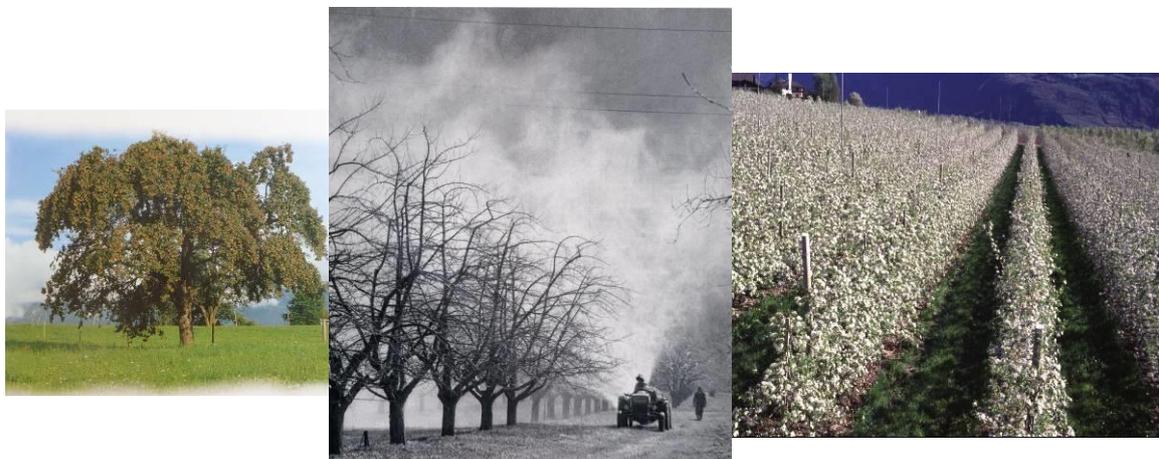
The LINSAs responded in various ways to these triggers. Institutionally, the School for Viticulture and Horticulture - hereafter called the Laimburg School - was created in 1962 in Laimburg. After the *Beratungsring*, the Laimburg School was the second leg of the AKIS created

to support agriculture production. The school also took over responsibility for research in horticulture in 1967 (Dalla Via and Mantiger, 2012). In 1964, the Beratungsring opened its membership to all interested producers in the province, thus dramatically increasing the coverage of independent and professional extension services (Lösch, 1964).

Technologically, and because land was a limiting factor, South Tyrol had to intensify its production system in order to provide a fair income for producers. The traditional method was labour intensive and gave low yields per hectare and needed to be replaced with a system requiring less labour with higher yields. Some producers started to introduce the Italian *palmette* system. This system reduced the height of the trees and reduced the need for labour. It was, however, not optimal. In January 1968, a presentation on high density planting was made at a conference on fruit tree production: *Giornata Frutticola di Merano*. In September 1968, a delegation of producers, including advisers from Beratungsring, visited Holland to study the apple production system there. They observed the slender spindle system, where apple trees are planted at high density and grafted on a dwarfing rootstock. The delegation was soon convinced that this was the future for the province (K. Werth, pers. comm.), and upon their return started the process of convincing the producers to adopt the slender spindle system.

In 1969, 30 ha of land were planted under the slender spindle system, some of it planted as a demonstration plot in the Laimburg School. At the same time Beratungsring advisers were busy explaining and demonstrating the advantage of the new system to producers. Apple producers were doubtful that such a system, where the trees resembled 'tomato plants' (K. Werth, pers. comm.) could suit their needs (see Photograph 3). The extension strategy of Beratungsring was to use any formal and informal channel of communication to make their case, link with the agriculture schools, visit demonstration plots, and, more importantly, identify some recognized and innovative farmers that could be convinced and champion the change. By 1971, 180 ha of orchard were planted to the new system. Despite this slow uptake of intensification, other progress were made, and in 1970 an average of 850 hours of work (a reduction of 11% compared with the 1945–1960 period) were needed to produce 27 tonne (an increase of 28.5% compared with the previous period) of apples per hectare.

The intensification led to another technological innovation. As production increased, there was a need to control the amount of fruit reaching the market at any given time to avoid the price fluctuations seen during the European crisis. In 1972, the Laimburg School built a storage area that was used for experimentation to test existing methods for apple conservation, with the most promising methods then piloted with cooperatives. The need for storage led to another varietal innovation, as Beratungsring and cooperatives were advising producers to plant varieties adapted to long-term storage. Thus, from 1970 onwards, older, traditional varieties started to disappear and were replaced with modern varieties more suited to the new production and processing methods in Italy.



Photograph 3. Evolution of tree shape to suit intensification

(Photographs courtesy of K. Werth)

Finally, in this period, the LINSAs accessed EU subsidies, with support from the national government of Italy and the province, to modernize the infrastructure of its cooperatives. One of the triggers upgrading infrastructure was the need to improve the sorting of apples to respond to the number of apple quality classes requested by the market, as it went from 2 – good or bad – in 1960, to 10 in 1970, and reached 30 in 2000 (K. Werth, pers. comm.).

1972 to 1990 – Quality improvement and first innovation platform

From a political perspective, 1972 saw the enactment of the second Statute of Autonomy. Among other things, this allowed South Tyrol to create two important provincial institutions. The Agriculture Research Station in Laimburg was established in 1976, finalizing the creation of a complete AKIS to support the LINSAs. The research station was set close to the Laimburg School and endowed with 250 ha of land, making it not only a research station but also one of the most important producers in the province. The second institution created in that period was the state cooperative for the protection of crops from weather adversities. This not-for-profit cooperative was created in 1973 with the objective of providing its members with passive protection against weather events, and more specifically hail. It is an insurance scheme as well as a cooperative that has as its objective to find all possible sources of funds (including from the provincial government and Italian state) to compensate for production losses due to weather events. The main trigger for the creation of these two institutions was political, as it was the will of the autonomous government to have its own structure to support agricultural production in the province.

Finally, the cooperative movement continued to grow and by the 1990s there were 34 apple producer cooperatives in the Bolzano valley and 9 in the Val Venosta. The consolidation of the cooperative structure at the level of the VIP and VOG was in part triggered by political will, as it was a policy of the autonomous province to support the consolidation of the cooperative system.

At the end of the 1960s, the concept of Integrated Production (IP) was launched⁴. In early 1970, in South Tyrol, a few progressive fruit growers took up the idea of integrated pest management (IPM) and wanted to implement it. The key trigger for this change was the occurrence of pests showing resistance to agrochemical control methods as well as the economic advantage that IP production could provide. In 1974, the 5th Symposium for IPM took place in Bolzano. Within the scope of that Symposium, *Beratungsring*, which in the meantime had grown from its 50 original members to having members in the whole province, demanded that its members monitor accurately the pests and beneficial organisms in their orchards, and strictly avoid unnecessary chemical treatment. Starting in 1977, *Beratungsring* in collaboration with the South Tyrolean Young Farmers (part of the *Bauernbund*) organized courses on IPM during the winter months. In 1980, 15 IPM producers work groups met fortnightly to monitor their orchards. Slowly, practical realization of the IPM concept by fruit-growers led gradually to the desired ecological awareness. By 1987, nearly 600 fruit growers had taken courses in IPM during the winter months. Finally, in December 1988, IFP was institutionalized, with the creation of the innovation platform *AGRIOS* as the workgroup for integrated fruit production in South Tyrol. It included the major actors in the LINSAs⁵. *AGRIOS* used a consultative process to define yearly guidelines for Integrated Fruit Production (IFP) to be followed by apple producers. *AGRIOS* inspectors audited the producers to ensure the quality and honesty of the system. It took 18 years from the first introduction of IP in the LINSAs until its successful institutionalization.

Additional institutional innovations also took place in this period that were important for the further development of the LINSAs, including:

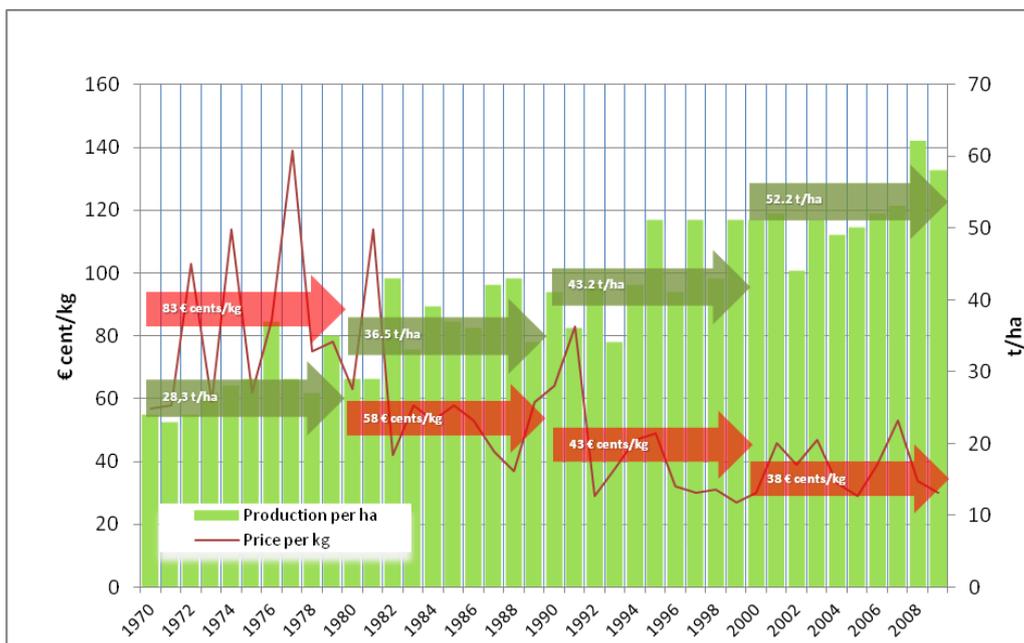
⁴ The concept of IP was launched by the International Organization for Biological and Integrated Control of Noxious Animals and Plants (IOBC).

⁵ *Beratungsring*; VOG; South Tyrolean Fruit Growers' Association ESO (merged with VOG in 1999); the provincial government; the Laimburg research stations; and farmer federations.

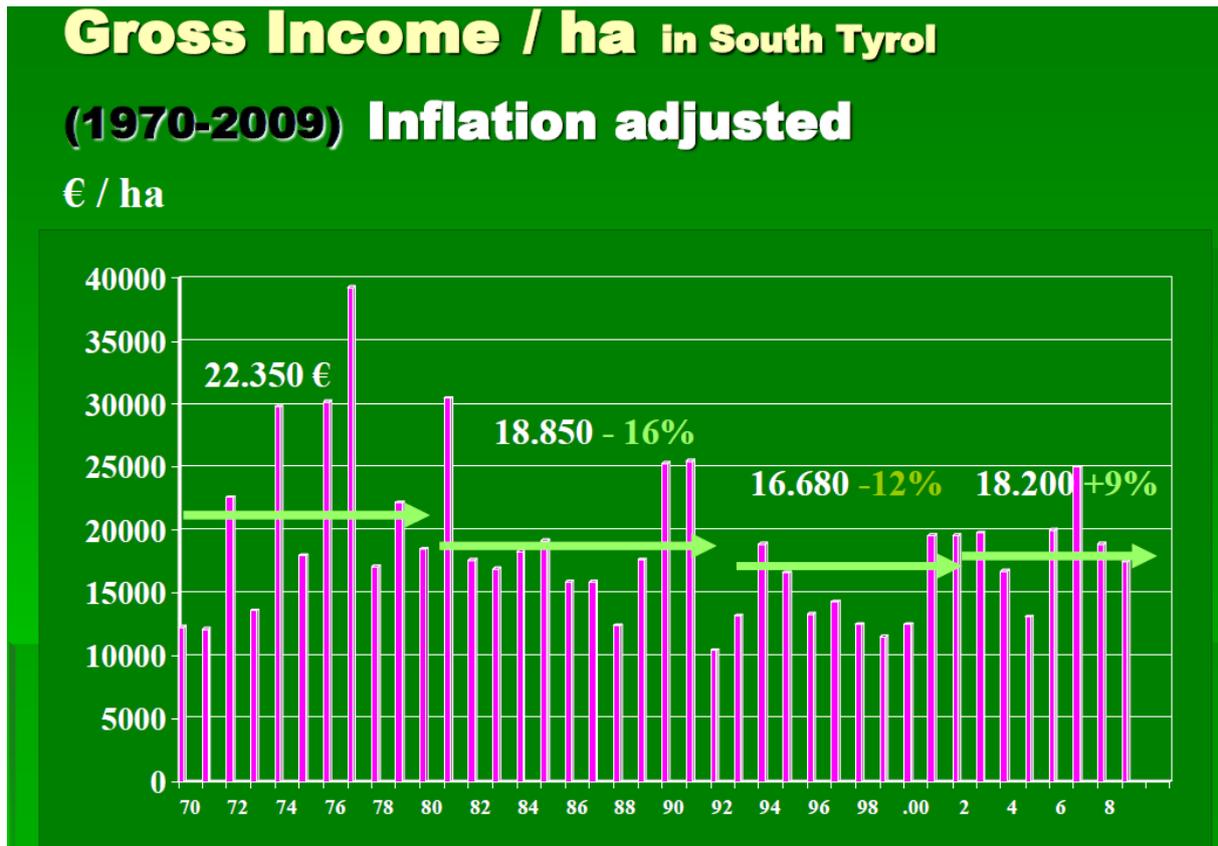
- 1974 – First organic (Bio-)apple producer in the province.
- 1977 – Recognition of *Mela Alto Adige* as a trademark for origin and quality.
- 1980 – Research programme on post-harvest technology established in Laimburg Research Station.
- 1981 – KSB, the first apple tree nurseries cooperative with Laimburg-led sanitary and quality control. The trees from the nurseries subsequently received virus-free certification (Sud-Tyrol – Alto Adige certified) from the relevant authorities.

Intensification of the production area continued and apple prices continued to fall (see Graph 1). By 1990, 16 000 ha had been planted in the new system, and on average 650 hours per ha were needed to produce 42 tonne of apple of up to 15 different quality types. This allowed the LINSa to ensure a fair return to the producers (See Graph 2).

Graph 1. Evolution of the apple production system in South Tyrol per average yield and price (prices are inflation adjusted to inflation)



Graph 2. Evolution of the gross income per hectare in South Tyrol (Figures adjusted for inflation)



1991 to 2001 – Variety innovation, consolidation and international networks

In the 1990s, the landscape of the apple sub-sector was changing rapidly, as the influence of supermarkets as buyers was increasing, and modernization of the storage and processing facilities was demanding higher investment to stay ahead of market changes.

One of the triggers for institutional innovation was policy based. People interviewed explained that in 1990 the provincial government decided that it would only provide subsidies (mainly the provincial component of EU subsidies) to cooperatives of a critical size, thus excluding small cooperatives. This decision started a concentration process, where neighbouring, small cooperatives merged into bigger units. The 9 cooperatives of the Val Venosta became 6, and the 34 cooperatives of the VOG federation became 18. This concentration of cooperatives not only allowed modernization of the infrastructure in an efficient way, but also provided an excellent basis for sustainability of the system. As one cooperative director explained, the amortization of the infrastructure bought in this period provided the necessary investments for upgrading the infrastructure. In effect, as the cooperatives are not-for-profit, the income generated by the sale of apples, minus the operational cost (including the amortization of infrastructure), is redistributed to the members. Such amortization today is valued in millions of Euros, and is available for investment to the cooperative. This smart allocation of subsidies coupled with the fact that they were distributed to cooperatives and not individuals, is one of elements in the increased efficiency of the LINSAs.

The principles of equity and transparency were respected during this process of concentration: whenever two cooperatives had to vote for or against a merger, the decision was to be taken by majority vote of the members for both cooperatives, and in order to avoid any influence and to maintain objectivity of the process, the votes in both cooperatives were to be taken at exactly the same time.

The intensification of the production system was completed in this period, with 16 000 ha of

orchards planted under the slender spindle system by 1990, having taken a generation (20 years) for 80% of the production area to be planted under the new system. Finally, in 2002, the new system covered nearly all the production area. In early 2000, it took only 450 hours of work to produce 55 tonne per ha of apples, branded “Mela Alto Adige (IFP)”.

The LINSAs were also opening up to international partnerships, with collaborative work with Swiss and Austrian research centres. In 1998, the first *Interpoma* took place. *Interpoma* is a biennial agricultural innovation trade fair, held in Bolzano for three days. It is one of the very few events in the world dedicated exclusively to the cultivation, storage and production of apples. It provides opportunities for stakeholders and beneficiaries to identify areas of common interest, to exchange knowledge, explore new markets and create new partnerships. During this period, the cooperatives and *Beratungsring* continued to organize trips abroad to visit other orchards and exchange ideas, which contributed to continued knowledge exchange.

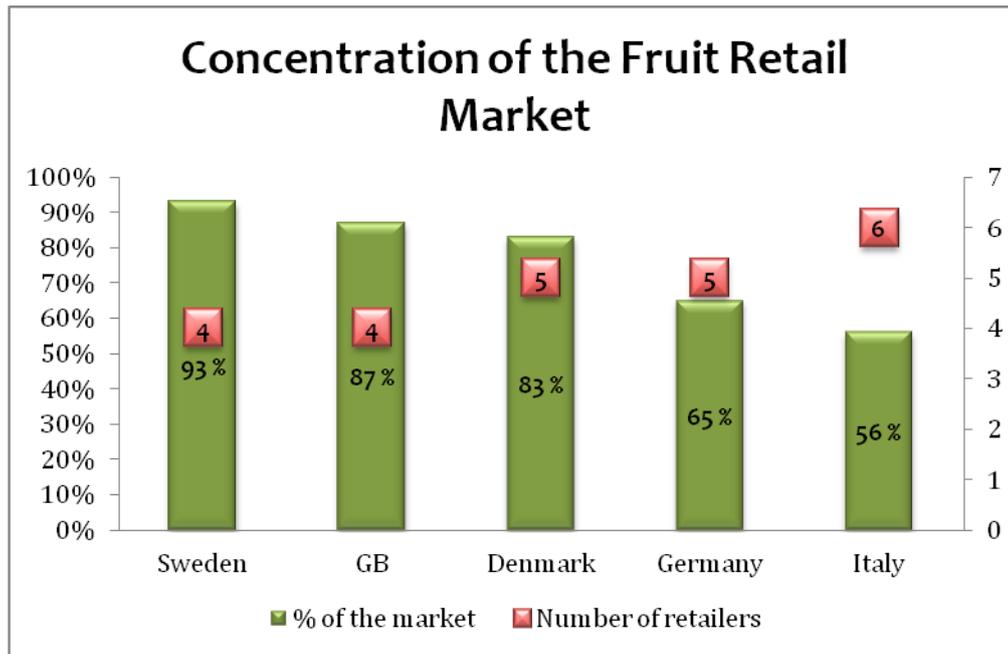
In 1991, researchers in Laimburg, in collaboration with a private company, *Isolcell*, started to experiment with new methods for storage, using Dynamic Controlled Atmosphere (DCA) technology, with fluorescence sensors, to improve the storability of apple and avoid the use of chemicals.

Despite all this progress and the excellent capacity of the LINSAs to adapt to new conditions and to keep innovating, this period marks also the time when it did not notice the importance that club or managed varieties would assume. This new way of marketing apples started in the mid-1990s and defined a new strategy for apple growing and distribution. A managed variety is a new apple variety that is patented and trademarked, and then grown and marketed in a production and marketing club. Access to grow the variety is limited to club members. The licences to grow these varieties fund the marketing that helps to create demand for them. This allows each club member to determine the best site to grow the variety, the amount of product brought to market, and the quality standard. This is not the forum for debate on club varieties, but the most significant point is that the LINSAs in South Tyrol did not see this change early enough, and it was late when they started to look for opportunities to enter the most important clubs, as the licences had already been distributed in other countries. Today, most of the club varieties grown in South Tyrol are done under sub-licences. Learning from this mistake, in 2002 the LINSAs created a new innovation platform supported by *VI.P* and *VOG*, the Variety Innovation Consortium South Tyrol (*SK Südtirol*).

SK Südtirol's objective is to coordinate, in collaboration with Research Station Laimburg and *Beratungsring*, the varietal innovation in South Tyrol. *SK*'s role is first to access new varieties, then to test them, and, if a variety is considered appropriate for South Tyrol, to prepare the procedure for *VI.P* and *VOG* to obtain marketing rights. Once the rights are secured, then either *VI.P* or *VOG* (or both) will then become member of the clubs for the managed varieties. After that, *Beratungsring* steps in to advise growers on the appropriate location, appropriate management and the best density to use to achieve critical mass of production.

2002 to date – Innovation, professionalization and the market

The last decade has seen a further consolidation of the cooperative marketing structure to respond to the concentration of the fruit retail market (See Graph 3). This happened in two steps. Initially, it was a business decision, when different cooperatives merged together to pool their resource and achieve a greater volume. Subsequently the incentive for the merger was triggered by changes in EU regulations. The cooperatives are now organized in marketing pools under *VI.P* and *VOG*, and 85% of the invoicing is done at *VI.P* and *VOG* level. The LINSAs can respond very efficiently to big orders. Tailor made software – ‘Clickview’ – allows any cooperative director or authorized worker to see all sales and stocks made in each and every individual cooperative federated under *VOG*. This is done in real time, per quantity, quality and price, and provides ultimate transparency. The year 2003 also saw fundamental reform of the EU CAP and the introduction of the single payment scheme, reinforcing the role of producer organizations and the need for centralized invoicing to access the subsidies. This has further reinforced the need for consolidation and the importance of *VI.P* and *VOG*.



Graph 3. Concentration of the fruit retail market

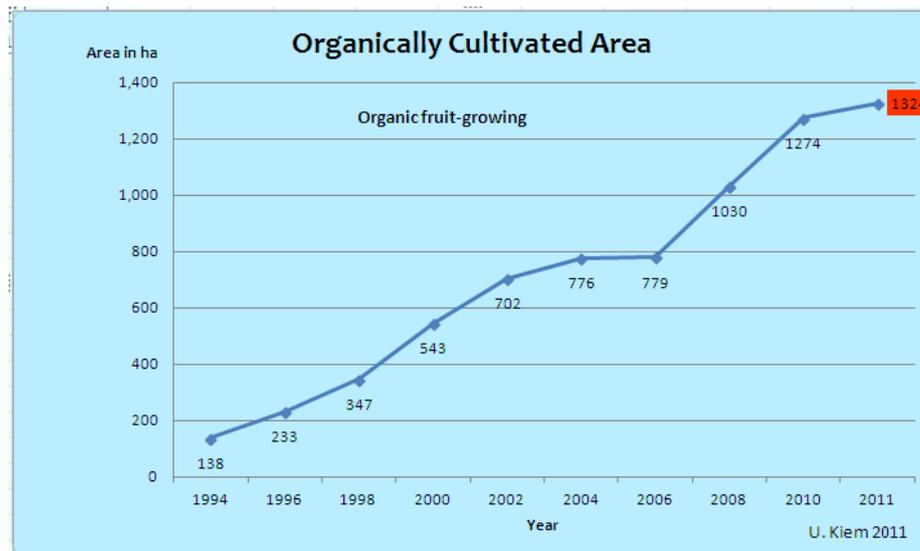
(K. Werth, pers. comm.)

The integrated production rules and regulations were strengthened during this period. The AGRIOS IFP process had to evolve. A new quality control organization, SQK, was created in 2001, and AGRIOS inspectors were transferred to this new structure. Following EU regulations, the IP guidelines are now established in Rome and AGRIOS' influence in the system has been reduced. AGRIOS today is a working group to discuss the IP guidelines that are set elsewhere and has little influence in terms of defining them.

In 1997, European retailers started a certification system to harmonize their standard procedures. The programme was initially named EuroG.A.P. and became GlobalG.A.P. in 2007. The LINSa adopted the GlobalG.A.P. certification and in 2003, 3% of the production area in South Tyrol was certified, and 4 years later 87% of the area was certified. Compared with the 19 years it took to institutionalize IFP, this was a very rapid adoption rate and was linked to factors within the LINSa, but also as a response to the CAP 2003 reforms.

The direct payment to the producer organization through the operation programme now depends on their compliance with the Standards of Management Requirements (SMR), and also Good Agricultural and Environmental Conditions (GAEC) under quality office control (Hermans, Klerkx and Roep, 2010).

There was also an increase in organic production in this same period (Graph 4). The first organic producer started farming in 1974; in 1991, Laimburg Research Station created a research department for organic production; and in 2000, Beratungsring included advice on organic production in its portfolio of services. In 2002, the first co-operative of organic producers was created (BIOP), and in 2003 the first guide on organic production was produced by Beratungsring. In 2011, 4.5% of the apples produced in the province were labelled 'Bio' (Kiem, Erschbamer and Tumler, 2011).



Graph 4. Organically cultivated area in South Tyrol

(K. Werth, pers. comm.)

Research on long-term apple storage was also a focus during this period, and trials with DCA were conducted at Laimburg Research Station. In 2003, the DCA technology was piloted on 150 tonne of apple in the Kaiser Alexander Cooperative. In 2005, four additional cooperatives adopted DCA, then in 2006, 15 additional cooperatives adopted it, and today a majority of cooperatives are using the system. A private company based in Bolzano, Isolcell, markets the technology. This is a significant technological innovation from this period, one that was essentially developed by this LINSAs.

In 2010 and in order to reach new markets, VI.P, VOG and two producer organizations from Trento created a new marketing organization, FROM. Its function is the advancement of apple exports from the region to non-EU countries, to begin with principally to Eastern Europe and Russia. This was stimulated by the erosion of sales in the traditional European markets, and the need to find new markets for products. FROM is the first organization in South Tyrol that includes as equal partners actors outside of the province, thus marking a new development in the LINSAs.

Finally, the Bauernbund very recently created an innovation incubator. This incubator is a forum where members can present and discuss new ideas. If those ideas are thought promising, the Bauernbund then provides assistance to find the financial and technical support for full development of the idea.

Mechanism of network development: Learning and drivers

Formal and informal mechanisms for network development with a strong social learning component have influenced the development of the LINSAs. The formal mechanism elements that supported the development of the network can be found at various levels.

- At the policy level, the provincial government established a good enabling environment by supporting apple producers (e.g. producers are exempt from some taxes), by supporting a good road infrastructure, and establishing a functional AKIS, either by developing public structures such as Laimburg Research Station, or by providing budget support to the Beratungsring. It also provides some directives such as a policy to allocate subsidies to cooperatives of a specific size.
- At the institution level, various linkages have been created. The cooperatives, a key component of the LINSAs, are well supported by the AKIS. Innovation platforms, such as AGRIOS or SK, have been created to provide the necessary space for discussion and learning. Extensionists and producers are included in the scientific committees that provide the input to define the research agenda of Laimburg.

- At the individual level, the competences and motivation of the people involved in the LINSAs are a strong component of network development. Interestingly, during the field visit, it was noticed that every key informant interviewed from the local government, Beratungsring, research or nurseries were themselves or had a close personal connection with an apple producer, further contributing to the trust and common understanding within this LINSAs.

The informal mechanisms used to develop the network are many. For example, as a rule in Beratungsring, every Monday morning all advisers hold an informal discussion around a table. They exchange tips and information and provide to all an overview of what is happening in the province, so each adviser can then inform their clients. Apple producers use every possible network to exchange knowledge and ideas, and 90% of apple producers interviewed for this study explained that a key source of knowledge was farmer to farmer exchange. Of great interest are the settings in which such exchanges took place. A majority of them explained that exchange happens in the margin of farm days or field inspections organized by Beratungsring. Respondents described that it was during coffee time or breaks in these settings that they exchanged knowledge with their peers. The geographical cluster created for innovation is a key mechanism that has allowed the creation of this LINSAs.

The social learning aspect of this LINSAs permeates the system. Learning in South Tyrol is linked to an outside and inside dynamic, both at individual and at collective level. The social capital created in this geographical cluster allows for the development of the system by absorbing existing knowledge from others, creating knowledge and a strong learning ethos in the sense of discovery or invention (Moshitz and Home, 2012). The evolution of the LINSAs followed an organizational learning path typical of a learning organizations (e.g. Cohen and Sproull, 1996; Huber, 1991).

The first period, from 1945 to 1960, was marked by empirical learning, where individuals and to some extent individual cooperatives developed new knowledge based on learning by doing, and trial and error processes. The process was unplanned and is best illustrated by examples such as the introduction of irrigation against frost. To some extent, the early introduction of IPM in 1970s before the creation of the AGRIOS system is also an example of an unplanned learning-by-doing mechanism.

Since 1960 and continuing, the LINSAs has introduced a more efficient mechanism of learning by emulation. Since the creation of Beratungsring and the first visit to Holland to study the Slender Spindle System, the LINSAs concerned itself with gathering knowledge developed elsewhere. Different knowledge channels are used for this type of 'horizon scanning'⁶: consultation of various written publications, visits to other producing areas, participation at events, and organization of fairs in Bolzano to attract outside experts. This type of learning starts as an imitation process and evolves into the improvement and conceptualization of acquired knowledge. The introduction of the Slender Spindle System is an excellent example of learning by emulation.

Finally, and most recently, the system has moved to "a learning by acquisition mechanism", where it understands that some elements needed to evolve are not present within the LINSAs and need to be bought. The development and acquisition of the Clickview software system and the construction of modern infrastructure, such as the automated warehouse and sorting and grading machine by the cooperative MIVOR, are good examples of such learning. (see Photograph 4).

⁶ Horizon scanning is a technique for detecting early signs of potentially important developments through a systematic examination of potential threats and opportunities, with emphasis on new technology and its effects on the issue at hand. The method calls for determining what is constant, what changes, and what constantly changes. It explores novel and unexpected issues as well as persistent problems and trends, including matters at the margins of current thinking that challenge past assumptions. (OECD, 2013)



Photograph 4. Automated warehouse of the MIVOR cooperative.

A common feature of all the learning mechanisms in the LINSIA is the strong bottom-up component, where the request for innovation and ideas is strongly focused on the needs and demands of producers. Finally, another mechanism that contributes to the development of the LINSIA has been the reinforcement of its identity by the recognition of *Mela Alto Adige* as a trademark for origin and quality.

Evolution and development of the linkages and collaboration between stakeholders

The cooperativism and the strong involvement of the fruit growers in the development of the LINSIA are not only a key to the system, but their ongoing role in reshaping the system and their continuous participation and leadership is essential to maintain the efficiency of the network.

The first level of collaboration is based on trust and on common interest, and the first cooperative was created on that basis. These two essential elements are still present today.

In addition to this personal aspect, institutional linkages have evolved as well. They started with the establishment of not-for-profit cooperatives and associations that collaborated to provide a fair return to apple producers. Subsequently, innovation platforms were created, such as AGRIOS, where a group of stakeholders established a workgroup to define and enforce production guidelines. This more formal form of collaboration and exchange reinforces the informal communication channels and the social cohesion among the actors. Actors in the LINSIA are present together in various committees and workgroups, and are also part of the same social networks; the formal and informal linkages reinforce their collaboration and increase the effectiveness and efficiency of the LINSIA.

Recently, linkages have become more professional. The consolidation of the marketing structure at pool level in VI.P and VOG are changing some of the relationships between the producers and their cooperatives. For some interviewees, the increasing size of the cooperative was distancing the producers from their cooperative.

Discussion on linkages and collaboration

An interesting aspect of the linkages and collaboration in the LINSIA has been the difference in pace taken for ideas and innovation to spread in the LINSIA.

For example, looking at two innovation processes: IP and Good Agricultural Practice (GAP):

- It took 18 years, 1970 to 1988, from the first discussion on IP to the creation of AGRIOS.
- It took 5 years, 2003 to 2007, for GlobalG.A.P. certification to pass from 3% coverage to 87% coverage in the province.

IP was very much a bottom-up process, where producers first discussed the need for IP, and then *Beratungsring*, with assistance from the *Bauernbund*, providing training and support to increase the individual capacity of farmers, to finally establishing AGRIOS, gathering input from research and other actors involved. In contrast, GlobalG.A.P. was a top-down process, with specific directives coming from the retailers and supported by the 2003 EU CAP reform. The LINSIA was able to support the capacity development process needed at individual and institutional level by organizing courses and reforming organization. The pace of change was also supported by the awareness of the producers and the social capital built during the IP

process that allowed these changes to take place more rapidly. Compliance with the GAP standard is complex, and it is only thanks to the full support of the AKIS and the cooperatives and the collective action of the LINSAs that it could be met so rapidly. In the words of Paul Romer: “Knowledge builds on itself; the more we discover things, the better we get at the process”⁷.

Another example would be to look at technological innovation:

- It took over 20 years, 1968 to 1990, for the slender spindle system to be used by at least 80% of the producers.
- It took 10 years, 2003 to 2013, for the DCA technology to be adopted by a majority of cooperatives in the region.

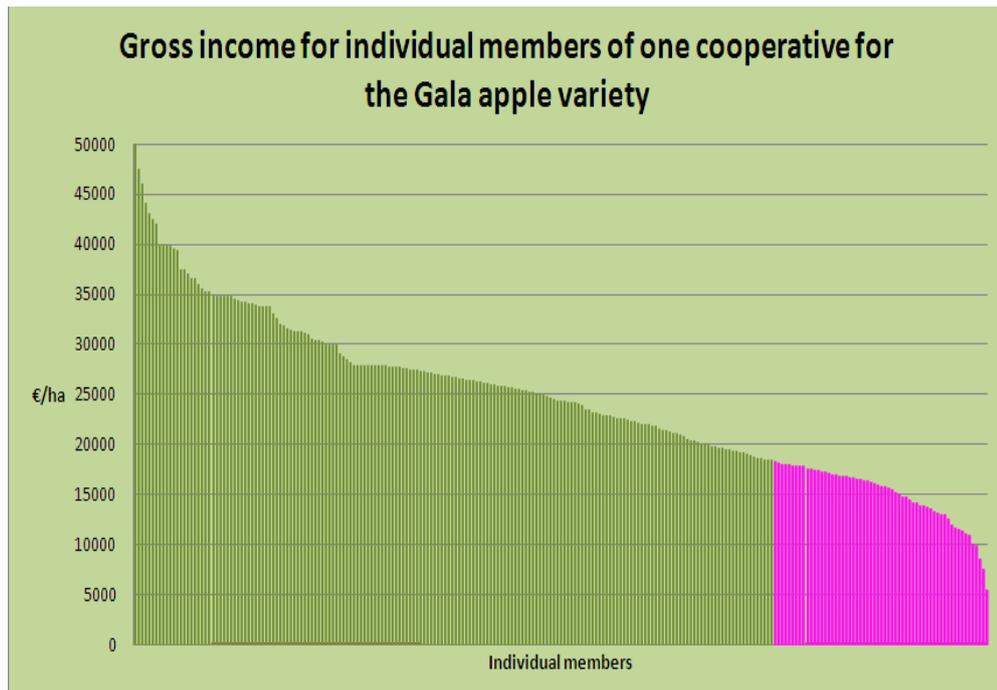
Again, the establishment of the Slender Spindle System was very much an internal LINSAs process, after producers became aware that they needed to change the production system, and Beratungsring found an appropriate technology to be emulated in the province. It was first necessary to share the information about the system, and then to slowly convince producers to adopt it. The education and research as well as support provided when there was need for investment and assistance for loss of production during the switch from the old to the new system were all complementary elements in the process of a generation changing practices. In contrast, the DCA system appeared when the LINSAs was mature; it started by a partnership between a public and a private entity, and built on the post-harvest research that had started in 1972. Cooperatives were involved from the beginning in testing the process, and by using the amortization of their infrastructure, cooperatives upgraded their groups rapidly but without trauma.

An interesting aspect was the types of factor that triggered the collaboration between actors, where in the early stages of the LINSAs most of the factors were endogenous to the system and the capacity development process had to cover people, institutions and policies in a learning-by-doing manner. The later triggers for change were exogenous and the existing system adapted rapidly. Communication between producers and cooperatives, research centres or advisory service providers at this point was excellent, as most of them met regularly, and every adviser or researcher was personally connected to apple production.

Opportunities provided by the Agricultural Knowledge and Information System

As seen from the foregoing, the AKIS system is present and strong in South Tyrol, and the various actors have well-defined roles. The producers and their cooperatives, together with Laimburg and Beratungsring, are the basis of the system. Interestingly, the opportunity for progress in the LINSAs lies in the current variability of production and gross income among producers. As Graph 5 shows, in this very successful LINSAs the variation in income is dramatic. For the same apple variety planted in the same environment and with the same type of advisory services provided, the most successful producer can have a gross income of € 45 000 to € 50 000 per hectare, while the least performing would have a gross income of € 5 000 to € 10 000 (see Graph 5).

⁷ Interview with Joel Kurtzman for the review periodical *Strategy + Business*, 20 November 2001.



Graph 5. Comparison of gross income of members of one cooperative for one apple variety. X-axis represents individual producers of the cooperative. In pink are the producers who are below the break-even point.

Research could identify the underlying sources of the variability, Beratungsring could tailor its advice to the different producers based on their location on the curve, and the education system could review its curriculum to address the challenges identified by research. There is a potential for sustainable productivity increase from existing producers.

An additional opportunity lies in the lesson learnt from the experience with the managed varieties. The LINSAs have an excellent method to learn by emulation or acquisition and has, with the fairs and study tours, developed a good system to gather information on potential threats or opportunities. However, its capacity to analyse the information is based on the knowledge it has accumulated within the LINSAs. It is able to identify opportunities and threats that it understands. The managed varieties system was such a new way of marketing apples that it was not noticed as a threat or opportunity. This implies that the AKIS should develop further its foresight capabilities.

From an innovation perspective, we should note the vibrant private sector in the province, which is supporting the LINSAs. Outside of the not-for-profit institution supporting the producers, various industries have been created, such as the private companies building and marketing post-harvest technologies, or sprayers, or the support service industry to repair machinery and infrastructure. A complete agricultural innovation system has been created to support apple production in South Tyrol.

6. Conclusion

The LINSAs in South Tyrol have adapted and evolved since the end of the Second World War and are today a very successful apple production system. South Tyrol as a geographical cluster for innovation coupled with a favourable productive environment is the basis of this successful value chain. The development of an effective and efficient LINSAs was possible through a combination of organizational learning mechanisms: learning by doing, learning by emulation, and finally learning by acquisition.

The system of cooperatives established in the province is crucial for this network success. Together with the AKIS, they have influenced the rate at which ideas were produced or

emulated, adopted and incorporated in the production system, ultimately contributing to innovation. The enabling policy environment created by the provincial government and the Bauernbund helped this by allowing producers and their cooperatives to take risk and innovate when needed.

The establishment of a strong and well funded AKIS with formal, informal and personal connections with the producer organizations increased the LINSAs efficiency, effectiveness and relevance, and provided a strong agricultural innovation service system to support apple production in South Tyrol. Today, this mature LINSAs can use the knowledge develops itself, or can it emulate knowledge created elsewhere.

In South Tyrol, innovation occurred in various unplanned locations where people, groups or organizations were collaborating. Consciously or unconsciously, the LINSAs evolved based on basic concepts: in a region where soil, water and labour were a finite resource, the path to innovation was to consider knowledge and ideas as their main infinite asset. The LINSAs used this to its best advantage, considering knowledge as a non-rival good it has gathered, and shared it freely and created value from it.

References

- AGRIOS (Workgroup for Integrated Fruit Production in South Tyrol)**. No date [online]. History. See <http://www.agrios.it/history.html> Accessed 2013-08-24.
- Alcock, A.** 2001. The South Tyrol Autonomy. A short introduction. County Londonderry, Bozen/Bolzano. See <http://www.provinz.bz.it/en/downloads/South-Tyrol-Autonomy.pdf> Accessed 2013-08-24.
- Carbonara, N.** 2004. Innovation processes within geographical clusters: A cognitive approach. *Technovation*, 24: 17–28.
- Christanell, J.** Südtiroler Beratungsring für Obst- und Weinbau, J. 2012. Frostberechnung in der Praxis. Presentation made at the Gleisdorf Steiermark on 22 November 2012.
- Dalla Via, J. & Mantinger, H.** 2012. Die Landwirtschaftliche Forschung im Obstbau Südtirols: Entwicklung und Ausblick. *Erwerbs-Obstbau*, 54: 83–115.
- Cohen, M.D. & Sproull, L.S.** (Editors). 1996. *Organizational Learning*. Sage Publications, Thousand Oaks, CA, USA.
- FAO/World Bank.** 2000. Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD). Strategic Vision and Guiding Principles. See <ftp://ftp.fao.org/SD/SDR/SDRE/AKIS.pdf> Accessed 2013-08-23.
- Fedele, J.** 2008. Le origini della Suedtiroler Volkspartei (1945–1948). PhD thesis, University of Padua, Italy. See <http://paduaresearch.cab.unipd.it/1555/> Accessed 2013-08-23.
- Gatterer, C.** 2007. In lotta contro Roma. Cittadini, minoranze e autonomie in Italia. *Praxis 3*, Bolzano (BZ), Italy.
- Hermans, F., Klerkx, L. & Roep, D.** 2010. Comparative Analysis and Synthesis report. WP3 Understanding the Context. SOLINSA. See http://www.solinsa.org/fileadmin/Files/deliverables/D3_1a_Comparative_analysis_and_synthesis_report_final_Nov_2011.pdf Accessed 2013-08-25
- Huber, G.P.** 1991. Organizational learning: the contributing processes and the literature. *Organization Science*, 2(1): 88–115.
- Juma, C.** 2011. *The New Harvest: Clusters as Local Innovation Systems*. Oxford University Press, New York, USA.
- Kiem, U., Erschbamer, M. & Tumler, E.** (editors). 2011. Bio-Leitfaden 2011 Anleitung zum biologischen Obst- und Weinbau. Beratungsring. Südtiroler Beratungsring für Obst- und Weinbau. See <http://www.beratungsring.org/info/organisation/broschueren/bioanbau.html> Accessed 2013-08-23
- Leonardi, A.** 2009. *1809-2009 Südtiroler Landwirtschaft zwischen Tradition und Innovation*. Athesia, Lana (BZ). Italy. 134 p.
- Lösch, F.** 1964. *Nach Kräften unterstützen und Fordern*. Obstweinbau. Südtiroler Beratungsring für Obst- und Weinbau.
- Nicod, C., Chuluunbaatar, D., Hakim, S. & de Meyer, J.** 2013. Smallholder Farmers in South Tyrol's Apple Production: Background Research for the write up of an Agricultural Innovation Case Study. FAO, unpublished report.
- Moschitz, H. & Home, R.** 2012. Studying learning and innovation networks – a conceptual and methodological framework. Paper presented at *Agriculture in an urbanizing society*. International Conference on Multifunctional Agriculture and Urban-Rural Relations, Wageningen, 1–4 April 2012.
- Oberhofer, H.** 2007. Die Geschichte des sudtiroler Kernobst-sortiment. In: H. Oberhofer. *Obst- und Weinbau in Wandel der Zeit*. Sudtiroler Beratungsring für Obst und Weinbau, Lana (BZ), Italy.
- OECD (Organisation for Economic Co-operation and Development)**. 2013. <http://www.oecd.org/site/schoolingfortomorrowknowledgebase/futuresthinking/overviewofmethodologies.htm> Accessed in July 2013.
- Prange, R.K., DeLong, J.M. & Harrison, P.A.** 2005. Quality management through respiration control: Is there a relationship between lowest acceptable respiration, chlorophyll fluorescence and cytoplasmic acidosis? *Acta Horticulturae*, 682: 823–830.
- Putnam, R.** 1993. *Making democracy work: Civic traditions in modern Italy*. Princeton: Princeton University Press.
- Rizzo, F.** 2009. Local institutions and agrarian structure matter in Leader: Case study from Finland and Italy. *Maaseudun uusi aika*, 2.

- VOG.** 2013. The Association of South Tyrolean Fruit Growers' Co-operatives. See <http://vog.it/en/our-company/history.html> Accessed October 2012.
- Wülker, H.D.** 1995. The Raiffeisen Principles. A presentation by the Secretary General of the International Raiffeisen Union (IRU), on April 6, 1995, at the Rabobank Nederland, Utrecht, on the occasion of an IRU/ICA joint meeting. See <http://www.iru.de/index.php/iru/die-raiffeisen-prinzipien?lang=en> Accessed 2013-08-23.
- Zanella, A., Cazzanelli, P. & Rossi, O.** 2008. Dynamic controlled atmosphere (DCA) storage by the means of chlorophyll fluorescence response for firmness retention in apple. *Acta Horticulturae*, 796: 77–82.