

AlpBioEco

Market Potential Analysis for Regional Products in the Alpine Space

Value Added Chain – Apple



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1 INTRODUCTION

In addition to falling production prices, the food sector in the Alpine region is facing increasing competition on the world market. Furthermore, a central challenge in primary production, processing and marketing is to meet the challenges of a sustainable economy with global climate protection goals as well as to satisfy changing consumer expectations with new product innovations. The bioeconomic opportunities along the value chain of selected primary products in the Alpine region do not yet seem to have been sufficiently exploited. The better use of by-products and waste products from primary production and more sustainable production processes in the sense of the circular economy still hold untapped potential. New innovative production, processing and marketing strategies are in demand.

The Interreg Alpine Space Project "AlpBioEco" has set itself the objective of highlighting the potential of the bio-economy for the creation of "green growth" and new employment opportunities in the Alpine region. In concrete terms, "AlpBioEco" has decided to develop good practices and new business models for the Alpine Food and Botanical Extracts Sector. To do so, the project will determine the bio-economic potentials along the value chains of apple, herbs and walnuts.

As a contribution to the work package WP-T1 of "AlpBioEco", this study analyses the value chain of apple cultivation (production, processing, marketing, distribution respectively consumption) and the corresponding bioeconomic potentials in the Alpine region. For this purpose, basic information is acquired that should enable the identification of innovative bio-economic business models. By presenting the economic relevance and the market dimension as well as the bioeconomic potentials, this report shows how the competitiveness of apple cultivation can be increased and its economic strength can be boosted by cross-border cooperation between the Alpine countries.

The Alpine Space investigated extends from France to Slovenia and comprises a total of five EU Member States (France, Germany, Austria, Italy, Slovenia) as well as Liechtenstein and Switzerland. The Alpine region is more vulnerable than other European regions to the effects of climate change, which results, among other consequences, in extreme weather events or natural disasters. In this geography region, natural and economically prosperous regions meet in the narrowest of spaces, densely populated and depopulated regions, traditionally rural areas with areas of high research competence and regions that provide and use natural resources. The Alpine region is a region full of diversity and contrasts: Untouched nature and lively cities, innovative research centers and sparsely populated regions, the use of natural resources and the protection of sensitive ecosystems characterize its image.



Figure 1: participating regions of Alpine Space

List of participating regions divided by country:

Austria	Whole country
Liechtenstein	Whole country
Switzerland	Whole country
Slovenia	Whole country
France:	Région Auvergne-Rhône-Alpes*: Ain, Ardèche, Drôme, Isère, Loire, Rhône, Savoie, Haute-Savoie Région Bourgogne-Franche-Comté*: Doubs, Jura, Haute-Saône, Territoire de Belfort Région Grand Est*: Bas-Rhin, Haut Rhin Région Provence-Alpes-Côte d'Azur
Germany:	Freiburg Oberbayern Schwaben Tübingen
Italy:	Liguria Piemonte Lombardia Trento Bolzano Veneto Friuli Venezia Giulia

2 METHODS

Basic research

To create a market overview of the product “apple” we conducted a desktop research between September and December 2018. The research surveyed secondary statistical sources, which include international statistical databases (e.g. FAOstat, Eurostat) and were complemented with regional analyses of the respective state institutions from the single Alpine countries (e.g. Amt für Land- und Forstwirtschaft Südtirol, Landesinstitut für Statistik der Aut. Prov. Bozen – Südtirol (ASTAT), Trentino Agricoltura, Bayerische Landesanstalt für Weinbau und Gartenbau, Landwirtschaftskammer Österreich). Thereof, we generated market data on regional production (e.g. regional growing areas, production quantities, sales volumes classified by the main products, etc.) and merged them in a synoptic presentation for further market analyses.

Furthermore, we systematically evaluated explorative results of international as well as regional specific publications and statistics on agricultural economics and marketing as well as fruit cultivation. That also included documents and reports from international associations (e.g. World Apple and Pear Association, Eurofruit, Assomela), events (e.g. Prognosfruit, Interpoma) or institutions as well as from the regional advisory rings of the apple cultivating regions. This analysis provided insights into the organization of production and storage methods, processing, quality assurance as well as marketing and disposal methods. Specifically we examined from the literature new product innovations as well as modern marketing and sales opportunities following the principles of the bio-economy. For the identified main products in the apple value chain, we schematically traced the networking of the major players along the value chain.

Validation and optimization of the market overview

In a second step, we validated the obtained market data and supplemented them by other experts. For this purpose, we conducted quantitative and qualitative interviews.

Firstly, we requested national and regional experts to provide us with an E-Mail feedback on the drafted synopsis of results, we could so far prepare from our first market analysis. This E-Mail survey among regional experts offered the possibility to request in detail additional data and information on the products and gave us a deeper insight to the situation at a smaller production scale. In the six sections of the questionnaire, we asked about general data on apple cultivation, the value chain and the relevant actors, market data and products, regional specificities, projects and initiatives. Furthermore, we requested them to send us unpublished studies and statistics. For the identification of contact persons and experts, we could count on the support from the project partners. In December 2018, we sent the E-Mail survey to more than 200 experts from the regions of interest. At least, 18 of them answered and provided us a completely compiled questionnaire (3 Austria, 5 Germany, 3 Switzerland, 6 Italy, 1 Slovenia, 0 France). That makes a return rate of nearly 9%.

In addition, we conducted telephone interviews with experts. Their assessments provided us the missing link to gaps and deficiencies on incompletely developed value chains, on previously unknown production areas or on missing information concerning the potential of bio-economic products. Due to the spatial distribution of the production areas within the single Alpine countries, we have foreseen 1-2 interviews

per country to consider also the spatial allocation. The selection of the interview partners resulted from the E-Mail request to experts to give feedback on the drafted synopsis results: in that request, the respondents could indicate their contact, if they agreed to give deeper information on the topics. We contacted all persons that have indicated their interest in a talk. In the beginning of February 2018, seven experts – 1 from Austria, 2 from Germany, 2 from Switzerland, 1 from Italy, 1 from Slovenia, 0 from France – gave interviews on the phone. The talks lasted from 15 minutes to 1 hour. The interviewer took notes on the most important information during the interviews. Therefore, it was not necessary to transcribe them.

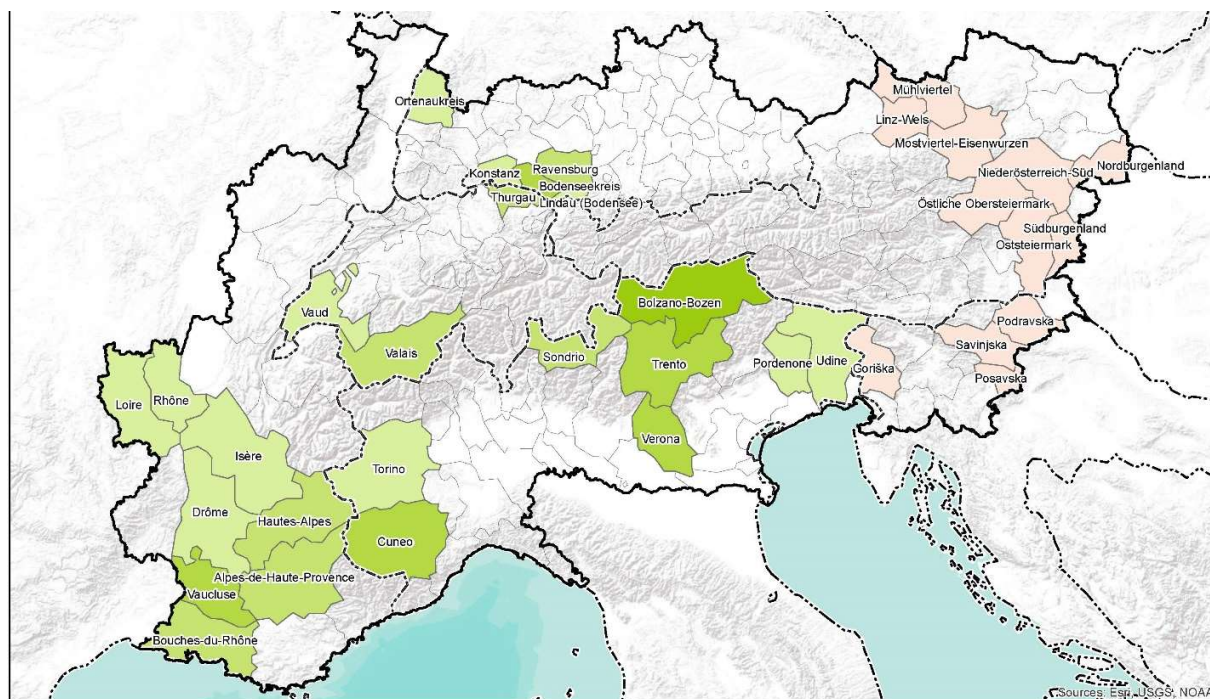
Despite the effort involved, the depth of detail and the amount of qualitative data processed in this report, we do not claim to have achieved by any means a satisfactory level of completeness in this first Alpine overview of apple cultivation. Still, the results provide a first insight into the various realities of apple cultivation and allow conclusions based on mutual comparisons.

3 PRODUCTION

In the following chapter, the most important apple growing areas of the individual countries are shown for the Alpine Space area. Depending on the available data and the availability of information, we provide an overview of the details of production, the prevailing farm structures and the special characteristics of the individual growing regions.

Total production in the Alpine Space

Figure 2 shows that apple cultivation in the Alps is concentrated in a few priority regions. The extreme southwest, in the French Alps and the Piedmont Alps, is one of the priority areas. In the cantons of Vaud and Valais, but also in Thurgau, there are important cultivation areas in the Swiss Alps. The Trentino Alto Adige region is the largest contiguous cultivation area in terms of area, which is also the most intensively cultivated. Further southeast in the Friuli-Venezia Giulia region and beyond the Italian border in Slovenia near Gorizia we have another small apple growing area. A traditional apple-growing region in Germany, also known beyond the Alps, lies in the Bodenseeregion around Konstanz, Lindau and Ravensburg. The cultivation area at the eastern foothills of the Alps forms the eastern border and extends from the Mühl- and Mostviertel via southeastern Steiermark to the northern Slovenian region.



Main apple cultivation NUTS3 - regions in the Alpine Space

Relevant apple cultivation area at NUTS3 level [ha]

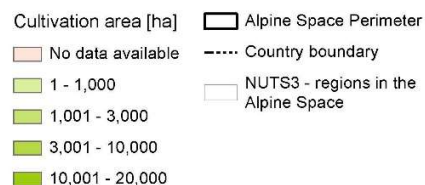


Figure 2: The most important apple-growing regions (NUTS 3) in the Alpine Space (source: Eurac Research, Institute for Regional Development).

National data Germany

Main cultivation areas

Within Germany, the Bodenseeregion in Baden-Württemberg with the districts of Bodenseekreis, Ravensburg and Konstanz is one of the main apple-growing areas in the Alpine region and is known mainly for table apple production. Another relevant area in the Alpine region of Baden-Württemberg is the Ortenau district (Statistisches Landesamt Baden-Württemberg, 2017). Within Bavaria it is the administrative district of Lindau (Bodensee) where on 521 hectares (82% of the total apple cultivation areas in the Bavarian Alpine region) most apples are cultivated (Bayerisches Landesamt für Statistik, 2017).

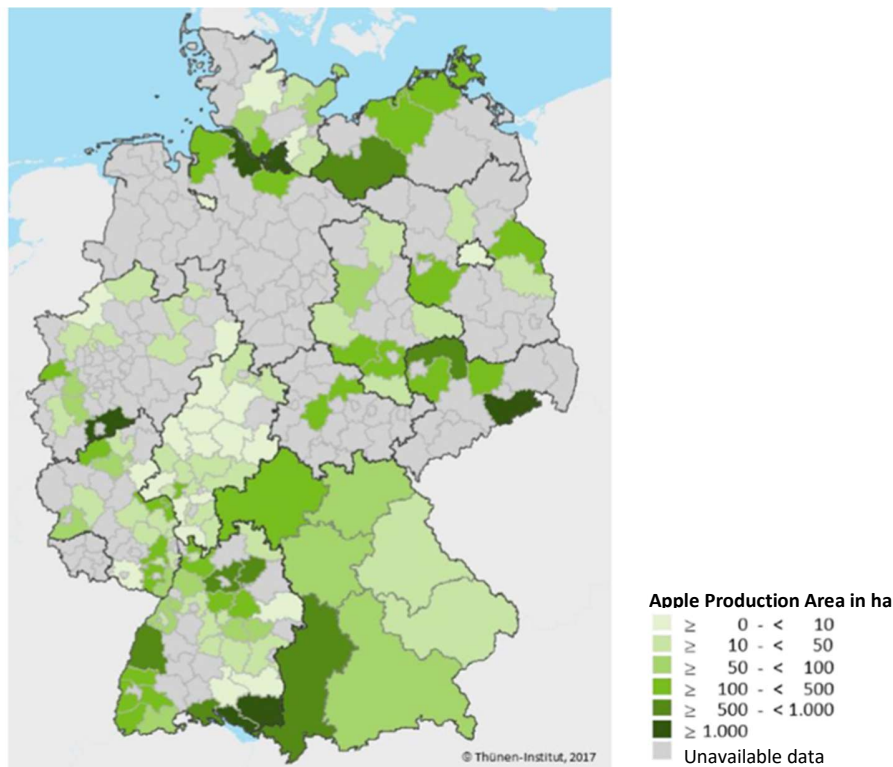


Figure 3: Apple cultivation areas in Germany, 2017. Source: Garming et al., 2018.

Production

With 10,206 hectares of apples, 30% of the apple cultivation area in Germany is located in the Alpine Space area. In Baden-Württemberg, 12,106 ha of apples are cultivated. Of this total, 9,570 ha are located in the two administrative districts of Freiburg and Tübingen, which are located in Alpine Space. Table apples are produced on a major part (83%) of the total area under apple cultivation in Baden-Württemberg. Apples for further processing are cultivated on 17% of the area. 7,100 ha (70%) of the table apple production area is located in the Bodenseeregion, which extends over the districts of Bodenseekreis, Ravensburg and Konstanz. In this region, about 870 ha of apples are cultivated for further processing, partly in new plantations with a planting density of 500-600 trees/ha, which were specially planted for juice and fructose production.

In Bayern, apples are cultivated on a total of 1,207 hectares, of which slightly more than half (636 ha) can be found in the Alpine Space area in Oberbayern and Schwaben. 85% of the area is used to produce table apples, 15% for the production of apples for processing. While in Schwaben 92% of the area is used for the production of table apples and only 8% for the production of apples for processing, in Oberbayern 59% for the production of apples for processing and 41% for the production of table apples.

APPLE PRODUCTION IN ALPINE SPACE GERMANY						
	total area of cultivation		thereof table apples		thereof processing apples	
	Number of holdings	acreage [ha]	Number of holdings	acreage [ha]	Number of holdings	acreage [ha]
Bayern (total)	567	1207	273	925	356	282
thereof Oberbayern	37	86	18	35	25	51
thereof Schwaben	142	550	108	504	48	46
Oberbayern+ Schwaben	179	636	126	539	73	97
Baden-Württemberg (total)	3295	12106	1695	10012	2020	2093
thereof Freiburg	1384	2327	501	1709	1014	619
thereof Tübingen	1064	7243	733	6468	474	755
Freiburg+Tübingen	2448	9570	1234	8177	1488	1374
Alpine Space Deutschland	3527	10206	1360	8716	1561	1471

Table 1: Apple production in Alpine Space – Germany. Source: Bayrisches Landesamt für Statistik, 2017; Statistisches Landesamt Baden-Württemberg, 2017; Bayrisches Landesamt für Statistik, 2018; Statistisches Bundesamt (Destatis), 2018.

17% of the total apple production area in Baden-Württemberg is managed according to organic principles. 1,375 ha as table apples and 717 ha as processing apples (Statistisches Landesamt Baden-Württemberg, 2017). In an online survey in Tübingen, the proportion of organic cultivated areas was estimated to be 20%, which is significantly higher than the 4% estimated in Freiburg.

The main types of cultivation are spindle in apple orchards and high trunk in scattered apple plantations. In the online survey, the experts identified the spindle as the type of cultivation with the greatest potential in the region. The experts rated the scattered apple plantations as having average potential.

Distribution of varieties:

In the Alpine Space in Germany the main variety is Elstar (20%) followed by the varieties Jonagold, Gala and Braeburn (Figure 4).

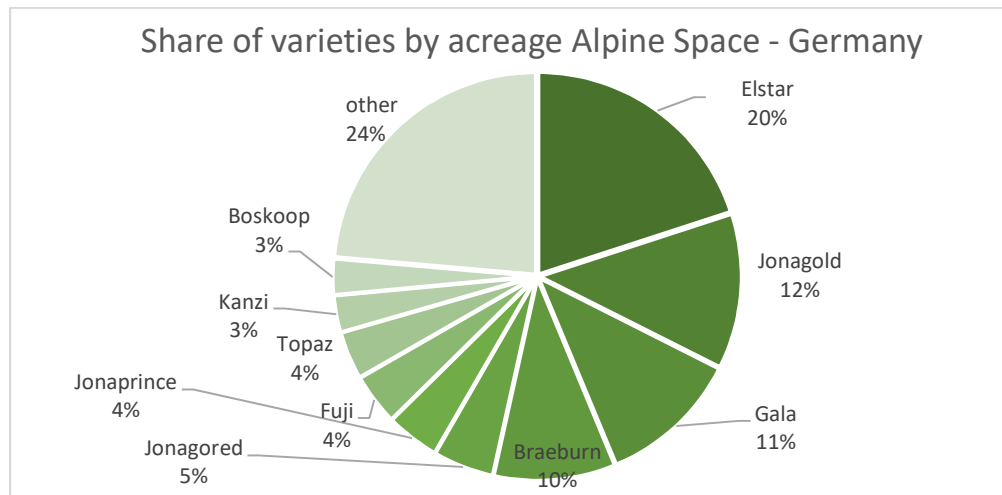


Figure 4: Share of varieties by acreage Alpine Space – Germany. Source: Own figure, according to Bayrisches Landesamt für Statistik, 2017; Statistisches Landesamt Baden-Württemberg, 2017.

The most important varieties in Tübingen and Freiburg were Nicoter/Kanzi, Caudle/Cameo and Evelina. In Freiburg, early apples/summer apples and Boskoop are regarded as typical regional varieties. In Tübingen, numerous traditional and regional varieties are cultivated in scattered apple plantations. These include Brettacher, Jakob Fischer, Boskoop, Schwaigheimer, Teuringer Rambour, Bittenfelder, Goldparmäne, Bohnapfel, Gewürzluke, Schweizer Rosenapfel and numerous other regional varieties.

Variety	Elstar	Jonagold	Gala	Braeburn	Jonagored	Jonaprince	Fuji	Topaz	Kanzi	Boskoop	Golden Delicious	Pinova	Santana	Delba-restivale	Idared	RubINETTE	other	Total
acreage [ha]	1742	1083	986	847	425	372	359	333	257	252	115	108	66	47	29	16	1676	7037
[%]	20,0%	12,4%	11,3%	9,7%	4,9%	4,3%	4,1%	3,8%	2,9%	2,9%	1,3%	1,2%	0,8%	0,5%	0,3%	0,2%	19,2%	100%

Table 2: Area shares of the varieties in Alpine Space Germany. Source: Bayrisches Landesamt für Statistik, 2017; Statistisches Landesamt Baden-Württemberg, 2017.

Operating Structures

Baden-Württemberg:

A closer look at the farm structures reveals a fundamental trend towards larger farms: small farms are becoming fewer, large farms are increasing. In general, it can also be observed that the larger the farms, the more table fruit and the less fruit is produced for processing. The farm structure differs in Freiburg and Tübingen. In Tübingen (Bodenseekreis + Ravensburg), which is important for table fruit cultivation, 71% of the total area under cultivation belongs to large farms (>10 ha) and only 5% of the area is part of small farms (0.5-2 ha) (Hartmann, 2017). Also, the online survey showed for Tübingen an average farm

size of approximately 9-15 (20) hectares for farms with apple orchards. This does not include scattered apple plantations. According to the survey, these have an average farm size of 1-2 ha.

In Freiburg, the average farm structure is slightly smaller (52% of the total area under cultivation in large-scale farms and 14% in small-sized farms). In Freiburg it can also be seen that small farms mainly produce fruits for processing (Hartmann, 2017). In the Bodenseeregion, the average farm size of 7.1 hectares is within the German average. The average apple cultivation area in the rest of Baden-Württemberg is significantly lower. Also, in Schwaben (Bavaria) the average apple cultivation area is about 3.9 hectares (Garming, et al., 2018).

Special Characteristics

A special characteristic of German apple cultivation is the relatively high proportion of must fruit/scattered fruit (Garming et al., 2018), even though there is no exact census of the scattered fruit areas for the total German cultivation area (Streuobst Bodensee, 2008). In Baden-Württemberg, however, the areas planted with scattered fruit plantations were surveyed in 2009:

„Whereas 15 million trees were counted in Baden-Württemberg in 1935, at the last census in 2009 the number was only 9 million trees on an area of approximately 116,000 hectares, which has since been further reduced (Scharfenberger, 2018). [...] If one calculates the annual decrease rate from the difference between the 11.4 million fruit trees in 1990 (Maag, 1992) and the 9.3 million in 2005 and updates this annual decrease rate from 2005 to 2013, a population of approx. 8.2 million fruit trees on an area of 102,500 hectares results. Compared to 1990, the number of fruit trees in Baden-Württemberg has therefore decreased by approx. 28%. If we assume for a first estimation for the period 1988 to 2013 the same annual decrease of fruit trees as in Baden-Württemberg from 1990 to 2005, we would still have 6.2 million trees in Bavaria. If we continue in a second calculation the mentioned annual rate of decline of 2.65 % until 2013, we still have about 5.5 million fruit trees in 2013 purely mathematically. The rounded 6 million fruit trees for 2013 correspond to 75,000 hectares of scattered fruit areas in Bavaria" (Kilian, 2013).

In Baden-Württemberg, the scattered apple plantations mainly contribute to the processing industry: The scattered fruit survey which was conducted between 2000 and 2005 identified 9.2 million fruit trees as scattered fruit trees in the federal state, of which around half were apple trees (Schmieder and Küpfer, 2010). Even though scattered fruit cultivation also exists in the other federal states, no systematically collected data are available (Garming et al., 2018).

National data Austria

Main cultivation areas

In 2017, 1,932 farms cultivated apple orchards, which covered 7,700 ha or 49% of the total orchard area. Thus, the number of farms decreased by 5% compared to 2012. The number of trees also fell by 3% to 22.4 million. The tree-density remained almost constant with an average of 2,923 apple trees per hectare. Almost three quarters (74%) of the apple area had tree densities of more than 2,400 trees per hectare. Particularly high tree densities were recorded for the varieties Gala, Golden Delicious, Braeburn, Granny Smith and Red Delicious, but also for more recent varieties such as Opal, the red-fleshed summer apple Red Love and Crimson Crisp (Statistics Austria, 2018c).

Production

On average, 70% of the total fruit production in Austria originates from intensive orchards and 30% from extensive orchards (scattered fruit plantations).

Share on intensive/extensive apple yield			
	total	% intensive	% extensive
production [t] 2017	185244	70%	30%
production [t] 2018	387954	62%	38%
average production 2012-18	252785	70%	30%

Table 3: Percentage of intensive/extensive yield, Source: Statistics Austria, 2018b.

Approximately 50% of Austria's fruit-growing area is cultivated with apples. The main cultivation region is the Steiermark with 78% of the area, followed by Niederösterreich (9%) (Statistics Austria, 2018b). The main location for apple cultivation is the village of Puch on the Steirische Apfelstraße.

Intensive Apple production Austria 2017						
	acreage [ha]	% share of total acreage Austria	Production in tons [t] 2017	Average Production [t] 2016-18	% average share of total production	Yield [t/ha]
Burgenland	309,41	5%	7.116,53	7.735	5%	23
Carinthia	24,48	0%	440,70	380	0%	18
Lower Austria	619,29	9%	13.624,42	13.607	9%	22
Upper Austria	312,95	5%	10.953,15	11.533	8%	35
Salzburg	0,50	0%	2,75	2	0%	6
Styria	5.216,00	78%	93.887,94	105.780	74%	18
Tyrol	91,21	1%	1.368,15	2.003	1%	15
Vorarlberg	26,48	0%	45,02	641	0%	2
Vienna	67,01	1%	1.916,56	1.701	1%	29
Austria	6.667,33	100%	129.355,22	143.381	100%	19

Table 4: Intensive apple production in Austria 2017. Source: Statistics Austria, 2018b.

In conventional cultivation, Gala (24%), Golden Delicious (22%) and Jonagold (9%) are the most important varieties (Figure 5). The most important varieties in organic cultivation are Gala (22%) and Topaz (21%), Golden Delicious (13%) and Braeburn 7%. By now, 461 farms (24%) manage their apple orchards organically. 76%, however, continue to work conventionally. The highest proportion of organic farms,

37%, is in Oberösterreich. In terms of area, 22% (1,700 ha) are organically farmed and 78% adhere to the conventional system.

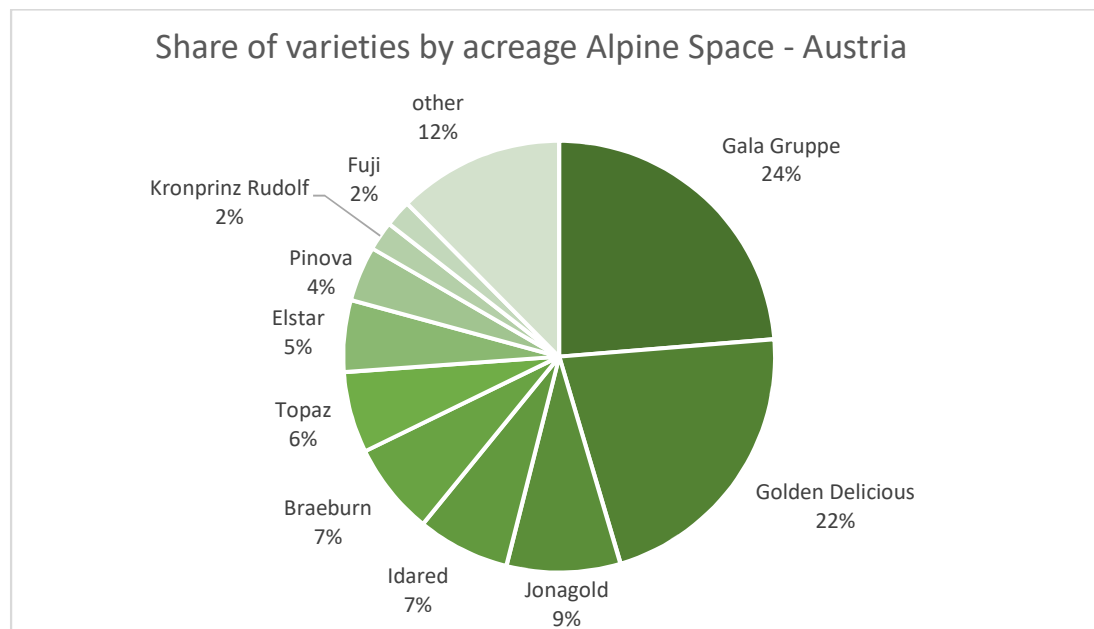


Figure 5: Share of varieties by acreage Alpine Space – Austria. Source: Own figure, according to Statistics Austria, 2018e.

The area of organic production almost doubled compared to 2012. Most organic apple cultures (71%) could be found in the Steiermark. In Niederösterreich 20% of the areas were located, in Oberösterreich 5% and in the Burgenland 3%. In relation to the total apple area of a federal province (apart from Salzburg with a total area of 1 ha), the highest organic share was recorded in Niederösterreich, where 45% of the areas are organically farmed (Statistics Austria, 2018c).

Operating structures

In most federal states, the majority of farms are small-structured with areas measuring up to 2 hectares. An exception is the Steiermark, where about 30% of the farms are larger than 5-10 hectares and where about 12% of the farms manage more than 10 hectares. Also, in Oberösterreich almost half of the farms are larger than 2 hectares, whereby even a quarter of the farms are larger than 5 hectares (Statistics Austria, 2018c) (Table 5).

Distribution of size of agricultural holdings Austria		
Size of holdings	share of holdings	share of acreage
< 2ha [%]	52%	8%
2-5ha %	18%	15%
5-10ha %	21%	40%
10-15ha %	5%	15%
15-20ha %	4%	22%

Table 5: Size of apple producing agricultural holdings. Source: Statistics Austria 2018c.

Special Characteristics

Almost half (47%) of all apple farms are already equipped with anti-hail nets. With an increase of 16% compared to 2007, the area now being covered is 76% (Statistik Austria, 2018c).

62% of the apple area already existed before 2009. Only within the last three years, between 2015 and 2017, 12% of the area was newly planted. 40% of all apple farms planted during this period (Statistik Austria, 2018c).

Supply balance for apples in Austria (average of 2012-16)	
Production [t]	280.394,8
Imports [t]	118.671
Exports [t]	88.889,8
Domestic use ² [t]	310.175,6
Processing ¹ [t]	119.200
Losses [t]	32.905
Human consumption ²	158.070,6
Human consumption per capita (in kg)	18,42
Degree of self-sufficiency in %	88,2

¹ for producing juice, must and spirits; ² including imported jam and preserved fruits

Table 6: Supply balance for apples in Austria. Source: Statistics Austria, 2018d.

National data Italy

Main cultivation areas

In Italy, the Alpine Space covers 7 regions. Four of them are very relevant for apple growing. The main cultivation area is Südtirol/ Alto Adige with 18,500 ha of cultivated area (42% of apple cultivation in the Italian Alpine region) followed by Trento with 9,929 ha (23%) and the two regions Veneto and Piemonte, each with 14% of cultivated area (reference period 2017; Istat, 2019). In 2010, the Trentino-Alto Adige region, with the two autonomous provinces of Bolzano and Trento, had 50% of Italy's apple areas with intensive fruit cultivation and 70% of Italy's total harvest were produced in these areas (Garming et al., 2013).

Production

In 2018, a total of 44,049 hectares of apples were cultivated in Alpine Space in Italy, of which 95% (42,013 hectares) were in production. The total apple harvest was 2,149,668 tonnes, slightly above the average harvest of the past 9 years (2009-2017: 2,005,053 tonnes). The average harvest is 48.77 t/ha.

Apple production Italy - Alpine Space			
	2017	2018	average (2009-2017)
apple surface total [ha]	43.902	44.049	42.920,0
apple surface in production [ha]	41.410	42.013	40.838,7

apple surface out of production [ha]	2.492	2.036	2.081,3
percentage of surface in production [%]	94%	95%	95%
percentage of surface out of production [%]	6%	5%	5%
total production [t]	1.630.220	2.149.668	2.005.053
total production harvested[t]	1.615.052	2.128.812	1.992.029
Yield [t/ha]	39,00	50,67	48,77

Table 7: Apple production Alpine Space – Italy. Source: Istat, 2019.

Golden Delicious is with 48% the most cultivated variety in the Alpine Space in Italy. This is followed by Gala with 14% and Red Delicious (11%) (Figure 6).

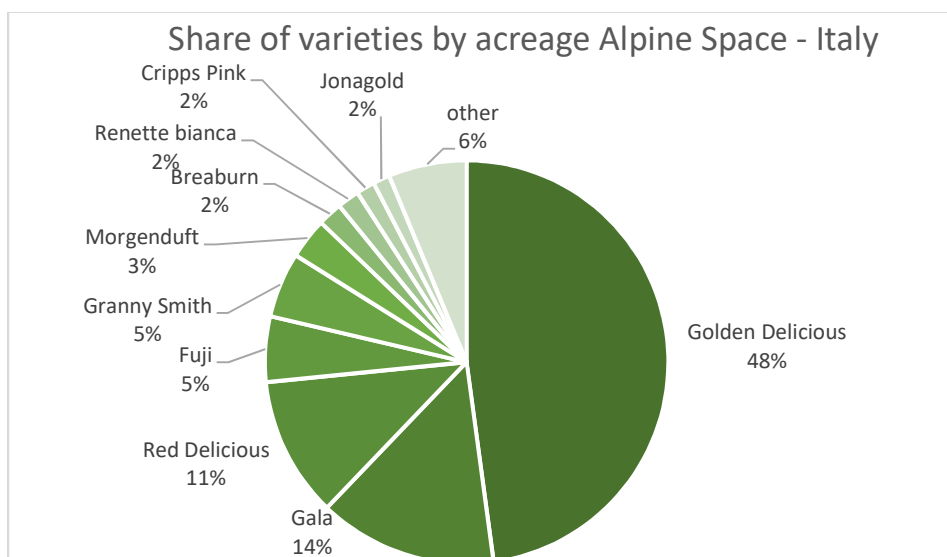


Figure 6: Share of Varieties Alpine Space by acreage Italy. Reference year 2012. Source: Istat, 2012a.

Operating structure

In 2007, there were 28,898 apple-growing enterprises in the Italian Alpine region. In 2010, the average size of apple farms in Italy was 1.1 hectares. Between 2000 and 2010 the number of farms in Italy decreased by 58%. This means that the number of farms more than halved during this period. The shift due to the structural change towards fewer but larger farms took place to a lesser extent in the Alpine region of Trentino-Alto Adige compared to the other Italian regions. This underlines the continuing importance of small enterprises in this region (Garming et al., 2013), which are excellently organized through the cooperative system.

Percentage of acreage by size class of holding in %	
<1,00 ha	28,5
1,00 -1,99 ha	13,1
2,00 - 2,99 ha	9,9
3,00 - 4,99 ha	17,1
5,00 - 9,99 ha	16,0
≥10,00 ha	15,5
Total	100,0

Table 8: Percentage of acreage by size, class of holding in %. Source: Istat, 2012b.

Special Characteristics

Between 2007 and 2013, the average yield in the Italian growing regions amounted to 40 tonnes/ha. Compared to other countries, the productivity per hectare in Italy is higher due to the favorable climate. In Trentino-Alto Adige, the productivity per hectare was significantly higher than the national average: during the same period, an average of approx. 55 tonnes per hectare of apples were produced in this alpine region (Garmin et al., 2013).

National data Switzerland

Main cultivation areas

All of Switzerland lies within the Alpine Space programme area. The main apple-growing regions are Thurgau (31%), Valais (28%) and Vaud with 15% of the total apple-growing area in Switzerland (Table 9). Apple cultivation is the main fruit crop in Switzerland with 60% and is cultivated on a total of 3,806 hectares. Apple cultivation has been declining steadily since 2010. Compared to 2010, areas used for apple cultivation have declined by 9.8%. This decline can also be seen in the main growing regions (BLW, 2017).

Apples from intensive orchards Switzerland				
	Switzerland total	Thurgau	Vaud	Valais
Acreage [ha] 2017	3.805,9	1.163,1	551,6	1.054,4
Share of acreage [%]	100%	30,6%	14,5%	27,7%
Change in Acreage [%] 2010-2017	-9,8%	-10,8%	-11,9%	-11,3%

Table 9: Apples from intensive orchards – Switzerland. Source: BLW, 2017.

Production

The total harvest in 2017 was 147,058 tonnes, 73% of this coming from intensive orchards. The average harvest (2013 - 2017) was 32.04 t/ha.

Apple Production in Switzerland		
	Quantity [t]	share of total production [%]
Production total [t] 2017	147.058	100%
Production from intensive orchards [t] 2017	107.970	73%
Production from scattered orchards [t] 2017	39.088	27%
Average Production total [2010-17]	197.407	100%
Production from intensive orchards [t] 2010-17	128.084	65%
Production from scattered orchards [t] 2010-17	69.324	35%
Yield [t/ha] 2017	28,4	
Yield average [t/ha] 2013-17	32,04	

Table 10: Apple production in Switzerland. Source: Agristat, 2018.

In the years 2013 - 2017 the average harvest of apples was 32.04 t/ha.

Yield Switzerland [t/ha]	
2013	33,2
2014	36,6
2015	36,7
2016	25,3
2017*	28,4
average (2013-2017)	32,04

Table 11: Yield of apples 2013 – 2017. Source: Agristat, 2018.

Gala is the main variety of apples cultivated in Switzerland with 24%, followed by Golden Delicious (12%) and Braeburn (9%) (Figure 7).

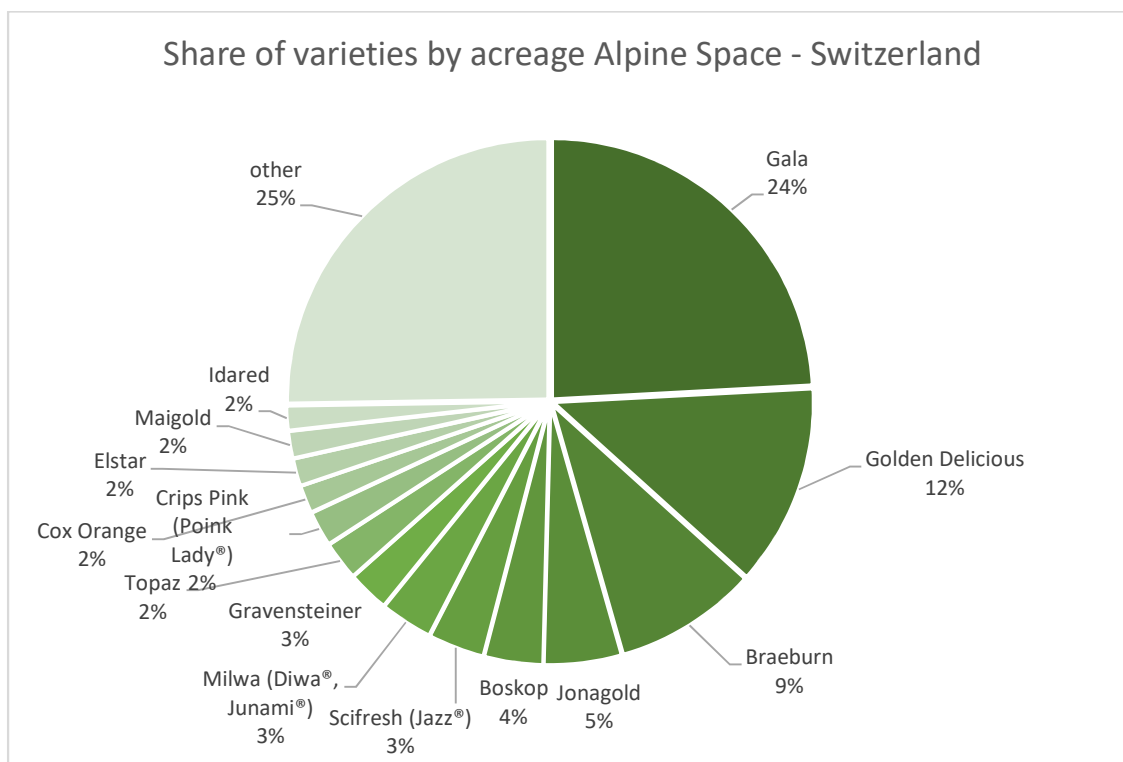


Figure 7: Share of varieties by acreage Switzerland. Source: Bundesamt für Landwirtschaft, 2017.

Special Characteristics

"The Swiss fruit sector is aligned to the Swiss domestic market. In 2014, 1,881 tonnes of table apples were exported out of a total of 142,000 tonnes. Special varieties are exported, which are also specially marketed. Switzerland's good image as a country with an intact environment, clean air and clean soil certainly offers opportunities for improvement" (Schweizer Obstverband, 2015).

National data France

Main cultivation areas

The main growing region in France is Provence Alpes - Cote d'Azur. This region produces about 24% of the French apples on an area of 9,015 hectares. The main production areas are Vaucluse followed by Bouches-du-Rhône, Haute-Alpes and Alpes-de-Haute-Provence.

Rhône Alpes is the number two apple growing region in the French Alps, with 3,220 hectares. It accounts for about 8% of the total French area under apple cultivation. Compared to Alpes Cote d'Azur, apples are grown here on smaller farms. In Alsace, on the other hand, only 1.2% (457 ha) of the French apple cultivation area remained. On ¼ of the production area, apples are mainly grown here for juice production. 1/3 of the total fruit production in Alsace is used for processing. The region of Franche Comte, on the other hand, with 28 hectares or 0.1% of the apple cultivation area of France, makes no significant contribution to French apple cultivation (Agreste, 2015).

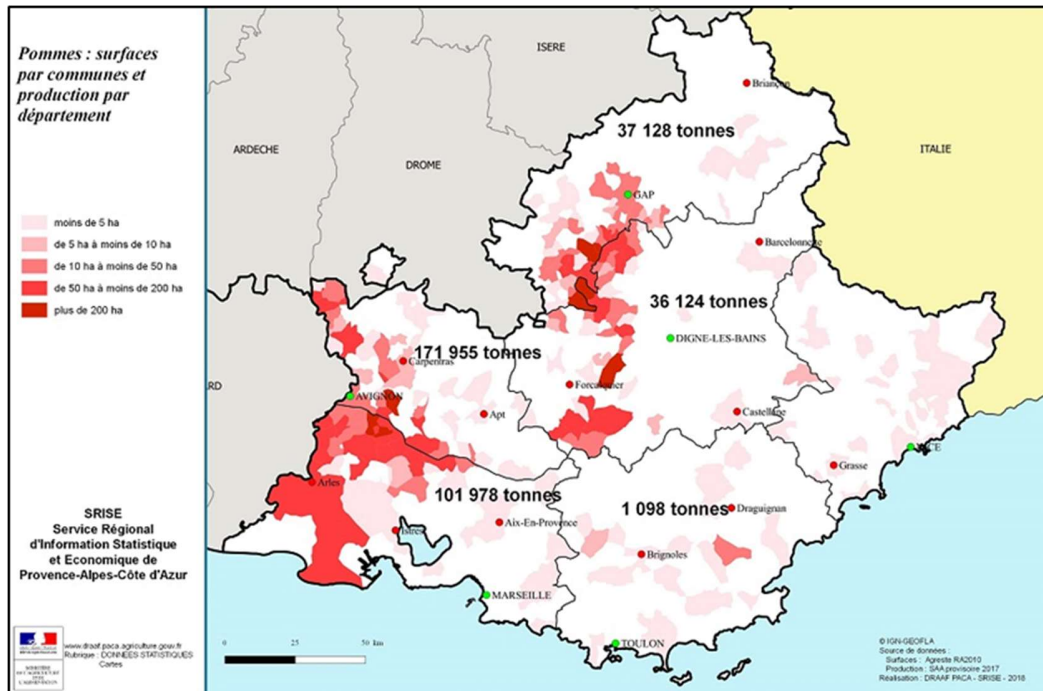


Figure 8: Apple production area in the province of Alpes-Cote d'Azur – France. Source: SRISE, 2018.

Production

In the Alpine Space of France, a total of 1,499 farms with an average of 8.5 hectares cultivate 12,720 hectares of apples. In 2013, 93% of these were conventionally cultivated and 7% organic (Agreste, 2015).

APPLE PRODUCTION IN THE ALPINE SPACE FRANCE (2013)								
	Number of holdings	acreage [ha]	Apple orchards in production net areas [ha]	acreage organic [ha]	acreage conventional [ha]	Average farm size [ha]	Share of total acreage in France	Percentage of holdings in France
France continental	3942	37296	34821	1995	32826	9,5	100,0%	100%
Frankreich AlpineSpace	1499	12720	12022	825	11867	8,5	34,1%	38%
Provence Alpes Côte d'Azur	766	9015	8625	463	8552	11,8	24,2%	19%
Rhône Alpes	643	3220	2973	270	2950	5	8,6%	16%
Alsace	84	457	424	92	365	5,5	1,2%	2%
Franche-Comté	6	28	n/s	n/s	n/s	4,7	0,1%	0%

*reference period 2013, old region definitions before 2016 Source: Agreste (2015) Inventaire des vergers 2013
Source: Agreste (2015) Inventaire des vergers 2013
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Table 12: Apple production in the Alpine Space – France, Agreste, 2015.

In France, the largest share of apples, between 92% and 96%, comes from intensively farmed plantations.

Share of intensive and extensive production France Alpine Space*				
	Apple meadow orchards [ha]	Apple orchards in production [ha]	Apple meadow orchards [%]	Apple orchards in production [%]
France continental	2475	34821	7%	93%
Frankreich AlpineSpace	698	12022	5%	95%
Provence Alpes Côte d'Azur	390	8625	4%	96%
Rhône Alpes	247	2973	8%	92%
Alsace	33	424	7%	93%
Franche-Comté	n/s	n/s	n/s	n/s
*reference period 2013, old region definitions before 2016 Source: Agreste (2015) Inventaire des vergers 2013				

Table 13: Share of intensive and extensive apple production in Alpine Space – France. Source: Agreste, 2015.

In the two regions France Continental and Auvergne-Rhone-Alpes, the area under cultivation has decreased by more than 10% over the past nine years. This development was less significant in the Provence-Ales-Cote d'Azur region, where it has fallen by 2%.

	France continental	Provence-Alpes-Côte-d'Azur	Auvergne-Rhône-Alpes
Acreage [1000 ha] 2010	41,7	10,2	3,6
Acreage [1000ha] 2018	37	10	3
Change in acreage (2010-18)	-10%	-2%	-11%
Average production [t] (2010-18)	1.552.189	387.533	109.089

Table 14: Apples cultivation areas in the Alpine Space - France. Source: Agreste, 2019.

Special Characteristics

More information on the specific aspects of French apple cultivation can be found on the website of the ministry for food and agriculture (<http://agreste.agriculture.gouv.fr/conjoncture/fruits/>) and in their publication about vegetable, fruit, flower and tobacco cultivation: [http://agreste.agriculture.gouv.fr/IMG/pdf/Graf1843 - Legumes fruits fleurs tabac.pdf](http://agreste.agriculture.gouv.fr/IMG/pdf/Graf1843_-_Legumes_fruits_fleurs_tabac.pdf) (2018).

National data Slovenia

Main cultivation areas

The main cultivation areas in Slovenia are in the statistical units Podravska, Savinjska and Posavska of the NUTS2 region Vzhodna and in Goriška of the NUTS2 region Zahodna. According to the survey, Gorenjska and the Province of Ljubljanska should also be included.

Production

Slovenia cultivated apples on 2,355 hectares in 2017. However, between 2010 and 2017 the area under cultivation decreased by around 15%. The annual average harvest in these past eight years was 61,845 t with an average harvest of 23.7 tonnes per hectare (Statistical Office of the Republic of Slovenia, 2017a).

1.133 agricultural holdings cultivate apples on 2,355.4 ha. At the 2.106 plantations, 92% of the apple-crops are cultivated in intensive orchard plantations, whereas just 8% of the apple harvest takes place in extensive orchards (Statistical Office of the Republic of Slovenia, 2017b).

Apples from intensive orchards 2017*			
	SLOVENIA	Vzhodna Slovenija	Zahodna Slovenija
Area [ha] 2017	2.355	2.144	211
Share of apple acreage in Slovenia [%]	100%	91%	9%
Change in area [%] 2010-2017	-15%	-16%	1%
Production 2017 [t]	13.605	11.465	2.140
Average Production 2010-2017 [t]	61.845	56.690	5.155
Share of total apple production in Slovenia [%]	100%	84%	16%
Yield [t/ha] 2017	5,8	5,3	10,1
Average Yield [t/ha] 2010-2017	23,7	23,7	24,6

Table 15: Apples from intensive orchards in Slovenia. (Statistical Office of the Republic of Slovenia, 2017a).

The average apple plantation measures just over a hectare (1,1 ha), with a density around 2.850 trees/hectare. Most of the plantations (54%) have a density of 1.600 to 3.200 trees/hectare. The majority of apples are grafted in the form of slender spindle (81%). 91% of the apple cultivation area is allocated in Vzhodna (2017). The acreage in Vzhodna is about 2.144 ha and was steadily decreasing over the last 8 years (2010-17). The acreage in Zahodna is about 211 ha (Statistical Office of the Republic of Slovenia, 2017a & 2017b).

Size class of density of plantation					
	Total	<400 trees/ha	400 to <1600 trees /ha	1600 to <3200 trees /ha	≥ 3200 trees/ha
Number of plantations	2.106	130	393	1.127	456
Gross area [ha]	2.355,4	22,6	165,5	1.551,1	616,2
average plantation size [ha/plantation]	1,1	0,2	0,4	1,4	1,4
share of plantation size [%]	100%	6%	19%	54%	22%

Table 16: Size class of density of plantation in Slovenia. (Statistical Office of the Republic of Slovenia, 2017c).

The most common apple varieties in Slovenia are Idared (23%), Golden Delicious (15%), Gala (12%) and Jonagold (12%) (Statistical Office of the Republic of Slovenia, 2017b).

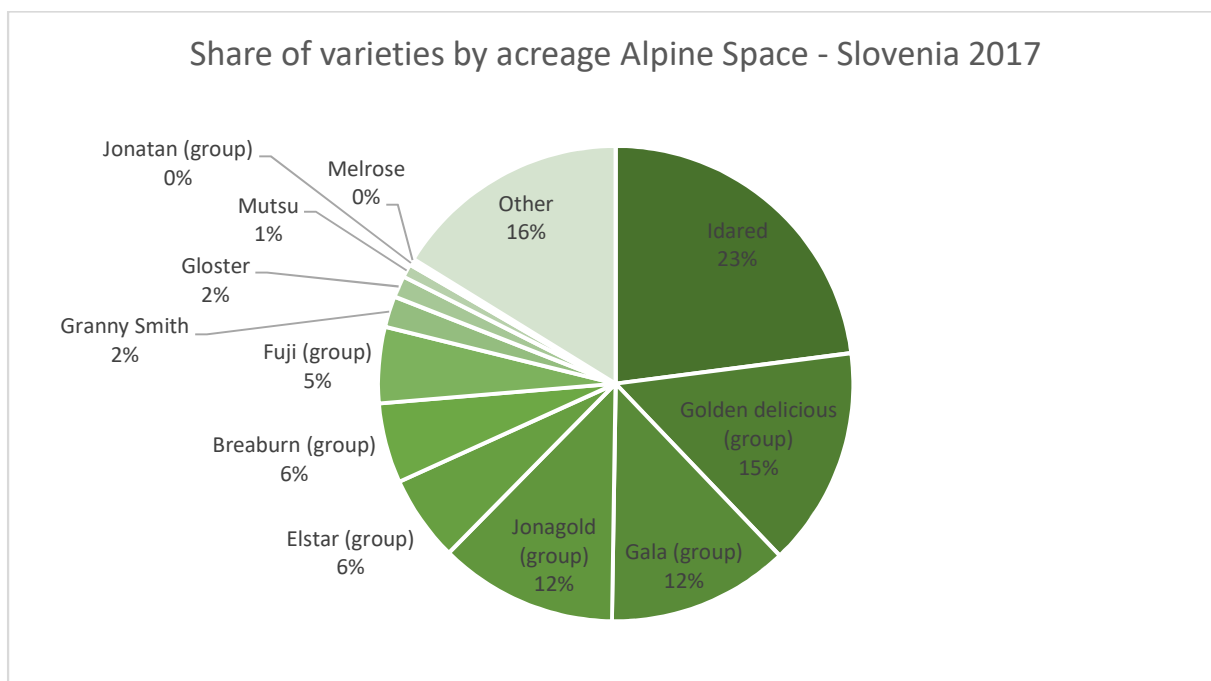


Figure 9: Share of varieties by acreage - Slovenia. Source: Statistical Office of the Republic of Slovenia, 2017b.

Region Vzhodna:

Specific training and cultivation system: One row system, slender spindle form, on the last year mostly prune to fruit wall system. The greatest potential of apple training systems in Slovenia: Spindle.

Operating structure

The evaluation of the questionnaires has shown an average farm size in Zahodna of 1.9 ha, which is well above the statistically determined values of Table 16.

Special Characteristics

According to an expert, all scattered apple plantations in the Vzhodna region are managed organically. In the organic intensive orchards, the main variety is Topaz (80%). The most important club varieties are: Antares, Evelina (both organic) and Fuji Kiku (conventional). The greatest potential, according to an online survey, has the scab-resistant varieties Topaz Bonita, Evelina and Antares.

4 PROCESSING

General information on processing

Apples are either sold as so-called table apples, i.e. apples which are sold as fresh products by washing and sorting, or they are used by pressing, cutting, drying, etc. as the primary raw material for the refining process to a product of a higher processing stage. This process results in some residual materials or by-products that can be used further.

In the entire Alpine Space, apples are mainly marketed as table apples after harvesting. Thereby, the apples are first stored in large boxes in cold rooms. A controlled air composition (controlled atmosphere) helps to preserve the apples and make them storable for several months. After removal from the cold store, the apples are sorted according to quality, washed in water and brushed. Achieving the highest possible proportion of dessert apples is a priority for the producers in the apple-growing regions studied, as this often results in a producer price that is more than three times higher than that of the processed product. Table 17 compares the share of table apples and processed goods in the total apple harvest in 2017 in the Alpine countries (national level).

	Share of Table apples of the whole yield 2017 [%]	Share of Processing apples of the whole yield 2017 [%]
Germany	Ca. 75%	Ca. 25%
Austria	Ca. 59%	Ca. 41%
Switzerland	100%	0%
Italy	100%	0%
France	Ca. 76%	Ca. 24%
Slovenia	100%	Not applicable

Table 17: Share of table apples and processing apples of the whole apple yield in 2017. Source: Eurostat, 2018.

According to Garming et al. (2018), in 2015 about 27% of the harvested apples in Germany were processed to a higher processing level. According to experts, apple producers in Germany are specifically setting up scattered apple plantations for the production of processing apples. In 2017, Baden-Württemberg used the harvest of 17% of its approx. 10,000 ha apple cultivation area for further processing. In Bavaria it was even 23% of the 1,200 hectares of apples cultivated (Garming et al., 2018).

In Austria, the processing of apples plays an even greater role. Here, according to Eurostat (2018), more than 40% of the harvested apples were or had to be converted into processed apple products in 2017.

According to Eurostat (2018), 100% of apples in Italy are sold as table apples. An Italian expert, on the other hand, estimates that 10-30% of the total apple production in the northern Italian regions of the Alpine Space is processed. This is usual here, when the apples are not suitable for sale as table apples. The proportion of processed goods depends annually on the climate, weather conditions, pest infestation and abiotic damage.

According to the Schweizer Obstverband (2018), contrary to the statistical figures from Eurostat (see Table 17), about 30% of the apple harvest from commercial fruit growing is processed further. This also refers to apples that do not meet the quality requirements for table apples.

In France, according to Eurostat (2018), about three quarters of the harvested apples are sold as table apples, one quarter is processed.

In Slovenia, according to Eurostat (2018), the whole apple harvest is transformed to fresh products for trade (table apples). For this reason, Slovenia's statistics, as well as those of Italy and Switzerland, show a 100% share of table apples in total production. However, due to natural phenomena and the resulting damage, part of the harvest is further processed.

The role of cultivation for processing

Intensively cultivated apple orchards are mainly used for the production of table apples. Apple harvests from extensive cultivation or from scattered apple plantations, on the other hand, are more suitable for further processing as the apples usually do not meet the standards of table fruit. However, this does not exclude the possibility that apples from scattered apple plantations may be sold as table apples, e.g. by direct marketing.

Statistical data on scattered apple plantations usually refer only to the number of trees in the individual regions/countries. According to our research, however, the areas are not surveyed or do not appear as fruit orchards. Overall, most statistical data on apple production relate to commercial orchards and plantations. Table 18 shows the data from various sources on the share of intensive (apple plantations) and extensive (scattered orchards) apple cultivation in the Alpine Space.

	Intensive production	Extensive production
Germany	-	-
Austria²	70% of yield	30% of yield
Switzerland³	65% of yield	35% of yield
Italy	-	-
France⁴	95% of acreage	5% of acreage
Slovenia⁵	72% of yield	28% of yield
² reference year 2017-18. Source: Statistics Austria, Obstproduktion Erwerbsobst/Extensivobst, endgültiges Ergebnis 2017 ³ reference year 2010-17. Source: Agristat, Statistische Erhebungen und Schätzungen über die Landwirtschaft und Ernährung ⁴ reference year 2013, old definition of statistical regions. Source: Agreste 2015, Inventaire de vergers ⁵ reference year 2010.17. Source: Statistical Office of the Republic of Slovenia. Production of fruit in extensive orchards, Slovenia annually.		

Table 18: Share of intensive and extensive apple production in the Alpine Space.

In Ravensburg, Germany, the cultivation of scattered apple plantations in terms of acreage plays a greater role than the cultivation of apples in orchards, according to experts. In Baden-Württemberg, scattered apple plantations are financially supported with public subsidies. Nevertheless, apple cultivation in orchards is economically more important here. About 1/3 of the apples from scattered orchards in Ravensburg are processed into juice by a dense network of decentralized, medium-sized "Keltereien"

(operations in which the fruit is pressed). This dense network of processors has the advantage that apple producers only have to cover short delivery distances and achieve a high producer price due to the competitive pressure between the “Keltereien”. In addition, these processing enterprises produce very innovative products. The rest of the Ravensburger apples from scattered orchards either are delivered to distilleries and are processed into schnapps or brandy or are used for own purposes of the producer.

According to experts, in terms of area, the cultivation of scattered fruit plantations in Austria plays a much greater role than the cultivation of orchards. From an economic point of view, however, it plays a lesser role, since the value added in the production of table goods is higher, despite a smaller percentage of the area. Apples from scattered apple plantations are mainly processed into juice, must or cider by the producers themselves. According to Statistik Austria (2017), Austrian farmers harvested 129,377 tonnes of apples from commercial orchards (plantations) and 55,888 tonnes from scattered orchards in 2017.

In Italy, according to experts, the plantation cultivation of apples is the main form of cultivation in terms of both acreage and economy. The cultivation of scattered apple plantations plays only a minor role. The apple harvest is therefore mainly processed into table apples.

Discussions with Swiss experts revealed that almost the entire harvest from scattered apple plantations is processed. An estimated 95% of scattered orchard apples, so-called "must apples", are processed into apple juice, apple juice concentrate or cider in must factories. In terms of acreage and also economy, this form of cultivation plays a lesser role in Switzerland than plantation cultivation. Nevertheless, it has traditionally been anchored as a dual-use area (formerly used as fruit orchard and at the same time as pastureland) and is also financially supported for the conservation of biodiversity. Statistical data on scattered orchard areas were not found, but the Hochstamm Suisse association estimates the number of tall trees in Switzerland as a whole at 2.3 million. According to the Schweizer Obstverband (2018), 22,160 tonnes of cider apples were harvested in 2017; the total apple harvest in the same year was 96,478 tonnes (this year the harvest was severely damaged by frost). In addition to scattered apple plantations, intensive apple orchards for the production of must apples are also planted to a very limited extent in Switzerland. According to expert estimates, approximately 20% of the harvest from intensive plantations is processed.

Classic processing products from apples

In the Alpine Space, processing apples are mainly processed into products in the food sector. The most important products are: Apple juice, apple fruit juice concentrate, cider vinegar, apple sauce, spreads, jams, chutneys, apple pieces frozen/steamed in cans or raw, pectin for the baking industry, apple chips, dried fruits, alcoholic beverages such as cider, apple wine, apple must, apple sparkling wine, schnapps or liqueurs as well as other products such as apple seed oil, apple flour, etc. During the processing of apples, residues or by-products are produced, which means that in some cases it is not possible to use 100% of the apple. In apple juice production, for example, approximately 25% by weight of residues, so-called pomace, are produced (cf. Shalini and Gupta, 2010). Under the assumption that 25% of the weight of residues (pomace) accumulate in any form of apple processing, similar to apple juice production, it is possible to calculate approximately the expected annual amount of apple pomace accumulating in the Alpine region with reference to the percentage of processed goods in the relevant Alpine countries (according to Eurostat, 2018 in Table 17 and the statements of the experts). According to this, in 2017 approx. 612,000 tonnes of processing apples were harvested, from which, according to this assumption,

a total of approx. 153,000 tonnes of apple pomace are expected to result. Unfortunately, there are no detailed data available on the processing of apples that could be used to calculate the residues more precisely.

In the non-food sector, apples and apple by-products (especially apple pomace) are used, among other things, to produce animal fodder and fertilizers. The leaves of the apple tree are sold dried as feed for small animals. The wood of the apple tree is used to make products such as furniture, works of art and decorative objects. The wood can also be used as firewood. According to expert discussions, the most widespread application of apple pomace in the Alpine Space (D, AT, IT) at present is the generation of energy in biogas plants. The fermentation residues produced are often used as fertilizer.

Assessment of the market potential of classical processing products

The following table (Table 19) lists which products are produced from apples in the Alpine Space according to our research. It also shows how the experts assessed the market potential of the individual products in their region within the framework of the online survey (response possibilities high, medium, low). The results presented are the answers most frequently given in each country. Fields marked in green indicate a high or high to medium market potential of the product according to the respondents' assessment in their country.

Product	Germany	Austria	Italy	Slovenia	Switzerland	France
Organic table apples	High/Medium	High	High/Medium	High	High	-
Conventional table apples	High/Medium	Medium/Low	High/Medium	Medium	Medium	-
Organic processing apples	High/Medium	High	High	-	-	-
Conventional processing apples	Medium/Low	Medium/Low	Medium/Low	-	-	-
Processing: Food-Sector						
Apple juice	High	High	High	Medium	-	-
Apple fruit juice concentrate	Medium/Low	Medium/Low	Medium/Low	Medium	-	-
Cider vinegar	Low	High	Medium	Medium	-	-
Apple sauce/ Apple spread/ Jam/ Chutney	Low	Medium	High/Medium	Low	-	-
Pectin (gelatin)	Low	Medium	-	-	-	-

apple pieces frozen/steamed in cans or raw	Medium	High/Medium	High/Medium	Medium	-	-
Apple chips/dried fruits	Medium/Low	Medium	Medium	Medium	-	-
Alcoholic beverages	Medium	High	Medium	Low	-	-
Apple must/Cider/Apple sparkling wine	Medium	High/Medium	Medium	Low	-	-
Apple schnapps/Liqueurs	Medium	Medium	Medium	-	-	-
Others (apple seed oil, apple flour, etc.)	Low	Low	Medium	Low	-	-
Processing: Non-Food						
Animal feed	Low	Low	Low	Low	-	-
Fertilizer	Low	Medium	Low	Low	-	-
Apple wood (furniture, decoration, ...)	Low	Medium	Low	Low	-	-
Apple wood as firewood	Low	Medium	Medium	-	-	-
Energy (biogas plants)	Medium	Medium	Medium	-	-	-

Table 19: Assessment of the market potential of the listed products in the food- and the non-food sector, according to the online-survey.

Table apples

German experts estimate the market potential for organically produced table apples to be high or medium, as demand and producer prices for organic apples will rise. Another reason for this assessment is the good organization of the marketing of organic products in Tübingen. In Freiburg, on the other hand, marketing is not yet organized. According to the online survey, the market potential for organic table apples in Austria is also high. The experts from Italy also estimate the market potential of organic table apples to be high or medium, as the demand for organic products is also increasing there. The same applies to Slovenia and Switzerland. Here, too, the respondents rate the market potential for organic table apples as high.

Conventional (incl. integrated) table apples have a high or medium market potential in Germany according to the respondents' assessment. On the one hand, because mass production is possible, on the other hand, because demand for regional, conventionally produced fruit is increasing. The Austrian respondents rate the market potential as medium or low. One expert thinks that table apples from Austria are not competitive on the world market and also on the domestic market and that their production will therefore decline in the coming years. In addition, apple consumption in Austria has declined steadily in recent years. According to experts, conventional table apples have a high or medium market potential in Italy. The expert interview showed that in the Italian regions of Trentino-South Tyrol and Piedmont relatively high producer prices are still paid for table apples, which is why the cultivation of integrated fruit continues to be attractive for producers. By contrast, Slovenia and Switzerland classify their market potential for conventional table fruit as medium.

Apples for processing, refinement and the food industry

The market potential of organically produced processing apples is estimated to be high or medium in Germany, as they are mainly produced in scattered apple plantations and pesticides are not used here anyway. Therefore, conversion to organic farming does not require much change in cultivation. Another reason for the high market potential is the increasing demand for organic juices. In Austria, experts estimate the market potential of organic processing apples to be high. The same applies for the Italian experts, as demand in Italy is rising. According to the online survey, there is no cultivation of processing apples in Switzerland.

According to experts, conventionally produced processing apples have a low or medium market potential in Germany, as the market is already saturated and competitive pressure on the world market is high. Italy and Austria also assess the market potential of conventional processing apples as medium or low.

The online survey showed that apple juice has the highest market potential of the processed products in the food sector in the entire Alpine Space; 7 out of 15 respondents attribute a high market potential to apple juice. As comments, the respondents added that "regional apple juice is enjoying increasing popularity" and that "especially organic and direct juices" have a high market potential. The results of the online survey showed that in Freiburg, for example, apple juice is the most important processed product. Here, the highest market potential is also attributed to apple juice. As a further potential in this product segment, one expert named mixed juices, i.e. juices that contain partly apple juice and partly juice from other fruit and vegetable varieties (e.g. apple-red beet juice). In second place in the food sector are the products apple must/ apple cider/ apple sparkling wine, to which four respondents attribute a high market potential. In Germany, the highest market potential is also attributed to apple juice and apple must/ apple cider/ apple sparkling wine. An expert from the Bodenseeregion stated that the production of apple juice and must still has unused potential, both quantitatively and qualitatively. In Austria, in addition to apple juice, cider vinegar has a high market potential. The Italian experts rated apple juice as the product with the highest market potential. In the non-food sector, the experts valued only energy production in biogas plants with medium market potential, although apple pomace is already used in (wild) animal feed and fertilizer production. Biogas production from apple pomace is already widespread in the Alpine region; due to the high demand for energy and the high availability of apple pomace as well as the high price that biogas plants currently pay to processing companies, this form of utilization of apple by-products will continue to play an important role in the future according to expert discussions. All other non-food products have only a low or medium market potential.

According to the online survey, the products with the lowest market potential in the Alpine Space are apple juice concentrate and other products such as apple seed oil or apple flour. In Germany, experts attribute the lowest market potential to cider vinegar, apple sauce/ apple spread/ chutneys/ jams and other products. In the non-food sector, all products (animal feed, fertilizers, apple wood) have a low market potential. Only the potential of apple by-products for energy production in biogas plants is rated much higher.

5 MARKETING

General information on marketing apples in the Alpine region

According to the online survey, the value-added chain of table apples (Figure 6) plays the most important role for the product apple in the entire Alpine region, i.e. table apples are mainly produced which reach the end consumer through the retail trade. The first stage of intermediate consumption is provided by all those actors who produce inputs such as agricultural machinery or providers of services that serve agricultural production (e.g. machinery rings). Primary producers are farmers who produce apples. The third stage of this value chain is taken by those actors who process the harvest into table apples. According to an online survey, producer organisations and cooperatives in Tübingen (DE), Austria or in the Italian growing regions are responsible for the processing, storage and marketing of table apples. They also sell the goods to wholesalers and retailers at home and abroad.



Figure 10: Value added chain table apples

Just in Valle D'Aosta alone, according to the online survey, apples are mainly marketed directly; there are no further trade stages between the primary producer and the end consumer. Direct marketing can take place either through sales from the farm, at weekly markets via online trading or via buying groups (foodcoops). In direct marketing, value added usually remains within the region.

Figure 11 shows the value added chain of direct marketing.



Figure 11: Value added chain - direct marketing

Another important form of value added in the Alpine region is the processing of apples to refined products. The raw material "apple" comes either from apple orchards, even if the table apples in this case do not meet the same quality requirements as those from scattered apple plantations or from particular apple plantations that have been created specifically for processing purposes.

Figure 12 shows the value added chain of apple processing.

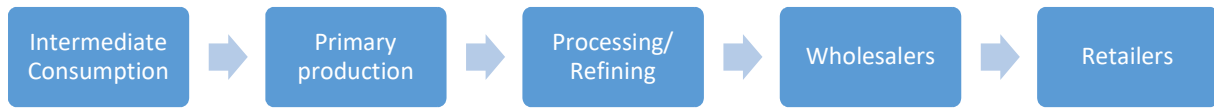


Figure 12: value added chain - apple processing

The following chapters deal with the relevant actors at the individual stages of the value added chain within the countries of the Alpine Space. Moreover, potentials of improvement along the value added chains per country are pointed out. These information are mainly based on results obtained from the online survey as well as from the statements of the experts contacted by telephone.

Value added chain – Stakeholders and Potentials of improvement

Germany

Producer organisations play an important role in the marketing of table apples in the German apple growing regions. Just in the Bodenseeregion the marketing share of apple production is about 75%. One expert sees an obstacle in the value chain of table apples in the politics of food retailing. Supermarkets in Germany prefer to buy fruit and thus also apples from abroad, although Germany would produce sufficient quantities of apples. However, German producers cannot offer domestic table apples on the German market at the same prices as their foreign competitors. The supermarkets achieve higher margins with the foreign goods as long as the consumer does not take care where the apples come from. Therefore, according to experts, it is important to draw the attention of German consumers to domestic products through advertising campaigns and awareness raising for regional food products. This would increase demand for German apples and reduce price pressure on German apple producers. An expert from Tübingen also sees potential for increasing the efficiency along the value chain in the digitalisation of logistics. On the other hand, Freiburg (Ortenaukreis) still lacks an organised marketing of organic table apples.

The direct marketing of apples and apple products plays a minor role in Germany. However, direct marketers are often active in the processing and refinement of special apple products, e.g. in the production of dried fruit or spirits, etc.

In Ravensburg, for example, a large network of decentralised apple press plants processes apples into apple juice or other refined products. Due to the high number of these mostly medium-sized companies, competition is fierce and the producer price to apple producers and the degree of innovation in the industry are rather high. In addition, the location of the apple press plants causes little logistical effort for the farmers. The refined products are then usually marketed in the region. Apple juice, on the other hand, is accepted in large quantities as a tank good also among food retailers, but is on the contrary also sold under specific trademarks.

Another small part of the processable apples, on the other hand, are refined by distilleries into grappa and luxury brandies.

Figure 13 shows the players along the value chain in Germany.

Intermediate Consumption	<ul style="list-style-type: none"> • Pesticide producers: BASF, BAYER, Belchim, CERTIS • Machinery manufacturer: Wanner, Lochmann, Zupan, Weber, Munckhof, Humus;
Advisory Service	<ul style="list-style-type: none"> • Competence Centre for Fruit Cultivation Bavendorf, BUND-Regionalverband, Landratsämter, Fruit Advisory Service of Landkreise, Advisory for cooperatives WOG and MaBo, Competence Centre for Fruit Cultivation Bodensee KOB, Uni Hohenheim, Kernobstnotierung LEL Schwäbisch Gmünd.
Processing	<ul style="list-style-type: none"> • Apple press plants, Destilleries • Württembergische Cooperative WOB, Marketing Cooperation Bodensee MaBo
Logistics	<ul style="list-style-type: none"> • BAG (Sammelstellen, Kühllager), Vertragsvermarkter der Genossenschaften WOG, MaBo Marktgemeinschaft Bodenseeobst
Trade	<ul style="list-style-type: none"> • Fruit wholesale market Mittelbaden, Beverage trade: BayWa, Vebo-Betriebe, Salemfrucht, Grundler, Spannagel, Veese; Various smaller retailers: WOG, Raiffeisen eG., MaBo EG.

Figure 13: Stakeholders identified in the survey along the value added chain of apple-products in Germany.

Austria

Austrian experts state that the networking among the actors along the value chain of table apples is very poor. In 1995, the year Austria joined the EU, there was only one producer organisation. Today, on the other hand, there are five. This has a negative impact on the competitiveness of the table apples produced here, because the fragmentation weakens the market positioning of the Austrian apple sector, which is already small in size, on the European market.

Direct marketing, on the other hand, is an opportunity for Austria, as the country is not competitive in the mass production of apples under the producer prices achievable there. Direct marketing is already a successful form of marketing for producers today, especially if they process and refine the apples themselves. Direct marketing in Austria is a relationship market in which the consumer establishes a specific affinity to the producer. According to the experts, this emotional bond enables apple producers to obtain higher producer prices on the market.

Figure 14 identifies the stakeholders along the value added chain in Austria.

Intermediate Consumption	<ul style="list-style-type: none"> •Hail protection systems: Frustar, Fruit Security
Advisory Service	<ul style="list-style-type: none"> •Chamber of Agriculture, Private consultants, Producer organisations, Research laboratory Haidegg
Processing	<ul style="list-style-type: none"> •Fruit Warehouse: Haiming, Oberinntaler Obst, Fruit community Styria OGS, OPST Fruit Partner Styria, EOS Producer organisation, Fruit Styria, Grünewald, Ribes, Hochstrasser, Bauer Fruchtsaft.
Logistics	<ul style="list-style-type: none"> •Hauliers from the Regions, Aple country - logistics, Frutura.
Trade	<ul style="list-style-type: none"> •OPST, OGS, EOS, Organic by heart, Frutura, Aroma, Zorn.

Figure 14: Stakeholders identified in the survey along the apple value added chain in Austria.

Italy

In Italy, integrated production of table apples continues to be paid at relatively high producer prices, which makes growing them on plantations highly attractive to producers. In line with the general trend, demand for organic table apples is also increasing here, and with it the market potential. Direct marketing of apples and apple products, on the other hand, plays a subordinate role in Italy.

According to an expert interview, the cooperative system in the provinces of Trentino and Südtirol/Alto Adige is a good example of a well-functioning producer network that makes a significant contribution to the success of the apple sector. In Südtirol/Alto Adige, for example, the individual fruit cooperatives are grouped under two large marketing cooperatives in order to concentrate their market strength. This means that the producers pursue a uniform marketing strategy and, in addition, benefit from the relatively high contributions of the EU for financing the marketing initiatives of the producer organisations.

In the other regions of Italy, however, the producers are less professionally organised, and according to experts "corruption" is largely responsible for the failure of joint initiatives. An expert from Valle d'Aosta identifies a need for improvement in the marketing of apples by cooperatives: in his opinion, a regional brand should identify the origin of the product. According to experts, the proximity to major cities should also be better exploited. In the case of Lombardy, the construction of a large warehouse or distribution centre from which the city of Milano can be easily reached could enormously increase the popularity of Lombardia apples among the inhabitants of Milano.

One expert argues that a weak point in the apple value added chain is the fact that producers, and in some cases entire regions, pursue only one economic strategy in marketing the apple production, which makes the system unstable and resilient to external influences.

Figure 15 illustrates the stakeholders along the value added chain in Italy.

Intermediate Consumption	<ul style="list-style-type: none"> •Pesticide products: Syngenta, Bayer, Adama, fmc, Biogard, Smart Fresh; •Maschinenhersteller: Fendt, Carraro, Aweta sorting machines
Advisory Service	<ul style="list-style-type: none"> •Administrative & Advisory authorities Agricolè Regional Aosta, Fondazione Fojanini, Fondazione Minoprio; Research institutes: Università di Milano, Università della Montagna di Edolo, Beratungsringe, Fondazione Mach, Laimburg
Processing	<ul style="list-style-type: none"> •Regional cooperatives, e.g.: Cofruits, Melavi', Cooperative sociali il sentiero, Melinda, La Trentina, Consorzio Valentina, COPAG, SFT, VI.P, VOG; •VOG Products, PAN deep-frozen products, FRUCTUS Merano, Zipperle, Iprona.
Logistics	<ul style="list-style-type: none"> •Corrieri Bartolini, Tavelli Autotrasporti, Manganetti Autotrasporti
Trade	<ul style="list-style-type: none"> •Apot, Melinda, La Trentina, sft, Iperal, Bennet, Coop Italia, Esselunga

Figure 15: Stakeholders identified in the survey along the apple value added chain in Italy.

Switzerland

In Switzerland, the production of table fruit plays a major role. The sorting, storage, packaging and logistics of table apples are mainly carried out by trading companies, which act as intermediaries between producers and retailers (in GER, IT and AT, on the other hand, the processing of table apples is mainly carried out by producer organisations or cooperatives). Throughout Switzerland, there is only one cooperative, spread over several locations throughout the country, which is active in the processing of table apples. Since almost all Swiss table apples are consumed domestically, almost all of the value added (excluding intermediate consumption) remains in Switzerland.

Experts estimate in Switzerland the share of direct apple marketing at 5-6%. Producers who market their apples directly either have their own warehouses or sell them fresh after harvesting. Another option would be to process the apples into refined products and to sell them directly afterwards.

In Switzerland, the processing of must apples is mainly carried out by must makers. According to experts, there are two large must makers in Switzerland, of which one is a producer organisation. They mainly produce juice, which is partly exported abroad. In order to be competitive on the European market, the producers themselves need to support exports, since no export subsidies are provided by the state.

Experts have assessed the apple value added chain as well organised and efficient overall, even though producer prices are still relatively low. The apple market is currently characterised by stability, with a reasonable balance between supply and demand. The Swiss Fruit Association ensures thereby good networking between the stakeholders along the value added chain, the promotion of fruit and the transfer of knowledge and training to enhance the skills for apple cultivation. According to experts, the potentials for improving the Swiss apple value added chain concerns mainly its infrastructure facilities: ongoing investments in warehousing and logistic solutions will lead to modernisation and an increased efficiency in the Swiss apple sector.

Figure 16 illustrates the stakeholders along the value added chain in Switzerland.

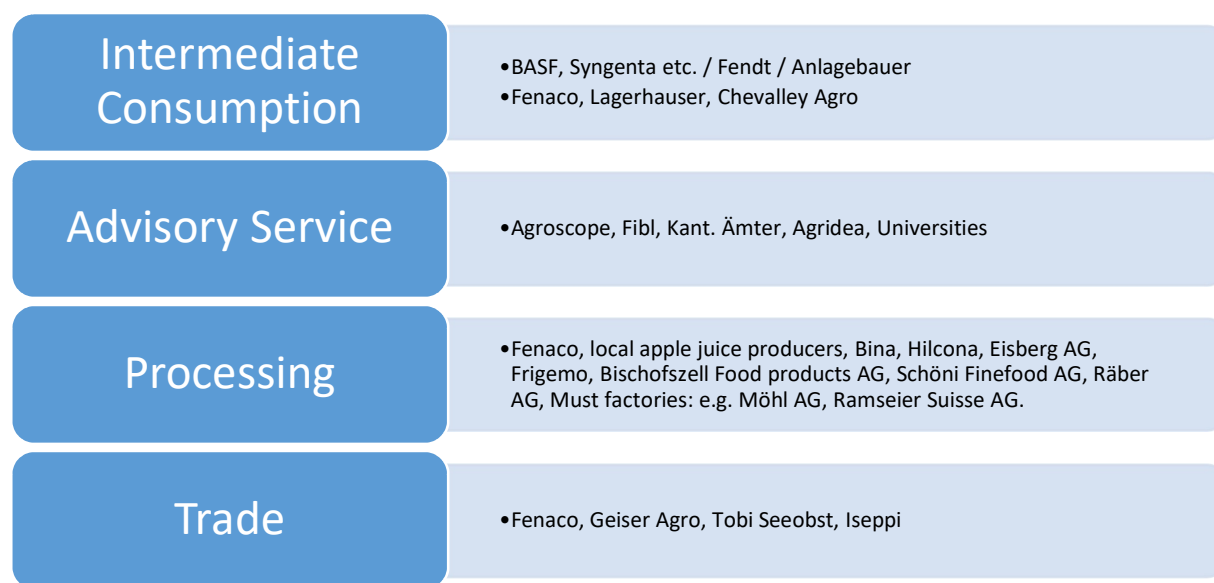


Figure 16: Stakeholders identified in the survey along the apple value added chain in Switzerland.

France

Since no experts from France participated in the survey, we rely for France on information about the apple value chain that can be found in the literature. Table 20 depicts the market shares across the different distribution channels. According to this, 81% of the apples produced in the French Alpine regions are marketed as table apples: 26% via producer organisations, 31% via wholesalers, 8% via commissioning agents, 9% directly via food retailers and 9% of table apples are directly exported abroad by the producers (Agreste, 2015).

Only 11% of apple production in the French Alpine region is marketed directly by producers. According to statistics from the French Ministry of Agriculture and Food (2013), just 8% of apple production is further processed.

Distribution channels for marketed apples [%]							
	producer organisations	wholesalers (not producer organisation)	commission agent	direct marketing	distribution	direct export	processing
Frankreich AlpineSpace	25,7	30,7	7,7	10,7	8,7	9,0	8,0
Alsace	10	19	5	18	15	17	16
Franche-Comté	n.a.*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Rhône Alpes	27	34	8	13	9	5	4
Provence Alpes Côte d'Azur	40	39	10	1	2	5	4
Source: Agreste – Inventaire des vergers 2013							

*n.a.: data were not available

Table 20: Apple marketing channels in the French Alpine Space regions 2013; source: Agreste, 2015.

Slovenia

According to experts, apple producers in Slovenia are still not deeply interconnected. Producer organisations currently play a minor role; producers and processors are pursuing a "lone fighter strategy". Thus Slovenian apple growers are not very competitive on the world market. The expert interview has revealed that it would be important for the Slovenian apple sector that the apple producers join together to form producer organisations or cooperatives. Overall, we have only less information available on the Slovenian apple value added chain than in other countries.

Figure 17 illustrates the stakeholders along the value added chain in Slovenia.

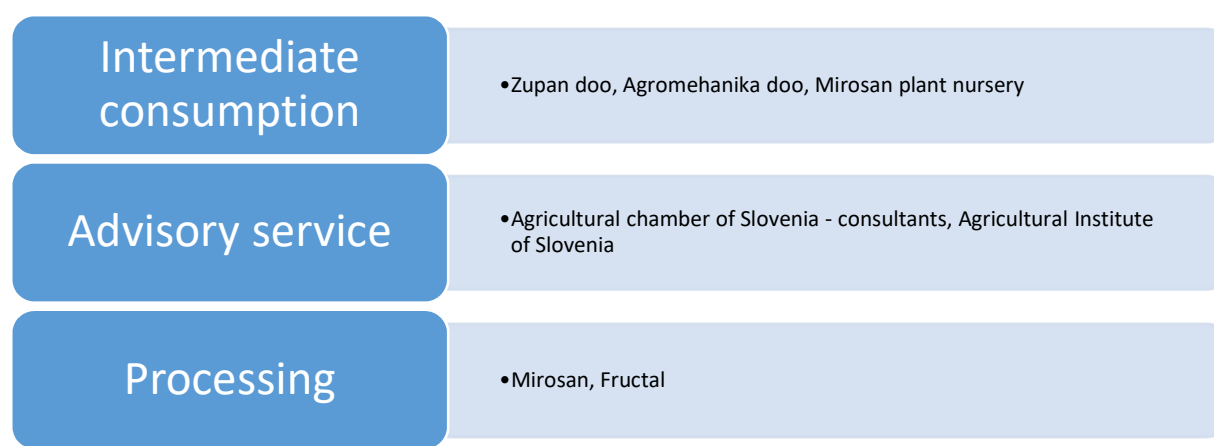


Figure 17: Stakeholders identified in the survey along the apple value added chain in Slovenia.

Market Situation – Price Development

Producer prices for table apples developed similarly between 2007 and 2017 in the EU countries located in the Alpine region. Germany, Italy, Austria, Slovenia and France are direct competitors on the world market. The producer price is formed here on the basis of supply and demand on the world market. Worldwide, the prices for agricultural goods depend, among others, on climatic and weather conditions and fluctuate accordingly from year to year. Only in Switzerland, as a non-EU country, the producer price for table apples is due to custom regulations more stable and consistently higher than in the other countries of the Alpine region. Figure 18 compares the development of producer prices for table apples in Germany, Austria, Italy, France, Switzerland and Slovenia between 2007 and 2017.

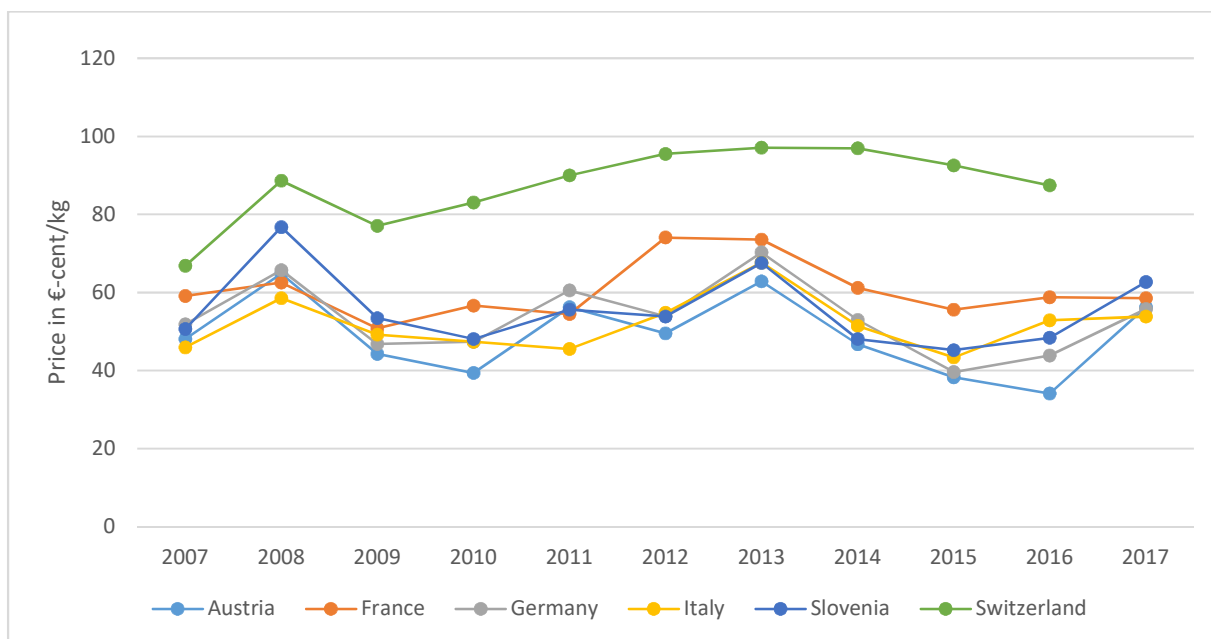


Figure 18: Development of producer prices for "table apples" in the six countries of the Alpine Space. Source: Own figure, according to FAOSTAT, 2018.

By 2016, according to FAOSTAT (2018), apple producer prices in the countries of the Alpine region ranged from 34 €-cent/kg in Austria to 87 €-cent/kg in Switzerland. At the regional level, the average producer price for table apples varied according to the results of the online survey from 28 €-cent/kg in Lombardy (Italy) to 94 €-cent/kg in Vaux (Switzerland). Table 21 lists by region the producer prices for table apples reported by experts in the online survey.

Country	Geographical reference	Producer price [€-cent/kg]
Germany	total	44,8
	Tübingen	53,7
Austria	total	35 (Statistik Austria, 2016)
Italien	Aosta valley	55
	Piedmont	28-38 depending by variety
	Lombardy	62
	Trentino	34
	South Tyrol	43
Schweiz	total	81 (0,92 CHF/kg)
	Vaux	94 (1,07 CHF/kg)

Table 21: Producer prices for table apples in 2016 by region in the Alpine Space according to the online survey.

Germany

The German experts in the apple sector state that there is a high price pressure on domestic apple producers regarding table apples. Increasingly, supermarkets are offering apples from abroad, as they are cheaper and with which they can achieve higher margins. Apparently, the consumers do not seem to prefer domestic apples or are not aware where the apples have their origin.

Austria

According to experts, producer prices for table apples in Austria are steadily declining. This is due, among other things, to the food retail trade, which mainly works with its own brands in Austria and thus depresses the producer prices for table apples. Apple growers cannot make a living from these prices, so that, in the opinion of an expert, they will switch to other crops after 2020. One reason for this is that this year the subsidy period through which many farmers were tied to apple production ends.

Italy

In northern Italy, thanks to the aggregation of producers and a uniform marketing strategy for table apples, experts say the price is still relatively high. Therefore, the business model "production of table apples" still offers the producers attractive economic future perspectives. Apple cultivation is still more lucrative than the cultivation of other fruit crops. In Piedmont there was even an increase in the cultivation area of apples. Even the online survey confirmed that prices in this region are the highest in Italy. However, an expert from Lombardia pointed out in contrast that the price of table apples has fallen constantly in recent years.

Switzerland

Due to border protection, Switzerland is only marginally exposed to the competitive pressure within the world market. There is a limited quota of imported goods, including apples. Therefore, the domestic demand for table apples produced in Switzerland is still high. To some extent, Swiss apple growers can thus maintain their prices. Nevertheless, according to experts, there is an enormous competitive pressure among the Swiss apple producers. For this reason, producer prices for table apples are relatively low under Swiss conditions. However, they are sufficient to preserve the apple cultivation areas and the supply of Swiss table apples at a stable level.

Regional brands - marketing strategies

Regional referencing and authenticity to generate added value

In Tübingen, the apple branch is marketing new, high-quality varieties, like snack apples, red fleshy apples or varieties without a carpel. This means that the region wants to establish itself on the market through quality and innovation in the variety sector. In cooperation with tourism, the apple branch in Tübingen wants to expand its positive brand image, including the brand "Obst vom Bodensee" (Fruits from Lake Constance). Furthermore, the producers manufacture the niche product must by letting the apple juice ferment.

In Austria, regional varieties are used primarily if their taste satisfies consumer preferences and they are merchantable as well as storable. In the province of Steiermark, for example, processed products are made from old varieties such as Ilzer Rosenapfel, Schafnase, Maschanzker or Gravensteiner. These products as well as the table apples from typical regional varieties are then marketed via the tourism industry.

The Valle d'Aosta is also trying to valorise old apple varieties by producing cider in order to support their cultivation. In Trentino, marketing is focused on the attributes of territoriality and quality of the product, here table apples are mainly produced. Also in Lombardy, apple farmers and producer organisations link the marketing of apples to the territory in which they grow: the Valtellina (from Bormio in the east to Lago di Como in the west). This valley is well known for its nature as well as for its mild climate and the tradition of apple cultivation. Within Lombardy, the apple grows only here. So the Valtellina apple is also the apple of the city of Milan and the rest of Lombardy. The territorial reference creates added value for apple production in Lombardy. For the future, the experts see potential in organic production and in cooperation with tourism. In marketing, the intensive apple cultivation in Südtirol/Alto Adige also focuses on originality, traditional production and the quality of the products. "Alpine tradition" is a catchword that is often mentioned in the marketing of South Tyrolean apples. For the apple sector in Italy as a whole, one expert sees opportunities in new export markets, new varieties, quality, regionality, the aggregation of producers and cost reduction along the value chain.

For the Slovenian respondents, the concept of " Tradition of apple production in the region " is the cornerstone of successful marketing.

Since Switzerland is shielded by customs protection from cheaper foreign goods, the apple sector is mainly affected by competition within Switzerland. Swiss table apples are almost only consumed within Switzerland. According to experts, the various producers are therefore trying to distinguish themselves from each other using different strategies. In this context, the regionality, the production method (organic/conventional), the quality of the apples and varieties (club varieties now have a market share of 20%) play a role. On the one hand, the Swiss varieties satisfy consumer preferences for crunchy, juicy aromatic and natural apples with good shelf life when stored at room temperature. On the other hand, they meet farmers' demands for good, regular yields, good market opportunities and resilience to diseases and pests. As customs protection is in the process of being reduced, Swiss apple producers will have to focus in future on sustainability, CO2 reduction, ecology and quality, according to experts.

Regional projects and initiatives

There are no events at the regional level in Freiburg where apple producers perform together and positioning themselves collectively. At the individual company level, however, apple producers organize events such as seminars with schools and kindergartens, " transparent production " (farmers give visitors an insight into agricultural production) and Christmas markets. The Bund für Umwelt und Naturschutz Deutschland BUND and the Naturschutzbund Deutschland NABU have started an additional charge project / apple juice project to conserve scattered orchards in Oberschwaben- Ravensburg (Tübingen). The participating farms commit themselves to maintain the scattered fruit trees through care and replanting. In return, they will receive producer prices that are two to three times higher than the usual market price. In partner wineries, the apples are processed into unfiltered apple juice and then marketed as BUND scattered fruit juices. The marketing of the products is supported by must festivals in various municipalities in the region. In addition to these events, Tübingen also organised apple hiking routes, apple hiking days, culinary apple weeks or guided tours to get to know the apple cultivation region better and also to strengthen the regional identity. The sales company "Obst vom Bodensee" organises various events such as the annual election of the apple queen, the apple ship or the season opening, as well as the trade fair for producers and processors "Fruchtwelt" in Friedrichshafen.

In 1986, 40 apple producers from the Steiermark region in Austria founded the association "Steirische Apfelstraße". The aim was to strengthen the economic power of the region and to bring the people closer to the landscape of the growing region. Along the Apfelstraße, fruit growing companies give an insight into their production and can sell their products directly from their farms. In addition, guesthouses, Buschenschank-Betriebe (a farm where a farmer may serve his products such as drinks and cold food), cafés and hotels as well as pensions are part of Apfelstraße and allow a synergy between agriculture and tourism. The association "Steirische Apfelstraße" organizes various events in the region of Apfelstraße. Austria also celebrates "Apple Day", which is not a holiday, but is intended to encourage the population to consume the popular fruit in the region. There are also school programmes, regional brands, apple festivals and market days.

In the Valle d'Aosta in north-western Italy, annual apple festivals are organised in Gressan and Antey-Saint-Andrè. In addition, the ESF project "NUTRALP" was launched there to study the bioactive ingredients of apple varieties cultivated in the region. This project contributes to new knowledge on the medical use of ingredients of regional apple varieties and thereby researches the bioeconomic potentials of the apple sector. In Trentino there is also an apple road in Val di Non and Val di Sole, two of the main apple cultivation areas in the province. Along the road, various events are organised on the topic of apples, such as the "Pomaria", an apple festival in the Val di Non or the apple hike "4 ville in fiore", where you can walk from apple village to apple village. In Lombardia there is, among other events, an apple festival with an exhibition of more than 200 experimental apples organized by the research institute "Fondazione Fojanini". In Piedmont, the Protected Designation of Origin 'mela rossa di Cuneo' (red apple from Cuneo) covers 4 varieties of apples with an intense reddening of the skin, a distinctive feature of apple production in this region. Since 2005, 13 apple varieties in South Tyrol have been protected with a designation of origin (EU label protected geographical indication) and therefore prevent imitation and misuse. The quality label guarantees originality and the traditional production as well as the high quality of the product. The Südtiroler Apfel g.g.A. (protected geographical indication) is regarded as an ambassador for the South Tyrolean Region (Südtiroler Apfelkonsortium, 2016).

In Slovenia the apple festival 'Kozjansko jabolko' is organised in the east of the country. There is also the new brand 'Bonita apple' of the cooperative Tibona.

The Swiss experts mentioned Agroscope's own breeding programme as a country-specific initiative in the online survey. When breeding new varieties, they take into account the preferences of consumers on the one hand, and the wishes of producers, fruit traders and nurseries on the other. In addition, the "Culinarium" label guarantees high-quality and sustainable products from Switzerland. This quality label covers not only the product apple, but also all products offered by Swiss farmers, restaurateurs or traders that have been produced under defined criteria. The brand "Viktor" includes the apple varieties Golden Delicious and Gala and was mentioned by the experts in Vaux.

6 INNOVATIONS - INNOVATIVE PRODUCTS FROM APPLE (BY-PRODUCTS)

By the term bioeconomic potential we mean innovative and sustainable applications of bio-based products and their by-products.

Our research has shown that in particular the by-products of apple juice production show bioeconomic potential and could be utilized, among other things, for the production of energy, animal feed or fertilizers. The by-products could be applied in innovative processes for the production of medical products (pectin, dietary supplements), cosmetic products (apple essence, apple seed oil), cleaning or other products like apple leather, or apple paper. Table 22 illustrates innovative applications for apples and their by-products in apple processing, which resulted from our empirical surveys among experts.

Application for	Products, Ingredients
Medical purpose, pharmaceuticals	Food supplements, anti-oxidative ingredients, pectin, polyphenols, or other secondary ingredients
Cosmetics	apple seed oil, apple extract, apple fruit water, apple fibre powder applicable as a peeling, apple stem cell extract, apple essences
Cleaning products	MCI-Innsbruck has experience in this field (MCI, 2013)
Other innovative products	Best practice examples
Apple leather	Leather products from apple pomace (company: Frumat Italy);
Eatable drinking straws	Start-up Wisefood-Germany produces the world's first drinking straw that can be eaten. Among others, it consists of apple pomace.
Apple paper	Paper from apple pomace (Italian companies: Frumat or Appeel Notebooks);
Natural surface material for interiors	Organoid Technologies GmbH from Austria uses apple pomace from the Bramberg fruit press to produce natural surfaces for homes and living spaces
Energy pellets	Pellets from apple pomace of various manufacturers e.g. eco energy trading (Öko Energiehandel);

Table 22: Innovative uses of bio-based products and their by-products

The interviewed experts stated that numerous regions in the Alpine region already use apple pomace for the production of animal fodder and for energy production in biogas plants. In turn, this results in by-products that can be utilised for fertilizer production.

Other innovative products are currently playing hardly any role for the apple cultivation in the Alpine region. Only in very few cases do companies make use of the bioeconomic potential of apples and their by-products. Innovative products made from apples and apple by-products (e.g. paper, leather, straws) are at present niche products at high prices in the Alpine region.

A German start-up company, which is not located in the Alpine region, produces drinking straws consisting mainly of apple pomace. Another expert also mentioned energy pellets made from apple pomace, which are produced, for example, by a German apple pressing plant. The pellets are then used by the apple pressing plant itself for heating purposes.

In contrast, the Austrian experts were not aware of any innovative products from apple by-products. However, our Internet research showed that natural surface materials are also produced from apple pomace in Tirol. According to the manufacturer, these can be used in many different ways: as wallpaper, as floor or acoustic panels.

In Italy, on the other hand, apple paper as well as apple leather are produced. According to experts, Italy also produces apple seed oil for the kitchen and gastronomy, which is also used for dermatological purposes. In addition, extracts from apple blossom are extracted for the cosmetics industry.

The Swiss experts named a Swiss company that uses apple pomace from organic must production for the manufacturing of cosmetic products. On the other hand, the use of apple pomace for energy production in biogas plants in Switzerland is not yet widespread.

In Slovenia, the production of innovative products from apple by-products has hardly been applied. The experts are not aware of any examples of initiatives that, for example, further recycle apple pomace materially or energetically.

7 BIOECONOMIC POTENTIAL OF APPLES IN THE ALPINE REGION

The bioeconomic potential of apples and apple by-products is still hardly exploited in the Alpine region. The experts assess the lack of interest on the part of entrepreneurs in innovations in the apple sector as a question of economic efficiency: There are cheaper raw materials for the production of recycled materials, not from apple production, but from other agricultural production processes or the food industry. The costly storage and logistics of apple by-products is another challenge. It is also difficult to predict the success of or demand for innovative products whose production is expensive and time-consuming. Before creative and innovative entrepreneurs get involved in risky projects, experts agree that it is necessary to examine the cost-effectiveness of an innovative use of apples and apple by-products and to determine the added value compared to the previous cultivation and processing system.

In Italy, for example, according to experts, demand for innovative products is rather low. Consumer preferences are more traditional and therefore an obstacle to innovative ideas: Italian consumers prefer to buy wine produced from grapes that have been grown and consumed in Italy for centuries than products that have less tradition in Italy, like must or apple wine. Due to the low demand, only limited innovative ideas emerge in companies. Moreover, in Italy bureaucracy is an obstacle to the creation of innovative companies or start-ups that want to exploit the bio-economic potential of apples. According to expert talks, innovative Italians who are thinking about setting up a new business are more likely to emigrate to Germany as the legal situation there is less restrictive.

Also in Switzerland, companies and agriculture themselves are very traditional and think more of food production than of innovative bio-based products from apple by-products. One expert sees potential for companies whose unique selling point is sustainable production and processing.

Since it is mainly the primary producers in Austria who process apples, another use of apple by-products (apple pomace) is currently associated with the challenge of logistics. The costs are too high and the money the producers receive for the apple pomace is too low. Therefore, it is mainly being used for biogas production. In 2015, table apples were even brought to the biogas plant because the market was flooded with foreign goods and domestic apples could no longer be sold. Experts see the potential in the apple

sector in Austria more in processing, in the production of niche products and in the direct marketing of apple products than in the bio-economy. In addition, regional brands could generate added value in the Austrian apple sector following the example of France, where region-specific products may only be sold in a certain region.

The lack of companies producing innovative apple products is the reason why apple by-products are sold to the biogas plant or to the livestock feed industry. So far, apple producers or processing companies pass on the apple pomace to those companies that offer them the highest price.

In Italy, an expert sees great potential in the use of apples, which are removed from the trees at a very early stage of maturation ("thinning") for yield regulation. These excess fruits are mainly worked into the soil. During this step, large quantities of waste apples are produced which could be used for further material processing. However, it should be checked whether the apples at this stage of maturity have already the necessary ingredients, e.g. for medical use. In addition, the collection of waste apples and the associated logistics pose a challenge whose economic viability would have to be examined.

Another potential that has not yet been sufficiently exploited is the production of biopolymers as packaging material from apples. Since consumers are becoming more and more critical of plastics, expert discussions have shown that in the future there will be a need for alternatives with which food can be packaged. Here, apple by-products can be utilised for the production of biopolymers.

The online survey showed that from the list of innovative products in the entire Alpine region, the medical use of apple by-products (food supplements, anti-oxidative ingredients, pectin, polyphenols, other secondary ingredients) was classified as with the highest market potential (5 out of 15 respondents rated the market potential as high). The experts justified this assessment with increasing health awareness and the natural image of such products. 2 Experts also assessed the use of apple by-products for the cosmetics industry as an innovation with high market potential. Another potential mentioned in the surveys is the production of pellets from apple pomace.

On the other hand, those surveyed attributed particularly low market potential to the products apple leather, cleaning products or the processing into natural surfaces for interiors. The assessments were commented as follows: " these products have no significance for the market" or "this product is not known".

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