



*Traditional Food Network to improve the transfer of knowledge for innovation*

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**Dissemination Level**

<b>PU</b>	Public	<b>x</b>
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## **TRAFOON Strategic Research & Innovation Agenda (Sweet fruits & olives)**

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## 1. Preface

In the European Union, Small and Medium Enterprises (SMEs) of the food sector are increasingly under pressure due to developing open markets, increasing demand of standardized and price competitive food products by the consumers, rising importance of large retailers, and challenges in obeying governmental regulations. This raises the risk of losing many traditional foods as well as traditional techniques of production, processing, preservation, and packaging that are applied by SMEs using regional raw materials and often have a role in the cultural identity of regions. SMEs of traditional foods must extend their skills in modern as well as competitive marketing and production techniques to comply with existing European regulations and to promote the aspects of their products related to nutrition and health.

To support traditional SMEs, **FP7 TRAF00N** project ([www.trafoon.eu](http://www.trafoon.eu)) has established a knowledge transfer network of 30 European research institutions, technology transfer agencies, and SME associations from 14 European countries by covering the value chain of four groups of traditional food products based on (1) **grains**, (2) **fish**, (3) **vegetables and mushrooms**, and (4) **sweet fruits and olives**. These food sectors are traditional, healthy foodstuffs which are essential for a balanced nutrition. Since November 2013 and until October 2016, TRAF00N is supporting European's traditional SMEs in these food sectors to foster sustainable innovation and entrepreneurship in the sector of traditional foods for the benefit of the regions of Europe and the European consumer.

TRAF00N increases the communication and interaction between traditional food SMEs, SME associations, and research institutions to improve and increase the knowledge transfer towards traditional SMEs on different areas of influence/activities (e.g. food production, food processing, packaging, marketing, labelling, certification, stabilization of production protocols to assure food quality and food safety, legal issues), and to enable research topics that are needed by European food SMEs.

### **TRAF00N WORK PLAN**

At the beginning of the project, the needs of traditional food SMEs all over Europe have been investigated and collected (Inventory of Needs, IoN). With this purpose, four questionnaires, one for each traditional food category, were developed including issues from the entire food production chain, but also questions related to food safety and quality, and entrepreneurship & legal aspects. All TRAF00N partners contacted the identified SMEs and SME associations via email/phone/visit, extracting the relevant information for the IoN through the corresponding questionnaire. After extract the needs, SWOT analyses of the results for each TRAF00N traditional food category were carried out by country and sector.



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Five multi-stakeholder workshops (MSWs) took place between September and October 2014 in Poland, Spain, Switzerland, the Netherlands and Czech Republic. In each MSW, TRAF00N partners, relevant SME associations and external specialist analyzed the results of IoN for the core regions of the food category. The main objectives of the MSWs were: 1) prioritizing the needs collected in the IoN, 2) matching the needs identified in the IoN with the available transferable innovations identified by partners, 3) identifying those needs which do not require in depth research and may be solved without the development of new research projects, finding the solutions within the consortium experts, external scientists, or in collaboration with ongoing projects and 4) identifying those needs requiring new scientific approaches to be included as recommended research lines/initiatives in the Strategic Research and Innovation Agenda (SRIA).

During 2015 and 2016, based on the results of MSWs, more than 55 Training Workshops (TWs, <http://www.trafoon.eu/training-workshops/>) for SMEs have been held in Europe. During the TWs, the technological, legal, or business-related solutions for these previously identified needs/demands have been transferred, where specifically trained mediators have been used to communicate these solutions in the language of the respective countries.

As additional knowledge transfer tool, a multi-lingual online Information Shop ([www.trafoon.org](http://www.trafoon.org)) containing the information gathered and implemented within the TRAF00N network has been created. This free access online tool includes information (PDF files, ebooks, audio and video files etc.) about innovations in primary production, processing and marketing of traditional food using regional raw materials in different languages. The Information Shop also contains databases of experts and organizations to enable potential future collaborations and SME-oriented research projects, and includes all technology/innovation knowledge transferred during the TWs and guidelines for product innovations in diverse European languages.

## **STRATEGIC RESEARCH AND INNOVATION AGENDA (SRIA) FOR TRADITIONAL FOODS**

Based on the detected innovation gaps and the identified needs that require further research, and complemented by SWOT analysis of the demands of SMEs during the MSWs, TRAF00N has developed four SRIAs for the core regions of the TRAF00N traditional foods categories: (1) grains, (2) fish, (3) vegetables and mushrooms, and (4) sweet fruits and olives. TRAF00N SRIAs will inform national policy makers about future research need of traditional food SMEs, especially fostering rural development.

Additionally, a general SRIA (no product-specific) for traditional foods at European level has been developed in collaboration with the FP7 TRADEIT project. This joint TRAF00N-TRADEIT SRIA will inform the European Commission and European policy makers about future research answering the identified needs of SMEs in Europe.



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## **2. Sweet fruits (TRAF00N selection of fruits, and TRAF00N countries: Switzerland, Serbia and Poland)**

Two fruits traditionally grown in Switzerland were selected as the main focus of TRAF00N project: strawberries and apricots. These fruits are known for their excellent sensorial and nutritional quality. Most of the fruits harvested are sold fresh, especially strawberries. As to apricots, they are present on the market as fresh fruits and processed into juice, puree, dried fruits or famous brandy – abricotine. Abricotine is an eau-de-vie made from apricots of the variety „Luizet“ and it has a Protected Designation of Origin (PDO) label.

Serbia selected two fruits: raspberry and plum. Raspberries are one of Serbia’s best known and most widely exported fruits. Serbia is one of the biggest producers and exporters of raspberries in the world. They are prized worldwide for their colour, unique taste and firmness. Raspberry of Arilje has protected indication of origin in Serbian IPO. Plum is the most common species of fruit trees in Serbia, and has the greatest economic importance. Serbia is the second biggest producers of plum in the world. Serbia mainly exports fresh, frozen and dry plums. Several other products such as brandy, jam, marmalade, sweet of plum, compote and plum puree are also produce among which plum brandy “Šljivovica“ is economically the most important.

Due to the scale of production, it was decided that in the case of Polish TRAF00N project will generally refer to the sweet fruit and berries.

### **2.1. General overview of current situation of sweet fruits’ sector and traditional food SMEs in Switzerland (including SWOT analysis)**

The traditional food sector aims to be innovative in order to maintain its competitiveness. Strawberries are produced in various regions of Switzerland such as Thurgau, Bern’s Seeland region and Valais. Around 10% of whole Swiss strawberry production takes place in Valais. The production of apricot fruits in Switzerland is highly concentrated in the canton of Valais, 98% of Swiss apricots are grown in Valais. Between 8 000 and 10 000 of tons apricots are harvested in Valais each year. Most of the fruits are sold fresh but some are also processed into juice, puree, dried fruits or famous brandy – abricotine. Abricotin is an eau-de-vie made from apricots of the variety „Luizet“ and it has a Protected Designation of Origin (PDO) label.

The analysis of inventory of needs carried out among Swiss SMEs involved in production and processing of strawberries and apricots led to the SWOT analysis, with the following results:

#### **Strengths**

- Local production



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- Strong image in consumers' minds (e.g. apricot brand Valais)
- Good coordination in supply chain (producers/researchers/professional organization)
- High quality of fruits
- Protection of indigenous production (frontiers)
- Open for innovation
- Well organized storage-transport chain between producer and trader

### **Weaknesses**

- Large diversity of packaging
- Disease and pest resistance vs. organic production
- Lack of communication with consumers
- The need to develop and/or improve storage technology
- Structure and organisation of distribution channels weakens small producers
- Problem of apricot pollination: a need to develop more self-compatible varieties
- Bureaucracy, multiply norms and certification cause overload with paperwork

### **Opportunities**

- Improved quality (eg. taste)
- Expanded general and specific knowledge on varieties
- Expanded knowledge on consumers' expectations
- Awareness of consumers on health aspect/properties of fruits
- Trend for healthy life-style (increased consumption of fruits)
- Development of new products, use of by-products, ready-to-eat products
- Access to new markets: Organic products, premium products ("haut de gamme")
- Assured supply of fruits for transformation
- Shortening the distance between producer and consumer (i.e. reallocate added-value along the chain)

### **Threats**

- Norms, regulations and certifications on EU level – the need of harmonization, simplification
- Multiple residues: no alternative products currently available
- Competition (at international level-low price of imported fruits; at national level-a need of national market observatory)
- Labour force: availability in the future + high cost (compared to foreign countries)
- Retailers' power (requirements, regionalism-private regional brands)
- Large distance between production area and consumption area



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- Environmental concerns (e.g. candles prohibition to fight frost)

## 2.1.1 Primary production

### a. Breeding issues:

- **trade-off between productivity and quality**
- **multi-resistant varieties for organic production**

*Example: developing new varieties that offer a reasonable productivity, keeping a good quality (external and internal); creating new varieties tolerant or resistant to several important diseases for successful cultivation of fruit species in organic production*

#### Specific Challenge

Fruits are partially consumed as fresh, without any industrial transformation. This implies the requirement for high quality to satisfy consumer expectations. In this setting, innovations regarding varieties become important. The large diversity of sweet fruit varieties is useful to select, create and develop new varieties relevant for stakeholders. These varieties are essential to face challenges such as adaptability to climate change, pest and disease resistance/tolerance, fruit quality and health claim.

#### Scope

- Design of varieties for each sweet fruit species adapted to current and future agroecological areas
- Production of relevant pre-breeding material associating techno-socio-economic characters to implement the agronomic value
- Shift from breeding activities based on novelties to breeding based on the maximization of the agronomic value for the stakeholders
- Adaptation of newest breeding techniques used for major crops that are not yet developed for sweet fruits
- Increase in disease resistance by developing varieties specifically resistant to one or a few dangerous diseases to allow producers' choice to invest in varieties targeting the risks encountered in their local geographical plots

#### Expected Impact

- Varieties accessible for EU-SMEs, producers, traders, processors and consumers and well-adapted to the specific needs of the market. The improved cultivars developed according to market's needs and with lower inputs (e.g. chemical spread) will bring high quality products, with a sustainable impact in conventional and organic systems
- Economic benefits to farmers and retailers (including a better market position), and increased health benefits for consumers
- Enhanced productivity by using cultivars with a regular yield and that do not require pollinators, thus reducing the cost of growing and harvesting
- A larger choice for growers among a larger range of available cultivars and will be able to adjust their choice of cultivars according to their local conditions and to their farming management practices (conventional or organic).



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## **b. Cost-efficient implementation of water management system**

*Example: reducing the water waste with efficient technical system*

### Specific Challenge

Innovative precision agriculture could be an appropriate answer to the current waste of water by the classical irrigation systems. Due to crop and soil variability fixed rate irrigation leads to areas in field being over-irrigated and loss of nitrogen by leaching while at the same time other areas may be deficient in water leading to drought stress of plants and yield losses. A new smart system should be proposed in order to allow more efficient use of water, improved yield and quality and to safeguard the environment.

### Scope

The Information and Communication Technologies (ICT) solution integrates Earth Observation derived information with *in situ* measurements and model outputs into a smart irrigation scheduling system enabling variable rate application of irrigation water to agricultural and horticultural crops.

- Implementation of analysing satellite and drone imagery for measuring spatial variation of drought stress intensity
- Implementation of variable rate application of irrigation water using existing hard and software infrastructure for drip irrigation and upcoming localized precision guns

### Expected Impact

- ICT solutions adapted for sweet fruits in order to assess drought sensitiveness and water stress
- Correct irrigation and adaptation of the duration and amount of water supply
- Exploitation of ICT solutions and recommendations for growers (irrigation service)
- Integration of remote sensing technology for smart precision irrigation platform

## **c. Implementation of technical solutions for controlling pest and diseases management in organic and conventional production**

*Example: measures for practical implementation, registration of biopesticides and biofungicides*

### Specific challenge

Public requests a diminution of the use of pesticides. Furthermore, organic production of sweet fruit, and especially of apricots, is not profitable because of the lack of direct and indirect solutions against some pests and diseases. Beside long-term solutions using breeding, some management strategies should be tested as short-term and mid-term solutions.



## Scope

The main goal is to develop efficient management strategies for sweet fruits. Fundamental and applied research should focus on:

- A better understanding of epidemiology and of biological processes allowing a diminution of pest and disease pressure
- The replacement of synthetic product by natural products.
- Assessment of new orchard management systems and observation networks of low input orchards

## Expected impact

- Technical solutions will enhance sweet fruit productivity for producers and permit to produce high value organic fruits
- Availability of sweet fruits from organic production to the consumers and enhancement of the positive image of traditional products
- Regular availability of organic traditional products for retailers
- Improvement and expansion of technical knowledge and sustainable solutions

### **d. Establishment and development of certified planting material**

*Example: procedures and schemes of control and certification for propagating material in order to improve the quality of propagations materials for conventional and organic production*

## Specific Challenge

Nurseries are often unaware of sanitary status of plant material. Furthermore, symptom development is not always visible on young plant material, especially by latent infections. Depending on pests and diseases, visual inspection does not always allow assessing the real sanitary status of plant material. Sanitary status control schemes are not well defined for every pests and diseases on minor crops, and especially for traditional sweet fruits. In order to avoid trading of infected plants and to diminish the disseminating risk of plant pests and pathogens worldwide, precise certification procedures need to be established at a large scale in the EU.

## Scope

- Establishment of objective criteria to define sanitary status for sweet fruits plants and optimization of needed diagnostic technologies
- Assessment of the level of infection by different pests and diseases on minor crops in stocks and nurseries

- Development, validation and promotion of the use of methodologies for the efficient characterization of the sanitary status of sweet fruit tree materials

#### Expected Impact

- Set of the most appropriate method for efficient certification procedures in order to prevent trading of infected material
- An update on the occurrence and distribution of pests and diseases on minor crops in the EU
- Availability of healthy plant material with higher sanitary status will represent a competitive edge for the EU market

### 2.1.2 Processing

#### **a. Implementation of modern packaging to enhance shelf life, to reduce waste and to improve the post-harvest technology (storage)**

*Example: intelligent packaging in modified atmosphere*

#### Specific Challenge

Fruits are highly perishable products. The quality of soft fruits such as strawberries diminishes quickly after harvest. Their shelf life does not exceed two days at room temperature, or four days when refrigerated. Just few days' extension of soft fruits shelf life would make a difference and decrease the losses due to the perished fruits. Efforts are made to develop modern packaging in order to enhance shelf life of fruits, using either modified atmosphere or adsorbent pads containing mixture of bioactive compounds (flavonoids and organic acids). Modification of storage atmosphere aims at decrease in the respiration rate of fruits. This effect is achieved by increasing CO<sub>2</sub> and/or decreasing O<sub>2</sub> concentration. High CO<sub>2</sub> concentration can also inhibit the generation of ethylene because it can influence the enzyme activity. Adsorbent pads are cushioned to protect fruits from damage during transportations whereas the mixture of flavonoids and organic acids work as antimicrobial agents. The results of the modern packaging usage in extending the fruit shelf life are promising, however, at the moment; these kinds of solutions are known mainly in the scientific world and are not yet implemented by SMEs.

#### Scope

New active packaging technologies are being intensively developed during the last years. The aim is to implement smart and economically reasonable solutions in SMEs

- Implementation of modern packaging technologies in fruit producing SMEs

#### Expected Impact



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- Enhanced shelf life of fresh fruits
- Decreased losses due to perished fruits

**b. Better implementation of waste management and development of value-added by-products**

*Example: increasing the valorization of by-products (damaged fruits, kernels of apricot, etc.) to increase their economic value*

Specific Challenge

Increasing environmental concerns have resulted in the need to minimize the amount of waste generated by the food industry. Utilisation of wastes for creating value-added by-products can bring also economical profits. From the two fruits chosen as the concern of TRAF00N project in Switzerland strawberries are mainly sold as fresh non-processed fruits, therefore the problem of waste utilization apply mainly to apricot processing. Starting with depitting, processing of apricot fruits results in large amount of apricot kernels. The results of scientific studies show the potential utility of apricot kernels oil for cosmetic purposes. On the other hand, juice production provides with large amount of pulp, which might serve as source of pectin.

Scope

The range of possible utilization of wastes originating from apricot processing is still narrow. Alternative value-added by-products of apricot kernels need to be developed. On the other hand, the solutions showed by scientific studies need to be evaluated for their economical utility and implemented to SMEs.

- Development of alternative value-added by-products of apricot kernels
- Implementation of existing solutions to SMEs

Expected Impact

- Diminished amount of wastes
- Increase in economic value
- Wider range of products on the market

### 2.1.3 Product

- a. Reducing the diversity in forms, materials and numbers of packaging by raising consumers awareness (communicate on local environment, tradition and regional trademark)**



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*Example: facilitating the packaging step by reducing the number of different packaging and so the technical adaptation, the aim is to approach this problem through the education of consumers which therefore will develop the pressure on retailers*

#### Specific Challenge

SMEs are challenging the problem of great diversification of packaging. Different type, form and size of packaging are imposed by retailer. It makes packaging process time consuming, costly and requiring qualified labor force. The challenge is to obtain the optimal trade-off between the usage of smart packaging, the diversification of packaging due to branding and sustainability. On the one hand, smart packaging could help preventing early ripening and improve the shelf-life of fruits (2.1.2a). On the other hand the large diversification of packaging and labels increase costs for SMEs and potential amount of wastes produced. Due to high power of the retailers in the supply chain only the pressure coming from the consumers can change their requirements imposed towards producers.

#### Scope

- Standardization of packaging
- Improving the speed and easiness of packaging filling
- Consumer education in order to raise their awareness and encourage them to develop the pressure on retailers

#### Expected Impact

- Sustainability
- Decreased costs for SMEs
- Consumer awareness of consequences of different size, forms and numbers of packaging
- Weakening of retailer power in the supply chain

### **b. Producer targeted dissemination of knowledge on health, nutritional properties of their products**

*Example: measures aiming at spreading the knowledge on nutritional properties of traditional product, their beneficial effect on consumer health*

#### Specific Challenge

Strawberry fruits are highly valued for their taste and nutritional value. Strawberries are an important source of vitamin C in human diet as well as phenolic compounds: anthocyanins, ellagic acid derivatives and flavonols. The consumption of strawberries has been associated with prevention of inflammation, cardiovascular and neurodegenerative diseases as well as type-2 diabetes. Apricots are rich in carotenoids, phytochemicals which also might play role



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in the prevention of chronic diseases like macular degeneration and certain cancers. The consumer awareness about the health benefits of fruits is constantly rising. However, quite often their interest turns toward the tropical fruits such as goji or açai having the opinion of superfood. The producers should be aware of the health benefits of the local fruits and communicate the nutritional value and potential health benefits of their products.

### Scope

- Developing the measures of spreading the knowledge on nutritional properties of traditional products
- Including the follow up phase in the new projects aiming at evaluation of health properties of fruits, which will include the dissemination of the obtained results on the consumer-producer level

### Expected Impact

- Increased knowledge of producers on the health properties of their products
- Better communication between producers and consumers

## **2.1.4 Marketing**

### **a. Increase the awareness on traditional food through continuous education and communication**

*Example: development of greater role of the state institutions, public and private research sectors, as well as private investment sector in the field of branding of traditional products*

### Specific Challenge

Ways of consumption are evolving in occidental societies, like bigger distances between production and consumption areas, reduction of time dedicated to household shopping and mealtimes. Consequently, there is a lack of direct communication about food properties between producers and consumers. Moreover, the existing knowledge does not efficiently reach on one hand the producers and on the other hand the consumers. The exchange of information, transfer of knowledge and validation of innovative solutions need to be facilitated. Besides, the area of traditional products branding is crucial for apricot regarding its high potential value for the region of Valais.

### Scope

- Facilitating formation of national and international network of SMEs
- Facilitating the information transfer from research to SMEs thanks to activities such as workshops, research institution open days



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- Follow-up projects (following the research project) to carry out in order to implement innovative solution
- Improving communication between traditional food producers and consumers with activities like tasting panels, events gathering consumers and producers in retail stores
- Developing continuous education of consumers, regular flow of information towards consumer regarding quality characteristics, health properties, seasonality aspect, varieties, etc.
- Public support to promote branding of traditional products
- Investments in research activities to define intrinsic characteristics of varieties helping differentiation definition

#### Expected Impact

- Expanding knowledge of both producers and consumers about the expectations and abilities of each body (quality characteristics, maturity evolution, healthy properties, price information, know-how and habits)
- Increasing consumption of healthy food (e.g. fruits)
- Increasing awareness of traditional aspect of local products (characteristics of production and harvesting activities, internal and external characteristics)
- Developing branding activities and support of producers initiatives
- Better communication along the supply chain

#### **b. Constant improvement of policy conditions for labor management and organization of support**

*Example: improvement of labour advisory services, continual labour education, incentives by local authorities and government, improvement of marketing, negotiation and manager skills*

#### Specific Challenge

Fruit production displays peculiarities in terms of management and production activities. Traditional fruits production like apricots and berries demands high-labor investment. The acquisition of knowledge and skills on manual harvesting techniques should be efficiently performed. In a setting of political conditions evolution, there is a need to better address these crucial expenditures items.

#### Scope

- Improvement of labor advisory services
- Continuous labor education
- Promoting incentives by local authorities and government
- Improving management skills
- Flexibility on labor hiring to ensure availability according to harvesting period
- Promoting and facilitating succession of farms (especially financial sustainability)



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## Expected Impact

- Efficiency in labour activities
- Growth of labour economies (efficient training)
- Growth of farm handing over (family succession)
- Improvement of working conditions
- Increase of labor force availability

### **c. Implementation, harmonization and creation of laws and regulation policy**

*Example: heterogeneity in laws between European countries that can hinder innovation adoption in specific settings (for instance phytosanitary treatment prohibition)*

## Specific Challenge

With the evolution of regulations on sanitary and quality of production techniques like requirements on residues amount in production, there is a need to standardize the rules at a broader level. Innovation adoption can be hindered in specific settings (i.e. phytosanitary treatment prohibition).

## Scope

- Homogenization of European rules to facilitate use of agricultural inputs (e.g. pesticides)
- Reduction of certifications related to sanitary uses (e.g. limited number of inputs' residues on fruits at harvesting point) to simplify production frame and reduce administrative tasks
- Increasing flexibility regarding inputs uses to increase inter-firm and international uses of inputs
- Elaborating norms bases on quality criteria of products in order to increase quality level of production and incentivize stakeholders to target better quality than higher productivity, meeting consumers expectations

## Expected Impact

- Facilitating comparison of products used in different European countries
- Facilitating controls by authorized institutes and treatment management by SMEs
- Reducing bureaucracy time-consuming activities
- Putting priority on fruits of good quality

### **d. New business model (supply chain actor's balance)**

*Example: spreading the power between actors in the supply chain by implementing new organization or giving voice to the weakest actors*



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### Specific Challenge

Supply chains are governed by different type of stakeholders. Depending on their position in the chain, decision-making could be difficult because of an established power relationship. The evolution of life style and consumption ways are increasingly highlighting the power of retailers. There are more and more requirements of specific innovations towards more differentiation, diversified packaging and other high-labor and technology intensive assets.

### Scope

- Developing more coordination between the supply chain actors (e.g. producers, processors) and research centers to contribute to the improvement of knowledge transfer and communication along the value chain
- Improving trust along the supply chain by developing stronger relationships
- Promoting and strengthening the links in the network of apricot sector would increase innovation opportunities
- Increasing interactions between support and services institutions like research centers, universities, public office of arboriculture

### Expected Impact

- Balanced decision power on diverse important activities along the supply chain (e.g. increased producers power regarding upstream tasks)
- Better communication between upstream and downstream actors
- Increase in innovation diffusion thanks to better communication and trust among stakeholders
- Better value chain image towards consumers
- Stakeholders more engaged in collaborations in order to improve innovation development and implementation
- Development of innovation along the supply chain (raw material to processed food, packaging and other related activities)





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## **2.2. General overview of current situation of sweet fruits' sector and traditional food SMEs in Serbia (including SWOT analysis)**

Raspberries are grown on small family owned farms on plots of land that average 0.5 hectares. They are harvested by hand. Raspberries are grown on 16 thousand hectares throughout Serbia. With an average yield per hectare of 6 tons Serbia in 2004 produced more than 92 thousand tons of raspberries. During the recent years in Serbia average annual production of raspberry was about 80.000 t which is 5.5% of total production of fruit.

Almost 90% of raspberry is frozen in large warehouses, and only 10% are still used for processing or sale in retail stores. The majority of Serbian raspberries are exported frozen (93%), and only a small number of exported fresh. About 25% of world raspberry production is from Serbia.

The main problems in production of raspberry was high sensitivity to climate changes, inadequate implementation of production processes and unplanned increase of production areas, even in the absence of minimum for high-quality and cost-effective production of raspberries. Also, lack of money at the time of purchase and late payment to producers make a problem in production process.

Of all areas harvested with fruit, 67% goes on stone fruit, two third of which are areas under plum. In overall annual production of fruit in Serbia stone fruit participates with 57%. Orchards in Serbia occupy 4.8% of area under agricultural land. More than 50% of that is plum orchards.

Serbia holds second place, after China, with 158.000 ha under plum trees, which is 6.24% of total world area under plum. Serbia has double of more area under plum than countries in region, and holds first place in Europe, with Bosnia and Romania, far behind with 79.000 and 67.478 ha. All the other countries in the region have less than 20.000 ha under plum.

The majority of Serbian plum are exported fresh (63.39%), than frozen (21.10%) and dried (13.83%). Among other products (brandy, jam, marmalade, sweet of plum, compote and plum puree), the most important is „Šljivovica“ – plum brandy (1.18%). About 75% of all produced plum in Serbia is processed to plum brandy.



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Cultivation of plums faces many problems in Serbia today, planting material, plum varieties, cultivation methods, mechanization, production stagnation, decline in yields, age of trees. One of the main problems in cultivation of plum in Serbia is plum pox virus (PPV) for which effective measures does not exist. Majority of plum trees are infected with this virus, more than 70%, representing a threat to the future cultivation of plum.

After collecting of data from SMEs involved in production and processing of sweet fruits, SWOT analysis was performed with the following findings:

**Strengths:**

- Big potential of human resource and its well trained professionals
- Experience and tradition in innovation in Sweet fruit sector
- Big and diverse potential of domestic raw materials
- High quality of specific varieties recognized on international market (raspberry from Arilje)

**Weaknesses:**

- Low level of research and development in the companies
- Lack of long-term strategy for development in the companies
- Obsolete equipment
- Lack of continuous education in the companies
- Weak connection of companies with the generators of technologies and knowledge
- Low level of IPR culture
- Lack of marketing skills
- Lack of ICT skills (skill to complete questionnaires)
- Problem with labelling (mostly because of IPR issues)
- Packaging

**Opportunities:**

- Sweet fruit sector as national priority
- Possibility for IPR protection
- Financial opportunities in IPA (instrument for precessions associations) funds
- Building clusters and networking (Ethno cluster)
- Branding of traditional products
- Trends in health food and organic production



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Threats:

- Absence of standardization and harmonization of legal regulations
- Insufficient presence of knowledge and technology transfer institutions
- Distributer, bad cold chain transport
- Retailer, bad storage conditions and payments

## 2.2.1 Primary production

### a. Breeding issue trade-off between productivity and quality

#### Specific Challenge

Raspberries are highly sensitive fruits, which have small sustainability and week transportability. Raspberries are hand-picked, which increases the possibility of defects. These properties of the fruit can be mitigated by creating better varieties, with firm, transportable and larger fruits that can be easier separated from the plant leading to faster and easier harvest. At the same time productivity needs to be preserved allowing cost-effective production. Plum fruits are more tolerable to transport, but rupture of the epidermis in maturity state happen during harvest and transport, increasing quantity of defect fruits. Selection of new varieties with improved technological properties and good yield would reduce defects and increase profit.

#### Scope

The strategy of varietal innovation development from the perspective of the breeders should be established. The main criteria of varietal innovation should include: firmness, size, climate adaptation, productivity, easing of harvesting and resistant to transport. Universities, R&D Institutions should conduct the research, widely disseminate the results and successful transferred to producers in assistance of knowledge transfer agencies and IPO.

#### Expected impacts

- *Developing new varieties that offer a reasonable productivity, keeping a good quality (external and internal)*



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- *Introducing producers with economically sustainable production in the quality and quantity*
- *Cooperation with the scientific research sector*
- *Expansion of assortment in plantations on the orchard*
- *Work on the production quality and yield*

## **b. Establishment and development of certified planting material**

### Specific Challenge

In Serbia, 70-80% of plum trees are infected by plum pox virus (PPV) for which effective protection measures still does not exist. During the vegetative production of planting material, PPV is transmitted to the planting material from mother plants. Only effective measure is production of certified virus-free planting material. Recently, in some raspberry orchards was revealed the presence of a new detected virus, raspberry leaf blotch virus (RLBV), which has detrimental effect on the leaf and yield. In the coming period it is necessary to carry out sophisticated analysis to determine how the virus affects the quality of the fruit, mechanism of transmission and early diagnostic methods.

### Scope

Set of measures should be taken to prevent the further spreading of viruses such as quarantine measures and post-quarantine control, removing of infected plants and permanent control over plants under the risk, production of free-virus plants and prevention of virus infection through certification of planting material, control of the transmission process, selection of safety location for new plum/raspberry cultivation and development of methods for early detection of viruses. The long-term national strategy by governmental bodies should be established. Universities, R&D Institutes, local and national public bodies, policy makers, different associations, producers, media etc. should be involved to overcome this problem.

### Expected impacts

- *Creating new varieties tolerant or resistant to several important diseases for successful cultivation of fruit species*
- *Establishing procedures and schemes of control and certification for planting material in order to improve the quality of planting materials for conventional and organic production*
- *Development of diagnostic methods for early detection of the viruses*

### **c. Cost-efficient implementation of water management system**

#### Specific Challenge

Raspberry is a plant that requires a lot of moisture, since her root develops in the surface layers of soil. Raspberry flowering and ripening during the late spring and summer, when temperature of air could be very high which would cause a rapid loss of soil water by evaporation and transpiration through the leaves. Accordingly, the first condition for the growth of the raspberry is the presence of a sufficient amount of moisture in soil and air. Plum trees require good supply of water during entire vegetation period, with air moisture between 75-85%. Irrigation drop by drop combine with fertilizers and implementation of atomizers are the best way to supply orchard with enough quantity of water, especially if sensors are distributed inside it. The investment for this type of irrigation is very high for individual producers and SMEs, so any technical solution which could reduce the investment costs could significantly improve application of modern irrigation techniques.

#### Scope

Majority of raspberry and plum orchards in Serbia are in private property, and most of the orchards are in rural highland areas. Majority of private orchards contains of several smaller parcels, which makes difficult implementation of modern techniques of irrigation. Development of new irrigation techniques with better energy and water saving, or adaptation of existence for small orchards could increase the number of implemented solutions. Better cooperation between state and fruit producers, more funds for traditional producers and organisational support should be established.



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### Expected impacts

- *Development of technical solution to minimise the investment costs*
- *Reducing the water waste with efficient technical systems*
- *Using modern technologies that are adapted to our climate, demographic, organizational and market conditions.*

### **2.2.2 Processing**

- a. Implementation of modern packaging to enhance shelf life, to reduce waste and to improve the post-harvest technology (storage)**

#### Specific challenges

Modern packaging such as packaging in modified atmosphere (MAP), active/intelligent packaging, and packaging in edible films are still in development in Serbia. Many SMEs in Serbia expressed the wish to extend the shelf-life of their products. They considered that adequate packaging and storage conditions could contribute significantly. They were not aware of the concept of MAP, active and intelligent packaging and were unsure of what benefits they will achieved concerning that implementation of modern packaging increase the investment costs. Increasing the knowledge on new technological achievements in the field of packaging and storage would be of primary importance for introduction of modern packaging in fruit post-harvest treatment in Serbia.

#### Scope

Packaging innovation is necessary for producers and processors of raspberry and plum if they are to extend the shelf-life of products or to expand beyond the normal regional markets. The training and educational programmes should be established by the research community and should be realized by support of local authorities. Establishment and publication of electronic magazine which would translate science innovation results to easy to follow format can be



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useful for this issue. Further, purchasing of modern packaging technology could be enabled through specific funds allocated to support of SMEs.

## Expected impacts

- *Increasing knowledge on modern packaging technology*
- *Introduction of modern packaging in fruit food chain*
- *Extended shelf-life of raspberry and plum products*
- *Implementation of modern packaging technology*

## **b. Modernization of storage technology of raw materials and products**

### Specific challenges

Modern cold storage (control atmosphere, ultralow oxygen, ultralow ethylene, storage with dynamic atmosphere) are the best way to preserve fresh fruits. Building of these types of cold storage is still in development in Serbia, largely due to cost. Besides that, existing storage still don't have enough capacity to storage all fruit products during the harvest season. On the other hand, distribution of fresh fruits and their products as well as their storage in distributive centers or markets are sometimes in inadequate conditions which significantly reduce the shelf-life of products. Increasing the knowledge of all stakeholders including in post-harvest treatment of fruits on new technological achievements in this field would help to introduce the post-harvest technologies in fruit food chain and reduce the unnecessary losses.

### Scope

Production of raspberry and plum are mainly performed by SMEs with ten or less employees or by individual producers. Consequently, there is very little in-house knowledge about innovation in production and processing of fruits. Continual education should be organized through different forms by seminars, training workshops etc. But, many smaller SME's focus attention on business maintenance (lower number of employees, maintaining turnover) and have no capacity to attend trainings/events/workshops. Education through media (TV, radio, journals), short-trainings or through local agricultural bodies (agricultural

advisory services) could help to overcome this problem. Better cooperation between local producers through formation of cooperatives in assistance of financial support could facilitate purchasing of modern storage technology with satisfy capacity.

### Expected impacts

- *Education of producers on significance of modern post-harvest technology*
- *Modernisation of storage conditions*
- *Implementation of adequate storage conditions in distributive chain*
- *Extend the availability of raw materials after harvest season*
- *Provide the raw material of comparable quality during extended period*
- *Implementation of modern storage*

### **c. Development and implementation of modern processing technology**

#### Specific challenges

Processing of fruits in Serbia is at very low level concerning product portfolio. Only several products of raspberry and plum exist on the market among which lyophilized raspberry, dry plum, plum brandy, plum jam, marmalade, compote and sweet of plum are among the economically most important. Development of new processing technology would increase the portfolio of fruit products leading to better utilization of raw material and production of added value products. Products such as chocolate-coated fruits, juices, fruit wine, fruit spreads or confectionary products based on raspberry and plum are insufficiently produced. Majority of by-products and wastes are not exploited. Also, implementation of modern processing technology in existing processing processes could help producers to obtain added value such as in dry plum production. In Serbia, majority of producers has dryers with opposite air/product flow which gave products with unequal quality. Introduction of same air/product flow dryers in plum processing SMEs would enable productions of high quality prunes for shorter period of time and consuming lower energy compared to the opposite air/product flow dryer.



## Scope

Increase awareness of local equipment producers on innovation of their manufacture processes, significance of production of small scale equipment should be conducted through educational seminars/workshops. Research by Universities and R&D Institutions on development of new technology for processing fruits as well as by-products and wastes should be performed. Transfer of knowledge should be efficient by help of knowledge transfer agencies and IPO. Lecturers by experts on fairs, meetings of producers/processors associations and other proper events would increase knowledge of innovation in processing technologies.

## Expected impacts

- *Development and implementation of technology for processing of fruits, by-products and wastes adopted to SMEs capacity*
- *Increasing knowledge about the importance of processing technologies*
- *Increase investment in processing technologies and increase of processing capacities*

## **2.2.3 Product**

### **a. Faster and better implementation of food safety management systems**

#### Specific challenges

The prevention of pathogens contamination has to be a preferred strategy in food production. The implementation of GAP, GMP and GHP will ensure production of safe products. Potential risk during production of fruits exists in all phases of production process: on the field, during harvest, handling, processing, distribution and storage. The main risks for plum and raspberry production are worker hands, packaging containers and water for irrigation/fertilisation. Producers of raspberry and plum (especially individual producers) are not enough aware of the importance of personnel hygiene and all hazards that could have impact on safety and quality of their products.



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Concepts similar to hazard analysis and critical control point programs, if systematically applied in plum and raspberry production and processing, could increase safety and quality of products.

### Scope

Lack of skilled workers and technical personnel is one of the problems for introduction of good agricultural and hygiene practise. Continual hygiene audits and training should be frequently preformed to educate producers and processors. Also, short-term training programmes for new employees in issues such as HACCP, hygiene, handling, irrigation, packaging etc. could lead to faster implementation of food safety management systems. Such basic training can be conducted by local agricultural advisory services, regional chamber of commerce or producer organisations. Also thorough management risk assessment via traceability system and recall procedures should also be implemented.

### Expected impacts

- *Better implementation of all existing EU and other international hygiene standards as good practice-based (GHP, GAP), hazard-based (HACCP), risk-based (QMRA) systems and EHEDG standards*
- *Increasing knowledge of producers/processors about the food safety management*
- *Increase safety and quality of products*

### **b. Producer targeted dissemination of knowledge on health, nutritional properties of their products**

### Specific challenges

Raspberry and plum are fruits rich in bioactive compounds (BAC), mainly phenolic compounds (phenolic acids, tannins and flavonoids, such as anthocyanins and flavonols) and vitamins characterized by relatively high antioxidant activity. These compounds, either individually or combined, are



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responsible for various health benefits, such as prevention of inflammation disorders, cardiovascular diseases, or protective effects to lower the risk of various cancers. Raspberry and plum, fruits full of BAC, are also very delicious and have low energy, which is essential part of balanced diet. Although plum and raspberry are considered as traditional product in Serbia and their productions are bigger than other fruits, the consumer knowledge about health potential of these fruits are still limited. Producers should make an effort to spread the knowledge on nutritional and functional properties of traditional products to improve business success and reputation.

### Scope

To create better awareness of the importance of consumption of plum and raspberry products an effective dialog with consumers should be established. Promotional materials in supermarkets (flyers, posters), on social networks or promotion of traditional food through media could be effective way for distribution of information on health benefits of raspberry and plums. Also, training programmes, networking events, formation of science shops and development of communication strategy can assist in this issue.

### Expected impacts

- *Increase awareness of nutritional and functional properties of traditional fruits and their products among consumers*
  - *Increase consumption of traditional fruits and their products*
- c. Reducing the diversity in forms, materials and numbers of packaging by raising consumers' awareness (communicate on local environment, tradition and regional trademark)**

### Specific challenges

Product design dimensions can influence consumers' purchase intentions, word of mouth and willingness to pay. Different package size, transparency, visual-attractiveness also influence the sale of products. The self-opening, self-closing, self-sealing packaging became more popular among consumers. This movement in food packaging increase significantly investment of SMEs which is



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too much for financial limited SMEs economy. Raising consumers' awareness that quality of products are more important than visual impression and possible detrimental effects of too much packaging aesthetic solutions on production of traditional food would make a pressure to manufactures of packaging materials and equipment to reduce the packaging offers.

### Scope

The innovative packaging needs to enhance the product shelf-life, be attractive and consumer-friendly but also be sustainable. Producers of raspberry and plums together with scientific community, association of producers and consumers should on an easily-understandable way communicate with consumers on local and regional level about unnecessary manufacture of different size, forms and numbers of packaging. The traditional products should have several aesthetic packaging solutions recognized by consumers and protected by industrial design.

### Expected impacts

- *Reduction of different forms, materials and numbers of packaging*
- *Increase awareness of consumers of unnecessary production of different size, forms and numbers of packaging*

## **2.2.4 Marketing**

- a. Constant improvement of policy conditions for labour management and organization of support**

### Specific challenges

Production and processing of raspberry and plum are mainly family business or small company business in which the management, production, distribution, marketing etc. are activities of one person, mainly owners. Due to lack of time, managers of company are disabled to attend training programmes, explore databases or possibilities to get funds. There is a need to develop support programmes for very small SMEs. Such a support package need not be limited



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to financial matters but can cover organisational support, management support, external skills provision, etc.

### Scope

Local/regional training supports and guidance through the innovation process is essential for many companies. Associations of producers/processors together with local authorities (agricultural advisory services) should be more active in organisation of training workshops on all food value chain subjects. More control of individual producers should be done by AAS. Information about possibilities of getting financial support from funds should be better distributed among producers/processors. Academic community should be more involved in creation of novel knowledge and transfer of knowledge. Better communication and linkage between all actors in food value chain should be established. Formation of specific funds for development of traditional fruit sector is needed.

### Expected impacts

- *Development of an organizational model for clustering of producers and exporters of traditional fruit products*
- *Development of management models for SMEs*
- *Better networking between producers and academic community*
- *Long-term policy changes within financial sector*
- *Improved marketing skills of SMEs*

#### **b. Branding of traditional products**

### Specific challenges

Protection of intellectual property rights is at very low level in Serbia. Although intellectual property office has a long tradition in Serbia, producers and processors of raspberry and plum has a low level of knowledge about possible protection of their products and respective procedures. For example, the most famous Serbian brand - plum brandy "Šljivovica" is not protected. Only



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raspberry from Arilje is protected by indication of geographical origin in Serbian IPO. Absence of IPR protection causes difficulties in placement of traditional Serbian sweet fruit products on domestic and international markets.

### Scope

The problems of IPR protection and brand development should be overcome by the greater role of the state institutions, public and private research sectors, as well as private investment sector in the field of branding of traditional products. Increasing awareness on significance of protection of traditional products through different forms of industrial property rights (e.g. patents, indications of origin, trademarks and industrial design), copyrights and related rights could be helpful in marketing and placement of traditional fruits and their products on domestic and international markets. Development of effective training programmes for all stakeholders, researchers, producers and processors will increase level of IPR culture in Serbia.

### Expected impacts

- *Increase knowledge on IPR issues*
- *Increased number of IPR protected traditional products*
- *Better placement of Serbian traditional sweet fruit products on domestic and international markets*

### **c. Increase the awareness on traditional food through continuous education and communication**

### Specific challenges

Nowadays, the consumers become aware that what they eat reflect to their health. Consumers perceive fruits as products with a healthy image, especially when they are fresh. Nevertheless, European fruits intake remains well below the levels recommended by the World Health Organisation. On the other hand, consumers considered dried fruits to be healthy due to the (micro)nutrient content of the dried fruits, but they also regarded them unhealthy because of their high sugar content and a loss of vitamins due to drying. Although



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traditional drying processes lead to a significant loss of bioactive compounds, dried fruits can still be a valuable source not only of energy, dietary fibre and minerals but also of anti-oxidants. Continual communication and education of consumers will help them to understand the quality and health benefits of fruit products.

### Scope

To increase consumer interest and trust in traditional, natural, healthy foods, several important measures should be applied: research on consumer attitudes to traditional fruit products, personalization of consumer demand, transparency in traditional food production methods, research on all health benefits of plum and raspberry and their products, research on influence of processing methods on bioactive compounds in fruit and fruit products, inform consumers on health benefits of consuming plum and raspberries products through different dissemination activities such as promotion on fairs, through touristic offer of Serbia and media.

### Expected impacts

- *Increase the awareness of health benefits of consuming traditional fruit and fruit products*
- *Increasing demand for traditional fruit and fruit products*

## **2.3. General overview of current situation of sweet fruits' sector and traditional food SMEs in Poland (including SWOT analysis)**

In Poland, the industry processes about 60% of the harvest of fruits and 10-15% of the harvest of vegetables. Supply of raw materials is most commonly done through contracting, and sometimes through purchases on the stock exchanges, markets and intermediaries. It is currently one of the main sectors of the food industry.



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In Poland, in the processing of fruit and vegetables they operate 1363 companies, of which on an industrial scale - 270 companies. Over 90% of companies employing up to 50 people a permanent crew. Fruit industry is based on domestic raw material base. Up to 40% of the production is buyers in foreign markets. Poland exported about 500 thousand. t of processed and, together with fresh fruits and vegetables - about 881 thousand t, which represents 25% of the total agri-food exports. Poland is the world's largest exporter of frozen fruit (against Chile, Serbia, Canada and the USA). Exportation of frozen fruit is dominated by strawberries, raspberries, cherries, currants and gooseberries. The most important market for Polish frozen fruit and remain the countries of the Community (mainly Germany, France, Belgium, the UK. Britain and the Netherlands). The share of the EU-28 in the total value of exports of frozen fruit and vegetables in 2014 was 84%.

Fruit industry in Poland include processing of fruit to the following products: frozen fruits, concentrated fruit juices, juices and fruit beverages, jams, marmalades, marinated fruits, compotes, dried fruits, fruit wines and meads.

In recent years fruit and vegetable industry is a third (after the meat and dairy industry), a rapidly growing branch of food industry. The characteristics of Polish fruit and vegetable industry emphasizes the high intensity of physical and human capital, while low skilled workers, poorly advanced manufacturing technologies and intensive use of marketing. Despite the progressive concentration of the process, Polish fruit and vegetable industry is mature, but distributed.

Processed fruit and vegetables are located on the fourth place among the most frequently purchased organic food in Poland. You can on this basis, draw a conclusion about the untapped potential and the still existing large possibilities of exploring ecological niche by Polish producers of fruit and vegetable. Unused potential of the fruit and vegetable processing due to the still weak position organic production of fruit and vegetables in relation to conventional production, as a raw material base for the processing industry.

Harvest of fruits and berries in Poland in 2013 (thousands of tons, according to Statistical Yearbook):





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Apples	3085
Pears	76
Cherries	188
Plums	102
Sweet cherries	48
Peaches	10
Apricots	4
Strawberries	193
Raspberries	121
Currants	199
Gooseberries	15
Aronia	58
High blueberries	13

After collecting of data from SMEs involved in production and processing of sweet fruits, SWOT analysis was performed with the following findings:

#### Strengths:

- High quality of Polish fruits
- Good position on the European and world food market
- Fruits as a source of bioactive compounds
- Rapidly growing of fruit industry in relation to other branch of food industry
- Local sales create consumer enjoyment.

#### Weaknesses:

- Small assortment of traditional food as compared with traditional food of animal origin
- Financial difficulties related to access to bank loans
- Lack of infrastructure and problems with storage
- Lack of information to innovate and adapt to the market
- Lack of a marketing strategy
- Packaging

#### Opportunities:

- Positive publicity of fruits



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- Attracting money from European structural projects
- Developing of new packaging systems
- Storage improvements
- Organic production
- Health benefits of fruits
- Developing of export markets

Threats:

- Decreasing funding opportunities and more competition for funding.
- Climate/weather changes.
- Difficulties associated with the introduction of innovation
- Changes in the situation on world food markets.
- Difficulties with the export of politically motivated – embargo on fruits.
- Insufficient presence of knowledge and technology transfer institutions

### **2.3.1 Primary production**

#### **a. Breeding issue trade-off between productivity and quality**

##### Specific Challenge

The strategy of varietal innovation development for individual sweet fruit species should include good adaptation to different agronomical and ecological requirements, beneficial effect for consumer related to high nutritional value, the attractiveness of the food market, the opportunity to farming in a conventional and organic way, increase in disease resistance, adequate resistance to transport. The basic role in developing the strategy described above falls research centers.

##### Scope

The development of new varieties of fruits are extremely important. They ensure food product with high nutritional value, adequate quality technology, high content of biologically active ingredients. It is important to take into account that part of the fruit is consumed in the form of fresh, without



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processing. New varieties of fruit should also be appropriately adapted to different transport conditions, changes in climatic conditions, resistance to biotic and abiotic stress.

### Expected impacts

- Development of cooperation between scientists and fruit producers very beneficial for both partners
- The improved cultivars will be more attractive on the Polish and European food market
- Positive effect on the consumers health
- Expansion of assortment in plantations on the orchard
- New cultivars can reduce the cost of growing and harvesting due to their regular yield

### **b. The pest control pest diseases management in organic and conventional production**

### Specific challenge

Sustainable use of pesticides for fruit production is direct to minimize danger and risk for human health and natural environment of use of pesticides. This aim should be reach with inter alia improvement control and distribution of pesticides, introduction of more safety active substances and also encouragement to use low doses of pesticides or farming without pesticides. Earlier activities for reduce of possible side effect of using pesticides, place of sustainable use of pesticides in sustainable agriculture, progress in fruit protection in Poland and also activities which are necessary to secure popularization sustainable use of pesticides in Poland.

### Scope

The aim of the future activity should be developing strategy by researchers and practitioners. Very important seems to be a replacements of synthetic pesticides by products of natural origin. Research on epidemiology of plant disease should conducted. Researchers should also working on the problems with the practical application of the methods and quality assurance systems,



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horticultural products, including GAP, GMP, GHP, integrated production, organic production, HACCP, traceability, ISO 22000, trading standards Global GAP, IFS, BRC.

### Expected impact

- Several practical problems with related to organic fruit production will cease to exist
- Production of high value organic fruits will be increased
- Positive influence on the horticulture science
- Increase the positive attitude of consumers to organic fruits and traditional foods based on fruits

### **2.3.2. Processing**

- a. Implementation of modern packaging to enhance shelf life, to reduce waste and to improve the post-harvest technology (storage)**

#### Specific Challenge

Development of intelligent packaging for fruits. There is a number of types of smart packages as the time and temperature indicators, oxygen and carbon dioxide indicators, leaks indicators, freshness, biosensors, and the RFID tags. Indicators through specific changes, mainly base on colour and microbial changes, indicate a change in the composition of the atmosphere inside the package, or changes in the surface of the product.

Intelligent packaging systems exist to monitor certain aspects of a food product and report information to the consumer. The purpose of the intelligent system could be to improve the quality or value of a product, to provide more convenience, or to provide tamper or theft resistance. Intelligent packaging can report the conditions on the outside of the package, or directly measure the quality of the food product inside the package. In order to measure product quality within the package, there must be direct contact between the food product or headspace and the quality marker. An intelligent system should help the consumer in the decision making process to extend shelf life, enhance safety, improve quality, provide information, and warn of possible problems.

## Scope

In order to preserve the nutritional value of fruits and activity of the compounds contained in them becomes necessary natural development of new packaging methods. Do not forget about the dissemination of knowledge on the subject and practical training for SMEs on modern packaging. We must remember on the growing importance of packaging as a kind of symbol of fruit product.

## Expected Impact

- Implementation of modern packaging systems to fruit producing SMEs
- The shelf life of fresh fruits will be enhanced
- The problem of disposal of rotten fruit will be reduced
- Cost-effectiveness associated with a reduced loss of fruit
- Decreased losses due to perished fruits

### **b. Modernization of storage technology of raw materials and products**

## Specific challenges

Adequately controlled: temperature, relative humidity and the composition of the atmosphere in which the products are stored grown in the fields and orchards, allow delaying physiological processes, so extended is their durability and attractiveness for consumption. Each type of fruit or fruit product requires different conditions for storage. Depending on factors such as climate, weather, soil type, growing conditions, harvest time - optimal storage conditions will be slightly different each year, not only in relation to the product, but even with the variety.

## Scope

The work on the application of the most optimal conditions for long-term storage of fruit connected - maintaining a reduced temperature, depending on the species - in the range of -1 to 3 ° C, - maintaining an appropriate humidity -

the modification of the proportion of gas constituting the atmosphere in the chamber, oxygen, carbon dioxide , nitrogen.

Transfer of the knowledge on the fruit storage to SMSs applying different forms: seminars, training workshops, local agricultural advisory services, local journals, radio, and TV. Stimulation of formation of fruit producer cooperatives. This form can help in assistance of financial support for buying modern storage systems.

### Expected impacts

- Positively influence on the quality of fruits and fruit products
- Higher nutritional quality and higher content of bioactive compounds
- Better material for processing
- Positive influence on modern post-harvest technology
- Positive effect on Polish food marked

### **c. New trends in the production of juices**

#### Specific challenges

Juices are produced directly from unprocessed raw juice, which immediately after their pressing, filtration and possibly subjected to other treatments fining directed to the packaging unit without the step of pressed juice concentrate.

Fruit juices with the addition of grated fruit. These products are commonly called fruit smoothies - and characterized by a high content of dietary fiber. Another advantage of this kind of juices is that they do not contain sugar, sweeteners or preservatives.

Juices produce cloudy without enzymatic treatment, clarification and filtration. They include natural slurry-like substances colloidal and much more active polyphenols. The presence of pectin in the juices enhances their nutritional value. The antioxidant activity of such product is similar to the activity of fresh fruit.

#### Scope



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New research by scientist from Universities and R & D Centres should be conducted. Transfer of knowledge to ESMs on new technology. Increase awareness of local equipment producers. Informing consumers about the importance of new juices in human nutrition and their beneficial health effects.

### Expected impacts

- Positive effect on production of traditional food based on fruits
- Increase investment in processing technologies and increase of processing capacities
- Positive effect of fruit products consumption
- Development of cooperation between scientists and fruit producers
- Increase knowledge about high nutritional properties of fruits
- Implementation of modern packaging systems to fruit producing SMEs

#### **d. Application of by-products**

### Specific challenges

The use of by-products (bagasse) from the processing of raspberries and strawberries in the production of concentrated juices as an important element in deciding the business.

Industrial bagasse of strawberries and raspberries, which contain a high content of proanthocyanidins and elagotannins, at a relatively low level of pesticide residues can be used to make extracts that can be used in the manufacture of functional foods or as a plant protection product.

### Scope

Solving of biotechnological and technological problems at scientific research centers. Transfer of the obtained results and methods to SMEs. Training workshops for SMEs staff and workers.

### Expected impacts



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- Economical way of management of by-products of fruit industry
- Increased content of bioactive compounds in fruit products
- Economic profit of ESMs
- Development of cooperation between scientists and fruit producers
- Protection of environmental

### 2.3.3. Product

#### a. Implementation of food safety management systems

##### Specific challenges

The primary responsibility of the manufacturer of food is to provide a safe product to market. It should be free from chemical impurities (residues of pesticides, nitrates, heavy metals), pathogenic microorganisms and harmful compounds they produce. Especially important is the high hygiene of people working in the processing of fruits and high quality water used in industrial processes. Contamination fruit products cannot come from packaging and process equipment. Extremely important it seems to be the introduction of good manufacturing practice (GMP), good agricultural practice (GAP), good hygiene practice (GHP), and good storage practice (GSP).

##### Scope

Permanent training not only for the production staff, but also steering relating to production hygiene and food safety. Permanent training not only for the production staff, but also steering relating to production hygiene and food safety in terms of ensuring an adequate level of personal hygiene and health; ensuring adequate to meet the needs of clean work clothes, as well as the conditions for the regular maintenance of cleanliness. Do not forget short-term training programmes for new employees in issues such as HACCP, hygiene, handling, irrigation, packaging.





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## Expected impacts

- Greater awareness of employees about food hygiene
- Implementation of EU and other international hygiene standards to fruit industry
- Higher quality of fruit products
- Guarantee the presence of safe food on domestic and international market

### **b. Dissemination of knowledge about pro-healthy properties of fruits and fruit products**

## Specific challenges

This applies for example raspberries and strawberries with the high content of dietary fiber and the polyphenols. Among the phenolic compounds of raspberries and strawberries, they deserve special attention tannins, which occur both in the form of elagotannins and proanthocyanidins.

Many studies on phenolic compounds of fruit origin have demonstrated their antioxidant activity, antibacterial and prebiotic properties as well the ability to reduce the risk of certain diseases of the gastrointestinal tract and circulatory system.

Dissemination of information on particular health benefits of the cloudy apple juices. The growing popularity of cloudy juices, and a growing consumer awareness about healthy eating, manufacturers put the challenge - how to ensure the durability of natural juices, and at the same time provide consumers with the highest quality products without preservatives

## Scope

Informing the various social groups, including youth, about the importance of fruits in human nutrition and their beneficial health effects. To accomplish should be involved various measures. Mention may be mass media (local television, radio, newspapers). Important role may fall to the educational



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system (schools of different levels), advertising in stores, training centers dissemination of knowledge, popular lectures at the universities.

### Expected Impact

- Increase knowledge about high nutritional properties of fruits among different social groups
- Increase knowledge on traditional fruits among consumers
- Positive effect of fruits consumption
- Positive effect on production of traditional food based on fruits
- Better communication between producers and consumers

### **c. Logistic**

#### Specific challenges

Purchase on the market of logistic services or parts of it as a form of cooperation between suppliers and customers, through which it is possible to achieve market success. In modern economies observed tendency to buy the logistics services market. In this way it creates a better functioning of enterprises through a greater focus on their core business (core business) and to minimize outlays for capital investment. Outsourcing logistics it is also referred to as contract logistics. It is identified with the use of logistic services offered by an external contractor, subject to market transactions.

#### Scope

#### Expected Impact

- Positive effect of fruits quality
- Economic profit of ESMs
- Positive impact on the development of local transport companies Positive impact on the development of local transport companies

## 2.3.4 Marketing

### a. The impact on the consumer's interest to go traditional food

#### Specific challenges

In the modern society, knowledge of traditional food is insufficient. It is connected also with the general ignorance of consumers about nutrition and food. Communication between food manufacturers, including SMS, and the receivers almost does not exist. The development of companies producing traditional food seems to be very beneficial above all things for the economic development of small Polish towns and villages.

#### Scope

Advertising brand of traditional products. Taking into account the issues associated with traditional food in educational systems. This also applies to school education at different levels. Support for research projects on traditional food by government organizations. Scholarships for research scientists working in the field of traditional food.

#### Expected impacts

- Increase public knowledge about traditional food. Also this fruit-based
- The emergence of communication between the manufacturer of traditional food and its consumer. This communication will have the character to and from the consumer
- The development of education on traditional food and its health-properties
- Increasing consumption of fruits and fruit products.
- Health effect on consumers

### b. Support for fruit industry management by government agencies and local government

#### Specific challenge



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Work on the collection and processing of fruits, especially berries requires employees with special abilities and professional abilities. It is extremely important to get these workers and provide them with continuous training.

### Scope

Impact on local authorities to promote work in the area of fruit processing. Activating the advisory service in the local site management. Improving management skills through various forms of training. Ensuring adequate financial support through the banking system to guarantee an adequate policy of hiring and training

### Expected impacts

- Better labor productivity in fruit industry
- Rising professional qualifications of people employed
- Reducing the level of unemployment in small towns and rural areas
- Stimulating the development of the local economy

### **c. Activity in terms of laws and regulation policy**

### Specific challenge

Working on legal acts the purpose of their adaptation to European standards. This applies especially to standardize sanitation, which in turn enables and facilitates entering the European food markets. Especially important is the activity of a legal easy to gain money from the European funds for training employees and the development of infrastructure of the fruit industry.

### Scope

Simplifying procedures for sanitary relating to the fruit and their products. Unification of the European regulations regarding the contamination of food (especially for pesticide residues). Greater flexibility in the law relating to the relationship between manufacturing companies and other businesses. The new production standards ensure greater production and at the same time ensuring

food safety.

### Expected impacts

- Reducing bureaucracy in fruit industry
- High quality of safety foods
- Improved situation of trade for products of high quality
- Facilitating hygiene controls by authorized governmental institutes in relation to SMEs

### **3. Olives** (Table olives and olive oil, and TRAF00N countries: Spain and Portugal)

Table olives and olive oil are traditional products of Andalusia and the Mediterranean region dating back thousands of years. The EU is the main producer of table olives and olive oil, with almost one third and three quarters of the total production, respectively. The EU is as well the main consumer of these traditional products, with 26% of table olives and 64% of olive oil consumption (data from International Olive Council - IOC).

Olive trees are one of the main crops in Mediterranean countries. Olive orchards in Spain and Portugal account for 50% and 8% of the total olive area in the EU-27 (IOC), and it is the second crop in acreage after cereals in Spain. Data from the last six years (IOC) show that Spain is the top producer in the EU and in the world of table olives (73% of EU and 23% of world production) and olive oil (60% of EU and 44% of world production). The region of Andalusia produces nearly 80% of table olives and olive oil within Spain. These traditional products are of great economic, social and environmental importance in the production areas, with a total 32 million days of paid work generated in the olive sector in Spain alone (source: Agencia del Aceite de Oliva). The table olive sector in Spain represents 27% of the employment generated within the whole processed and canned vegetables industry (source: ASEMESA). Portugal is the fourth country in the EU in extension of olives crops and in table olives and olive oil production (IOC).

The olive sector represents a major source of employment in many Mediterranean regions, especially in areas with high unemployment rates.

### **3.1. General overview of current situation of olive sector and traditional food SMEs in Spain and Portugal (including SWOT analysis)**

The olives production varies greatly even within the same region, with hundreds of olive varieties being cultivated currently in the EU. Many of these varieties are grown only locally, which give a number of specialty olives and olive oils within the different regions. However, farmers face the same challenges in relation to olives production, mainly related to the improvement of farming practices and obtaining a high quality fruit that meets the standards of the table olives and olive oil manufacturers. A shift towards a more sustainable farming is also a challenge for farmers due to a pressure to obtain high yields that make their activity profitable.

The challenges for table olives manufacturers are common to all companies irrespective of the size of the company and their country of origin. Different specialty olives can be found almost locally across Europe, based on variations of the recipes, availability of different spices and aromatic herbs, different varieties of olives, etc.

The Olive oil sector varies in the different producing regions, although most producers face similar challenges.

The analysis of inventory of needs carried out among Spanish and Portuguese SMEs involved in production and processing of olive oil and table olives led to the following SWOT analysis:

#### **Strengths**

- Authenticity
- Tradition
- Quality increased
- Mature market

#### **Weaknesses**



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- Imperfect marketing
- Lack of consumer education
- Barriers to new markets
- Difficulty to ensure constant quality

### **Opportunities**

- Healthy claims
- Labelling
- Large consumer group
- Exploitation of by-products

### **Threats**

- Labelling fraud
- Sustainability
- Inputs and costs
- Increased supply

### **3.1.1 Primary production**

- a. Preservation of genetic pool by enhancing the knowledge of ancient varieties and development of new olive varieties for new challenges (high yield and oil quality, pest and diseases control, adaptation to climatic change)**

#### Specific Challenge

In the last years, olive growing has experienced a remarkable transformation which has favored the use of a reduced number of cultivars able to fulfill the requirements of the new intensive and mechanized orchards. Nevertheless, traditional olive cultivars and ancient olive trees represent an important and yet to be evaluated local genetic patrimony that could represent a very useful source of diversity against new and unforeseen climatic changes in the near future and in cases of outburst of new pest and diseases, like the case of *Xylella fastidiosa*. Knowledge, collection, conservation, characterization and evaluation of olive genetic resources are necessary steps against the genetic erosion risk and towards their efficient use in breeding programs. The need for new



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improved cultivars has promoted the development of olive breeding programs aiming at obtaining new cultivars with early bearing, high yield and oil content, suitability to different growing systems, high oil quality and resistance to well known (*Verticilium*) or recent outburst diseases (*Xylella*). As a result, up to date, a few new olive cultivars have been released although only some of them have been successfully marketed.

### Scope

The work will aim to acquire, maintain and identify local cultivars and ancient olive trees in ex-situ germplasm collections. These activities will be followed by the identification of the new obtained germplasm by means of molecular markers (SSRs and SNPs). The identification data will be included into the database of germplasm collections. The on farm conservation and use of such local and ancient olive trees will be promoted and enhanced. In addition, the new accessions will be evaluated for several pomological traits related to vigor, phenology, production, fruit and oil quality and for their resistance to pest and diseases. The results of such evaluations will help to determine the most interesting cultivars for their use as potential parents in future crosses of olive breeding programs as well as for the establishment of comparative trials in different agro-climatic conditions.

### Expected Impact

The project results are expected to:

- Increase awareness on the value of local genetic resources (cultivated and wilds) as well as ancient trees
- Improve methodologies for management, conservation, characterization and evaluation of genetic resources
- Promote on farm conservation and management of ancient olive trees
- Enhance the use of local and ancient olive genetic resources into breeding programs
- Develop new cultivars with improved agronomic behavior and able to face future challenges for olive growing.
- Enhance the link between germplasm collections, breeding programs and farmers.





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## 3.1.2 Processing

### a. Improvement of methods for valorization of olive oil by-products.

#### Specific challenge

The EU is the world largest producer, consumer and exporter of olive oil. The production of olive oil generates large amounts of three main types of by-products/biomass:

- The wood, the branches and the leaves coming from the pruning.
- The wastewater derived from the washing of olives and olive oil, on the one hand, and the Two-Phase Olive Mill Wastewater (TPOMW), called also “alperujo” in Spanish, on the other hand, both of them produced mainly in Spain.
- The classical olive mill wastewater (OMW) and olive cake derived from the three-phase manufacturing process (majoritarian system in Portugal, Italy, Greece and the rest of producer countries of the European Union).

The recovery of all these by-products into energy, for thermal and electric use, is a first challenge for the olive oil mills and industries given that, currently, there is little valorization thereof.

In addition, the olive value chain biomass is rich in a wide range of bioactive compounds, such as polyphenols, triterpenics acids and tocopherols, among others. These molecules have antioxidant and antimicrobial activities so a second challenge for the olive sector would be their use in different food, cosmetic or pharmaceutical applications.

According to the EU, “European waste management policies aim to reduce the environmental and health impacts of waste and improve Europe’s resource efficiency. The long-term goal is to turn Europe into a recycling society, avoiding waste and using unavoidable waste as a resource wherever possible. The aim is to achieve much higher levels of recycling and to minimize the extraction of additional natural resources. Proper waste management is a key element in ensuring resource efficiency and the sustainable growth of European economies”.

#### Scope



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In both cases, energy and bioactive compounds recovery, it is necessary to increase the research efforts with the aim of enhance the current knowledge about these processes with an specific focus on the olive value chain, since most of the prevalent approaches are based on the results in other sectors. Additionally, this effort would rather help to achieve the objectives for European renewable energy use and sustainability for the food waste recovery, with such an important crop and food product for the European economy.

### Expected impact

A holistic approach to olive processing industry waste valorization would have the following impacts on the sector:

- A reduction or elimination of waste, in some cases contaminants, and reducing the risk of fires caused by burning agricultural residues and remains of pruning.
- A reduction of the costs of waste management and even become a resource to generate additional income to their producers.
- The increase of added value and profit margins in olive value chain.
- Ensure the resource efficiency and the sustainable growth of European economies.
- The collection and management of biomass would generate a large number of jobs, especially in rural areas.

### **b. New strategies to improve the management of table olives' wastewater.**

### Specific Challenge

In several Mediterranean countries the production of table olives plays an important role in their economy. Moreover, in recent years there has been a worldwide increase in the production and consumption of these olives. Spain is the biggest producer in the world with 26% of the total production. The quality of olives differs from year to year and depends on various things such as climate, rainfall, the amount of pests etc. The most common method for producing green olives in brine is "Spanish-style" processing that comprises several steps: lye treatment (debitting), rinsing, brining, fermentation in brine, packaging and pasteurization. The production of table olives involves

several flows of wastewater. The processing of table olives come from traditional procedures that did not consider water as resource and the environmental effects deriving from its use. The processing of table olives is an activity concentrated in a few months per year (autumn-winter) and in restricted geographic areas (sometimes with little surface water resources). This determines a strong pressure on the water resources and on the quality of the surface water. The growing attention towards the use of natural resources and the arising of the national laws and, in the case of Europe Union, of community laws ever more constricting for what concerning the draining of wastewater, involve the need to assess with attention the use of the water into the table olives production processes.

## Scope

The wastewater is an important issue deriving from table olives industries, and the impact category mainly affected by the pollution of wastewater is the eutrophication. Among the various processing methods used to process green and black table olives, wastewaters are produced in different amount and affect in different way the impact category EU.

In order to improve the environmental performance of this processing–system, however, technological solutions could be adopted with the aim of reducing the amount of material used, the reuse of brines and/or the extraction of the most contaminant substances from the olives' wastewaters.

## Expected Impact

The project results are expected to:

- decrease the entire water requirement in the process
- reduce the environmental impact of the wastewater
- set specific wastewater treatment methods.

### **3.1.3. Product**

#### **a. Challenges to differentiate organic olive oils.**

## Specific Challenge



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Organic olive oil productions are characterized by small plots (often as small as 3ha and not generally exceeding 200ha) usually with lower productions in contrast with the conventional ones in which intensive and super-intensive cultivations are present using herbicides or pesticides. These facts have a clear environmental impact. The organic olive oil is extracted from the olive cultivated following the strict requirements of organic agriculture. European Union guidelines regarding organic production forbid the use of synthetic products (fertilizers and plant protection methods). The principles for organic agriculture are similar in the different European countries and the inputs permitted are regulated by law. Recent surveys showed that the demand for organic products by European consumers increased fourfold during the last decade. For all these reasons consumers tend to pay a higher price for all these characteristics and therefore traceability and its surveillance is an important issue.

## Scope

Analytical techniques would be needed to differentiate the origin of the olive oils production systems: organic versus conventional.

## Expected Impact

The project results are expected to:

- differentiate the olive oils obtained from organic and conventional cultivation systems
- highlight the differences between organic and conventional olives oils.

## **3.1.4 Marketing**

- a. Innovative approaches for consumers' education and commercialization: branding, changing habits and opening new markets.**

## Specific challenge



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Olive oil and table olive sectors, as food sector in general, face with increasingly changes in the consumer behavior and demands. In addition, these products appear to consumers as undifferentiated goods, despite being food products with clear potential for differentiation. As an example, some surveys show that there are major segments of consumers who have real difficulties in appreciate and even identify what is an extra virgin oil.

As a main challenge, the effort in research and production of quality olive oil and table olives should be accompanied by measures aimed at the consumer broadcast: sensory education, olive culture, product differentiation, different uses, different quality and category of products, etc. Through the consumer education, teaching them the difference among products, it could be solved the existing imbalance between a sector that demands an effort in more quality and improving products and a consumer who generally does not appreciate such quality.

A second challenge for the sector would be the adaptation both olive oil and olive table to international markets, on issues related to the taste, processing and product uses, in a market increasingly global and international for the food sector.

### Scope

The research in innovative presentations, sensorial characteristic and new uses applied to other cultures would be major priorities. These research activities might include conducting feasibility studies, understanding consumer concerns, attitudes and perceptions relating to food categories and promoting dissemination of results and technology transfer.

Research proposals should be encouraged to include participants not only from EU producer and consumer Member States, but also from third countries, since they would be targets of this topic.

### Expected impact

An improvement in the commercialization barriers based on consumers' education would have the following impacts on the sector:

- The opening of new niche marketing, especially in non-producing countries.
- The enhancing of the brands working on the previous issues.



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- A clear market differentiation for the companies among other edible oils and fats.
- The increase of added value and profit margins in olive products.
- The increase of confidence in consumers and markets about olive oil and olive table quality.
- To help food producers to communicate better the qualities, characteristics and attributes of their different food products.

### **b. Increase in culinary uses of olive oil.**

#### Specific challenge

Olive oil, due to its nutritional and sensory characteristics, has an added value that allows reaching a high market price, more than the remains of edible vegetable oils and other fats. The uses of olive oil are compatible and/or adaptable with most of the current emerging trends in food aimed at specific population segments: celiacs, vegans, lactose free, organic products, macrobiotic products, biodynamic agriculture, fresh...etc. In addition, there are proved evidences about the health benefits of olive oil in contrast to other edible oils, as the prevention of cardiovascular disease risk, cancer, obesity, diabetes,...etc., which should promote their increasingly presence in the kitchen and the food industry.

Nevertheless, it is generally accepted for a wide range of population that olive oil is not suitable for specific culinary uses, for instance, frying. In addition, food industries usually use other edible oils, different from olive oil, because a lower price and, sometimes, a better physicochemical characteristics for the desired product (melting point, as an example) instead of using olive oil as a healthier and higher quality ingredient.

With this background, there is a clear challenge in increasing the use of olive oil in culinary products, both homemade and industrial, for being a major product in the European agriculture and also for its benefits on the wellness and health.

#### Scope

Research efforts should address to demonstrate the suitability of its use to break preconceived ideas in consumers and food industries as well the



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adaptation of the product to specific recipes, for instance. Innovation in food pairing with olive oil would be another line to take into account in order to approach to the defined challenge. Finally, the health properties from those food products/recipes made with olive oil should be compared with those made with other fats, in order to identify the the most suitable for a balanced diet.

### Expected impact

The expected impacts for those insights previously mentioned would be as follows:

- The opening of new niche marketing, in national and international markets.
- A clear market differentiation for the companies among other edible oils and fats.
- The increase of added value and profit margins in olive value chain.
- The promotion on health in the food industry through the improvement of its ingredients.