Research, innovation and transfer in the olive oil sector in Spain: an analysis based on in-person expert panels

Dr Javier Sanz Cañada¹, Florencio Sánchez Escobar², Isabel Hervás Fernández³, Dr Daniel Coq Huelva⁴

¹ Instituto de Economia, Geografía y Demografía
Consejo Superior de Investigaciones Científicas (CSIC)
Madrid
² Independent consultant
florenciosanchez@hotmail.com
³ Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública Madrid
isabeloptera@gmail.com
⁴ Departamento de Economía Aplicada II, Universidad de Sevilla
dcoq@us.es

Abstract

The first objective of this research was to obtain a consensual picture of research, development, innovation and transfer issues and priorities in the national research, development and innovation system (RDI) relating to the olive oil sector in Spain. A second objective was to design a structured series of strategic recommendations to improve that system. The results obtained from three in-person expert panels applied a sequence of social research techniques based on Metaplan methodology were analysed. Discussion group and strategic participation workshop techniques were employed to achieve these objectives. The three panels broached the following broad areas of knowledge: (i) olive growing and olive and olive oil by-products; (ii) olive oil technology, health and new products; and (iii) agro-food social sciences. The experts concluded that there was a pressing need to remedy the current general lack of innovation and knowledge transfer from the national system to businesses and farmers. They also agreed on the need to broach RDI activities from interdisciplinary and transdisciplinary angles.

Key words:

Research, innovation, knowledge transfer, discussion groups, strategic participation workshops, olive oil, Spain.
Introduction and methodology

The national RDI system in olive growing and olive oil has made great strides forward in Spain, particularly so in the last three decades, in a broad number of areas of knowledge in consonance with their economic and territorial importance; however, there is still a significant shortfall in knowledge and innovation transfer to the national olive and olive oil sector.

One of the prime arguments in favour of boosting RDI in olive growing and olive oil production in Spain is the pressing need to improve value aggregation in this sector where structural changes are occurring in the value chain and international consumption. Furthermore, the lack of organisational and business innovation in the Spanish olive oil sector calls for urgent incentives to transfer and disseminate knowledge to farmers and companies. Other factors explaining the need to drive the national RDI system include the changes in the new land functionality of the sector and its role in rural development or the emerging social awareness of food safety, health, environment and food issues.

This article reports the outcome of three in-person expert panels aimed at obtaining a consensual overview of research, development, innovation and transfer issues and priorities in the national RDI system relating to the olive and olive oil sector in Spain, as well as a structured series of strategic recommendations for improving that system. This outcome is part of the results of the research project1 reported by Sanz Cañada et al. (2012 a), the purpose of which was to define and prioritise the lines of research and innovation that should be strengthened in Spain’s RDI2 system. Each of the three panels addressed the following broad areas of knowledge: (i) olive growing and olive and olive oil by-products; (ii) olive oil production, health and new products; and (iii) agro-food social sciences.

The methodology for the whole project entailed a sequence of three consecutive phases, the second of which is the subject matter of this article (Figure 1). The data collected in the first phase in which 86 lines of research and innovation were identified and defined in lengthy, semi-structured interviews with experts was the starting point for the second phase.


2 Sanz-Cañada et al (2012 b) is another publication generated by this project. Very little research has been conducted on the olive and olive oil RDI system in Spain, although the paper by Sayadi et al. (2012) on Andalusia is noteworthy.
In the second phase, three in-person expert panels were applied the following mixed methods social research techniques (Johnson et al., 2007; Teddlie and Tashakkori, 2009): a brief Delphi survey, a discussion group and a strategic participation workshop based on Metaplan methodology (Schnelle and Stoltz, 1987; Oakley, 1991), for which there has to be a maximum of eight experts per panel. This article reports the chief findings of the discussion groups and strategic participation workshops held by the three panels.

The experts selected for the first two phases of the project included university researchers and teaching faculty, as well as representatives from business, industry associations, institutions and the public administration, although in the last case the representatives took part as experts as opposed to in their official capacity. An attempt was made to strike a balance in the composition of each panel according to the profiles of the experts (Table 1).

The aim of the discussion groups was to detect the chief points of consensus and controversy when identifying problems and priorities in research, development, innovation and knowledge transfer. Each lasted an average of five hours. The methodological design of the groups was meant to encourage the convergence of participants’ perceptions or the emergence of lines of dissenting opinion and to facilitate the collection of qualitative data. Through interactive dialogue, the experts took a prospective approach in that they not only noted the problems facing the sector but also assessed the feasibility of different initiatives. The discussion groups were focal in nature and featured a questionnaire with semi-open questions and a moderator who played an active part in leading the group, which was especially evident when facilitating consensus (Greenbaum, 1999).

The objective of the strategic participation workshops was to construct a consensus-based set of strategic

<table>
<thead>
<tr>
<th>EXPERT PROFILE</th>
<th>Nr experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANEL 1: Innovation in olive production, sustainability and use of by-products from the olive and olive oil chain</td>
<td></td>
</tr>
<tr>
<td>1. Plant material, varieties and new olive growing</td>
<td>2</td>
</tr>
<tr>
<td>2. Cultivation systems: erosion, irrigation and crop protection</td>
<td>2</td>
</tr>
<tr>
<td>3. Biodiversity, integrated production and organic olive growing</td>
<td>2</td>
</tr>
<tr>
<td>4. Use of waste from the olive and olive oil chain</td>
<td>2</td>
</tr>
<tr>
<td>PANEL 2: Oil processing technologies: quality, food safety, health and new products</td>
<td></td>
</tr>
<tr>
<td>5. Innovation in quality olive oil production and sensory methods</td>
<td>2</td>
</tr>
<tr>
<td>6. Food safety in the olive oil chain</td>
<td>2</td>
</tr>
<tr>
<td>7. Olive oil and health</td>
<td>2</td>
</tr>
<tr>
<td>8. New products derived from olives and olive oil</td>
<td>1</td>
</tr>
<tr>
<td>9. Innovation in information technology and traceability systems</td>
<td>1</td>
</tr>
<tr>
<td>PANEL 3: Marketing, organisation, heritage and territory in the olive oil sector</td>
<td></td>
</tr>
<tr>
<td>10. Olive oil marketing and consumption</td>
<td>2</td>
</tr>
<tr>
<td>11. Multi-functionality, landscapes and natural and cultural heritage</td>
<td>3</td>
</tr>
<tr>
<td>12. Cooperatives and marketing (second-tier level)</td>
<td>2</td>
</tr>
<tr>
<td>13. Designations of origin and quality certification institutions</td>
<td>1</td>
</tr>
</tbody>
</table>

3 The experts were requested to complete the Delphi questionnaires twice, i.e. before and after holding the discussion group. Under each questionnaire heading they had to use a 1 to 5 scale to appraise the RDI identified on the basis of the analysis of the interviews. The object was for participants to ponder on the questions beforehand and then to incorporate the consensual points that subsequently emerged from the discussion group.

4 It should be pointed out that this is not a discussion group in the classic sense because it does not comply with the strict requisite of such techniques, namely that the members of the group must not know each other, since this is practically impossible in the national community of experts on prospective topics of research and innovation.
guidelines for improving the national RDI system. The card visualisation technique was used where participants were asked a number of questions to which they had to write down their answers briefly on a card. Once the cards had been completed and read out, they were pinned on a board. Participants then separated the different RDI actions into clusters by topic and objective and assigned each one a name. The set of research techniques employed is not meant to give an exhaustive list of RDI topics and lines of work but an overview of some of the chief debating points and recommendations for taking action on the issues and priorities in research, innovation and transfer in the Spanish olive and olive oil sector. The interactive dialogue that took place among the experts generated a wealth of intelligence on the different topics discussed.

The next section reports the results obtained in the three expert panels, which in turn encompassed 11 subthemes. The main consensus points are outlined together with any controversies and the main lines of discussion. The arguments are illustrated by textual quotes of statements made during the discussion groups, as well as of the strategic recommendations for action in the national RDI system (Figures 2–11).

**Analysis of expert panel results**

*Innovation in olive production, sustainability and use of by-products from the olive and olive oil chain*  

*Soil erosion and degradation*

Erosion is a pressing problem in a broad section of Spain’s olive orchards, especially those on steep land, and is part and parcel of the wider issues of soil degradation and management. The consensus among the experts was that it is the chief environmental problem in olive growing in Spain. They confirmed that the bulk of research in Spain has focused on quantifying erosion rather than on offering concrete solutions to remedy it: “Much of what has been done has been to continue quantifying the problems rather than offering solutions. I think there is a clear-cut difference between the progress made on the production front and the environmental solutions put forward.”

The experts also stated that few reliable data are available on erosion in terms of large-scale and catchment areas because the trials conducted so far have been very limited in number or very localised compared with the severity, variability and extent of erosion in Spanish olive orchards. Representative interdisciplinary research needs to be carried out on a territorial scale and models need to be validated for the assessment of soil losses:

“Very few trials have been conducted to measure soil erosion and soil erosion impact in olive growing and those that have been carried out have been very local and basically confined to three or four sites in Andalusia… It is very hard to fine-tune management systems and determine actual nutrient and herbicide losses outside the specific conditions of those trials… Extrapolation is very hard because very little territorial information is available.”

The experts also considered it necessary to research soil erosion and degradation more than erosion and soil loss:

“Not only is soil loss occurring in some olive orchards … there are some orchards where the soil has already reached a very severe stage of degradation that requires priority action and others where it has not yet reached such a critical condition. No systematic approach has been taken to this question.”

The experts emphasised that the innovation and transfer work of the research community should include offering clearer management guidelines to olive farmers to resolve these problems. In particular, one of the main alternatives for curbing soil erosion and degradation is to grow plant covers adapted to each agroecosystem, which also help to increase water application efficiency:

“Surprisingly, we have found many orchards where plant cover is applied as green manure in the springtime and the soil is excellent … If this kind of approach were to be applied a little further, it could help us to refine our management systems.”

The experts also thought it advisable to extend plant covers as widely as possible in rainfed orchards, not just in orchards on slopes with a gradient of more than 10% as is the case in Andalusia since 2010 where it is a cross-compliance requirement for direct payments under the  

---

5 Each question referred to each of the research and innovation clusters. For instance, one of the questions was: “What measures could be designed to develop priority lines of RDI in olive irrigation in order to enhance water use efficiency?”.

6 Bibliographical references on topics such as olive growing and sustainability and organic and integrated cultivation systems include Barranco et al. (2008), Gómez Calero (2010), Guzmán Casado (2011), Pajarón (2007) and Saavedra and Pastor (2002).

7 See Rodríguez-Lizana et al. (2007).
Common Agricultural Policy (CAP). Much research and experimental work remains to be done, for instance to determine the most suitable plant cover species for specific soils and climates depending on factors such as how they compete for water resources and minerals and their productive capabilities. It is important to identify the cover crop management system suited to the different agro-ecosystems and to relay the results to farmers. Lastly, the experts highlighted two new avenues of research and innovation: mechanical crop cover management and the biofumigant properties of specific plant covers when ploughed into the ground, which could therefore help to control verticillium wilt.

Figure 2 outlines the results of the strategic participation workshop on soil erosion and degradation

**Objective: evaluation and improvement of soil management systems**
- General studies on the agronomic evaluation of management systems by soil type
- Specific studies on evaluation of verticillium-infected soils
- Inter-disciplinary coordination of Spanish research teams working on verticillium wilt

**Objective: improvement of information on soil erosion and degradation at catchment level**
- Design of a programme to characterise and pinpoint olive growing areas by level of erosion
- Creation of an experimental network at micro/mesocatchment level to measure erosion and its effects on soil degradation

**Objective: transfer and demonstration of plant covers and plant cover management systems**
- Implementation of demonstration fields on use of plant covers
- Inclusion of research results in the design of agro-environmental policies according to erosion mitigation management systems
- Creation of model farms to test management systems

---

**Use of residue and by-products from the olive and olive oil chain**

Two main types of olive product waste are starting to have applications in soil replenishment, namely pruning debris and compost made from two-phase olive pomace (called alperujo in Spanish). These solutions are to be recommended, particularly in steep olive orchards owing to their special problems of soil erosion and degradation, and should therefore be disseminated and transferred.

It has been demonstrated that pruning debris gives more than acceptable results when used to improve the soil; however, in the major olive producing areas there is a surplus of pruning material, the transportation of which usually poses problems of cost-effectiveness. Hence, improved mechanisation of pruning debris collection using efficient machinery that is adapted to steep land and that has a minimal environmental impact is decisive when it comes to determining whether or not pruning debris can be reused. Such technological advances have to come from the machinery manufacturing industry. Also, research is needed on biomass soil degradation according to the environmental conditions as well as on the best management practices for using residue on different soil types in order to gain more insight into the sustainability of pruning residue:

“Pruning debris clearly improves soil properties .... Given the degradation of orchard soils, it is essential to combine this practice with composting or other practices. On the other hand, when there is a surplus of pruning residue, as can occur in major producing areas, it may prove even counterproductive to leave the residue on the ground because this could give rise to allelopathic substances that could have a negative impact on the balance in the orchard.”

Two-phase pomace is composted primarily for use as organic soil amendment and fertiliser, although with some limitations. Here again high transportation costs are the chief problem facing RDI: it is only economically worthwhile for olive growers to apply it when the orchards are near the composting plant. The production of organic fertilisers from two-phase pomace face the same problems of cost effectiveness, for exactly the same reasons.

Research in Spain is largely oriented at mixing two-phase pomace with other types of low-cost residue that are resistant to soil biodegradation in order to make organic fertilisers enriched with ligno-cellulose organic matter. The limiting factor is that this type of fertiliser lacks nitrogen but when it is nitrogen-enriched its pH increases too much; this is a very interesting problem for basic research.
Olive pomace and olive stones are the chief inputs for energy generation from olive oil biomass. Although this technology has recently been spreading, specific avenues of research still need to be followed up. For instance, it would be advisable to make the current technologies more energy efficient as well as to research into gasification (more combustion efficient) and to resolve the environmental problems posed by olive stone drying.

Some technological advances have been made in the reuse of pruning debris as a source of energy but they are not yet fully feasible. According to the experts, the main problems are likewise associated with the logistics of pruning residue collection. For this activity to be profitable, the transportation costs of such a bulky raw material need to be optimised and clear factory location criteria need to be established:

“It is important for research to be conducted on the reuse of olive growing by-products for agricultural and energy purposes. Here, logistics is the key issue because re-use will be difficult unless it is cost-effective for olive farmers to transport the by-products.”

Figure 3 outlines the results of the strategic participation workshop on the re-use of waste and by-products from the olive and olive oil chain.

---

**Objective: improvement and fertilisation of agricultural soils**

- Compilation of studies on the limitations on the spread of the use of by-products as fertilisers
- Analysis of the technical and economic feasibility of using residue and by-products for agricultural purposes
- Compilation of studies on the use of by-products as soil amendments
- Compilation of studies on the changes in the organic matter content of olive orchard soils and the need for applications of organic matter
- Analysis of the agricultural sustainability of pruning debris

**Objective: production of energy and valuable compounds**

- Analysis of the sustainability of pruning debris for energy purposes
- Study of the life cycle of pruning debris used as a source of energy
- Compilation of a study on the energy and economic balance of using pruning debris as biofuel
- Studies to identify high added-value (biological, pharmaceutical, etc) products in olive pomace

---

**Organic olive growing, integrated production and biodiversity. Weed, pest and disease control**

There is a consensus that the RDI system, policy making and industry should place top priority on the reduction and rational use of plant health products because of the risks they pose in terms of food safety and environmental pollution.

Herbicides have played an important part in weed control, besides facilitating harvesting and lowering costs. In point of fact, efficient weed control may lead to a 20–30% increase in crop production at lower cost. However, according to the experts, the uncontrolled application of herbicides, insecticides and fungicides has led in recent decades to major risks of soil and aquifer pollution, although the use of these products has decreased in the past five years.

They also agreed that verticillium wilt is possibly one of the most pressing problems in olive growing in Spain, and particularly affects superintensive irrigated orchards. Their joint diagnosis is that an interdisciplinary approach needs to be taken to verticillium wilt control in the form of a research programme involving at the very least specialists in plant pathology, cultivation systems and genetic improvement. This is warranted by the fact that accurate assessment of the importance of the different sources of propagation of the disease is not yet possible:

“The reasons have yet to be discovered. It is not yet known whether it is a natural progression of the disease due to the exchange of material or whether it is linked to an ecological imbalance in the micro-organisms in the olive orchard and other factors.”

The propagation of the disease is believed to be due to a variety of causes, such as inappropriate nursery practices or irrigation systems, for instance when the soil is kept constantly damp around the tree trunk.

---

8 See Junta de Andalucía (2010).
9 See Mercado-Blanco and López-Escudero (2012).
Contaminated irrigation water or other crops planted previously in the same plot are other possible origins of the fungus. The experts also recommended driving breeding research to obtain verticillium-resistant plant material in the environmental conditions characteristic of “new olive growing”.

**Objective: research and better understanding of organic olive farming**

- Study on the profitability of organic and integrated olive cultivation according to fertilisation and pest control
- Research to evaluate the environmental and economic value of organic and integrated olive growing according to the type of practice
- Studies on the energy and nutrient balance according to cultivation system
- Research on the characterisation of olive growing agro-systems

**Organic farming** and **integrated production** are management alternatives to weed, pest and disease control. The experts explained that while organic production is practised primarily in lower yielding orchards, although it is also starting to spread to other more productive areas, integrated production is expanding to all types of olive orchards.

They considered it vital to develop alternative pest control systems in the form of integrated management methods based on the use of auxiliary insect populations. As a general recommendation, they advised maintaining farm biodiversity thresholds:

“One thing that is clear is that pest and disease control is intertwined with diversity. In many cases, simply stopping the use of plant health products makes the pest problem disappear, although not always...”

**Objective: research and better understanding of biodiversity**

- Studies to define and standardise biodiversity scales
- Research programme to study biodiversity in the different production systems and make recommendations for biodiversity conservation
- Quantification of the carbon balance in different types of olive orchard

**Biodiversity** in olive agro-ecosystems is the sphere of olive growing sustainability in which research and innovation are perhaps lacking the most:

“In the case of environmental issues, there are several voids, one of which is definitely biodiversity research. This question has been addressed in research papers for twenty years now but when it comes to quantification, it is behind other types of environmental studies in olive growing.”

The conservation of the varietal diversity of Spanish olive orchards was another subject that was mentioned. Until quite recently, farmers propagated their own plants but a powerful nursery industry has grown up and now supplies all new plants, thus leading to a drastic reduction in the assortment of varieties on offer:

“Nowadays three or four varieties account for more than 95% of olive nursery sales. Traditional varieties are being replaced by others better adapted to the new form of olive growing”.

The results of the participatory strategic workshop on organic olive farming, integrated production and biodiversity are given in Figure 4.

**Olive irrigation and enhancement of water use efficiency**

From the point of view of RDI objectives, considerable progress has been made at world level in developing technologies for efficient water use. The top priority now is to provide farmers and local institutions with sustainability criteria enabling the allocation of water resources according to usage on a socio-economic and environmental basis. The proposal is therefore to give an impetus to advisory services for irrigation users:

“Water usage has to be acceptable from the social and land points of view, not just for the individual farmer... Water resources are general; by law, they belong to everyone.”

Specifically, the panel concluded that deficit olive irrigation tends to give higher yields and marginal profits well above those obtained for many other crops. The experts suggested boosting cross-sectional and interdisciplinary research and including weed and soil management in water research. They also concluded that it

---

10 See Rallo (2004) for an inventory of the varieties in Spanish olive orchards.
The outcome of the participatory strategic workshop on olive irrigation and the enhancement of water use efficiency is outlined in Figure 5.

**Objective: better understanding of district water use and farm irrigation management**

- Studies aimed at optimising the productivity of large-scale sustainable irrigation use (districts)
- Studies on the water balance in different soil cover systems
- Applied research to determine the water requirements of different olive varieties in different agro-ecosystems

**Cross-sectional objective: transfer and improvement of water use management**

- Creation of advisory service for irrigation users
- Inclusion of inter-disciplinary approaches in actions and measures relating to irrigation water use
- Inclusion of integrated environmental system approach (soils, climate, agro-ecosystems) in action related to water use

Figure 5: Strategic recommendations on olive irrigation and the enhancement of water use efficiency

Oil processing technologies: quality, food safety, health and new products

**Food safety and olive oil fraud**

Although modern societies are very aware of food safety, the panel believes that pesticide residues continue to pose a threat in the specific case of some oils in Spain. Nowadays, the effects of plant health products are known; the solution is therefore basically to transfer this knowledge. According to the specialists, the chief measure should be for olive growers and olive oil producers to be advised by agronomists who can teach them good practices. This means encouraging what are known as Integrated Production Associations (IPAs) or Associations for an Integrated Approach to Agriculture (GIAAs) where farmers collectively hire the services of agronomists.

Another complementary proposal was to encourage effective mill traceability schemes. This means performing analyses when the olives are delivered to the mill, which entails logistic and management problems.

Participants concurred that the industry must keep a watch on fraud because it distorts price formation, leads to a loss of reliability of standards and causes tangible damage to the numerous quality oils on the Spanish market.

The first threat is the addition of extraneous oils to olive oil, especially to refined oil. Although sufficient research has been carried out to control this problem to a large extent, fraud inspection is the crux of the matter and is very expensive. On the one hand, there are more than 20 types of analytical indicators for checking if product is solely olive oil. Research is also underway to test new techniques based on molecular biology which would appear to improve testing through the use of molecular markers. Nevertheless, it is considered essential to concentrate on developing quick, simple methods for detecting the addition of extraneous oils.

The authenticity of extra virgin olive oil is the second major issue connected with the potential for fraud. According to the panel members, this is more a question of certification and transfer than of basic research. For instance, it should not be left to producers to decide whether an oil is “extra virgin”; this should be certified by an independent agency. The fact of the matter is that there are virgin olive oils labelled as extra virgin that do not display the sensory quality required for classification in this category:

“I think there should be a system in place that offers external guarantees and which is industry-backed and funded”.

Figure 6 reports the results of the participatory strategic workshop on food safety and olive oil fraud.

---

11 When referring to research in Spain on food safety, fraud detection and the chemical components of olive oil and its by-products, a special mention should be given to *Grasas y Aceites*. **International Journal of Fats and Oils**, published by the Fats & Oils Institute (CSIC) where a large number of researchers are working on these subjects.
Mill innovation, olive oil quality and health

From the innovation angle, oil quality has improved greatly in Spain in the last two decades, driven by the advances in olive oil processing and packing technologies as well as by good practices in olive growing, harvesting, processing and oil storage. Nevertheless, the experts mentioned insufficient professionalisation and training of master millers and mill yard managers as the biggest failings in the sector. Hence, continuing efforts are needed in vocational and business training:

“Master millers and mill yard managers tend not to have sufficient sensory quality training. Mill management and consumers are not sufficiently trained.”

Research in Spain has made considerable progress in the obtention of quality oil although the panel agreed that the effort expended on quality improvement has not gone hand in hand with a suitable quality promotion strategy. This is a truly critical point in the Spanish olive oil industry. It is necessary to reorient business innovation policy, which must boost marketing strategies aimed at achieving market recognition of quality.

Research programmes on olive oil and health have lately been given an impetus in Spain. Results are currently being obtained on the antioxidants in virgin olive oil, which have anti-inflammatory and anti-carcinogenic properties, as well as on postprandial mechanisms. In addition, the experts underscored the future importance of research into the production of foods in which saturated fats are replaced by virgin olive oil.

However, so far research results have been transferred to the industry and consumers to only a very limited extent. The experts pointed out that the transfer of research findings to consumers has to be viewed in a broader context of relaying a multi-attribute concept of olive oil where “health” and other attributes such as “origin” or “sensory quality” are grouped as a whole in consumer minds. Consequently, it is urgent to boost consumer information and education to make consumers more knowledgeable about the taste and health properties of olive oil, for instance through programmes for school children or in the media. Emphasis was placed on the need to undertake a broad transfer programme involving research centres and hospitals, producers and packers, consumer associations, the Spanish Olive Oil Interbranch Association and the Administration. Some research networks of this type are already in place, for example the CEAS network (Spanish acronym for the Olive Oil and Health Research Network) which brings together health professionals and researchers in olive oil technology and others.

The outcomes of the strategic participation workshop on olive oil mill innovation, olive oil quality and health are shown in Figure 7.

---

12 Some of the literature dealing with aspects of olive oil processing or olive oil quality include Aparicio and Harwood (2003), Civantos (2008) and Uceda et al. (2008).
13 See section on consumer behaviour and marketing strategies.
14 Papers reporting the scientific results of research on olive oil and health include López-Miranda et al. (2010), Quiles et al. (2006) and Sánchez-Quesada et al. (2013).
**New products derived from olive growing and olive oil**

Present-day research has made great progress in identifying the positive effect of olive oil-based cosmetics on the skin. However, the production sector is generally unaware of these findings and there is hardly any action to transfer the pertinent technology to the olive oil industry. Prospects look bright for the demand for olive oil cosmetics because consumers are significantly more willing to pay for cosmetics than for oil. One point to bear in mind is that the commercial margins of olive oil-based cosmetics are very high (almost 100%) and much greater than those of olive oil. Cosmetics manufacturing could be a source of considerable additional income and could help to make production less seasonal:

“When you try to sell extra virgin olive oil, you do a lot of talking but the person opposite doesn’t listen for long. You realise they’re just not interested... but if you start talking about cosmetics, you get their attention and all sorts of possibilities open up.”

In the case of olive leaves, one key aspect of their utilisation is to extract their valuable minor compounds for potential application in the food and pharmaceutical industries. Here there is a problem of basic research because little is known about this subject. Olive leaf applications could be a future source of extra income in marginal olive farming districts.

Other avenues of basic research waiting to be explored are the potential reuse of the antioxidants in olive rinse water and the promising obtention of valuable minor compounds from oils and olive pomace.

Figure 8 shows the results of the strategic participation workshop on the new products derived from olive oil.
Marketing, organisation, heritage and territory in the olive oil sector

Consumer behaviour and marketing strategies

The experts first stated that research on olive oil supply is more consolidated than that on demand because olive oil economies are currently more oriented towards a supply model than a demand model. Although theoretical research on food demand models and techniques is quite far forward on an international scale, the experts agreed that the biggest research gaps are in concrete knowledge about the behaviour of olive oil consumers in the different segments and markets, especially international ones.

Lack of consumer knowledgeability about product characteristics is the chief obstacle to olive oil consumption. Although this lack is logically more pronounced on international markets, it is also quite evident among Spanish consumers. From a marketing standpoint, the solution lies in communication, promotion and advertising policies as well as in sensory education programmes for consumers in which tutored tastings are a very important tool. The experts therefore suggested driving applied research to analysis the psycho-social and economic factors that define behaviour in the different olive oil consumption segments:

“Keep on wondering why Spanish consumers, who are used to eating olive oil, do not distinguish between extra virgin and normal olive oil. I think this would be a question for sociological and perhaps even psycho-social research and would be well worth investigating.”

There was also a consensus among the experts that demand for new olive oil-based products – for instance meat products where saturated fatty acids have been replaced by oleic acid from extra virgin olive oil and canned products and processed baked goods in which olive oil is used instead of other fats – will gain increasing importance in the future.

Olive oil market penetration is an important area of research on marketing strategies, which have to be differentiated according to the target market channel and segment as well as the type of business (large cooperative, small private mill focused on quality differentiation, etc.).

When addressing the question of the penetration of packed olive oil on the domestic market, the experts agreed that the main stumbling blocks are the major business concentration in the large-scale distribution sector and the fact that such businesses use oil as a loss leader. As a result, agricultural or processing margins are very low. The experts also said that the domestic olive oil market in Spain is not mature, thus making it the prime target for increasing olive oil consumption in the near future:

“I think Spain is the best market for increasing consumption, at least of extra virgin olive oil. Is there also room for increasing olive oil consumption in general? The answer is yes, chiefly in restaurant, hotel and catering channels and even in institutional food service because households have a higher market share which is harder to expand.”

When it comes to packed oil penetration on international markets, the Spanish olive oil sector has still only a short albeit intense track record because for many decades the market basically focused on home consumption. More recently, the climate has been conducive to increasing olive oil demand, which has absorbed higher levels of production:

“In foreign markets, olive oils are positioned as the healthiest oils... Demand is growing, even without promotion and communication strategies.”

Promotion and communication strategies should be adapted to the peculiarities of demand in the countries of destination. For this to happen, it is crucial to investigate which attributes are most highly rated in the different domestic markets because consumer behaviour varies widely from country to country. Applied research should also investigate how olive oils can be combined with non-Mediterranean cuisines and what communication strategies help to increase product penetration:

“Olive oils are positioned in usage segments entailing little cooking time, such as salads. This limits the opportunities for demand growth .... I would carry out promotion linked to each national or local cuisine.”

Labelling was a topic that generated differing but complementary opinions during discussion. One was that if consumers do not know about extra virgin olive oil, putting too many details on the product label will only flood them with information and make the message less effective. Another was that the label is the only quick, cost-free

---

15 Parras Rosa and Muñoz Guarasa (2012) report recent research on consumption, business strategies, marketing and cooperatives in the Spanish olive oil sector while the paper by Rodríguez-Cohard and Parras Rosa (2012) gives an overview of olive oil marketing channels in Spain.

16 Alba Mendoza (2008), Jiménez Herrera and Carpio Dueñas (2008) and Uceda et al. (2010) have written three helpful guides to olive oil tasting to familiarise consumers and economic operators with sensory analysis.
source of information for consumers; hence, because they do not have a lot of time, labelling information has to be kept short and sweet and understandable in 15 seconds.

Figure 9 summarises the results of the strategic participation workshop on consumer behaviour and marketing strategies.

**Objective: better understanding of olive oil consumer behaviour**
- Research on consumer behaviour in the chief importer countries and domestic consumption segments
- Research on consumer behaviour vis-à-vis olive oil categories and by oil attributes
- Market research on what would make consumers willing to modify their oil consumption
- Study on the potential uses of olive oil in the gastronomy of target countries or regions
- Improvement of the Ministry of Agriculture Olive Oil Consumption Panel
- Analysis of potential markets for organic oils

**Objective: better understanding of the demand for new products and by-products**
- Studies on the demand for food products in which olive oil could potentially be used: technical and economic feasibility of uses
- Studies on the non-food diversification of oil use
- Analysis of the profitability and/or logistics of olive biomass utilisation

**Objective: better understanding and dissemination of olive oil attributes and culture**
- Study on the attributes characterising the link between oil production and territory
- Study on the inclusion of positive attributes in olive oil labelling
- Design of measures for effective oil quality communications strategies on international markets
- Campaign to disseminate olive oil sensory analysis to business operators and consumers
- Promotion of nutritional and sensory benefits of olive oil

*Business organisation of the olive oil mill industry and cooperatives*

While the objective of olive oil mills is to sell a larger proportion of packed, branded olive oil, the bulk market cannot be overlooked because it is still the major destination for the olive oil sold by producers in Spain. The main problem facing the olive oil industry is that it is heavily fragmented (1700 mills) compared with the packing industry and distribution sector which are distinctly oligopolistic. This means that mills have little negotiating power and leads to a structural decline in the prices paid to producers. Besides considering it necessary for mills to form business teams, the experts thought it essential to conduct research to establish criteria for making mills more professional, especially as regards their commercial functions because many cooperatives have a shortage of proper managerial and commercial staff:

“Another serious problem is that mills are no longer the only ones to sell oil; farmers now tell mills to sell their oil for them. As a result, there are more sellers and sales timing is not rationalised. Oil is sold at any time for numerous reasons – a daughter’s wedding, a village fiesta, … – but never according to professional sales criteria.”

The experts discussed the question of the most appropriate organisations for combining the production and commercial aspects of the sector. One proposal was to concentrate cooperatives into larger first-tier units (first-tier cooperatives are cooperatives whose members are natural or legal persons) that are more capable of making their employees more professional. For instance, there are still many towns and villages where there are several cooperatives. Grouping together at municipal level would lower production costs and aggregate supply.

According to the experts, another factor that heavily restricts the business capability of cooperatives is the principle of “one man, one vote” because small, part-time farmers cannot play the same role as professional farmers who earn their living from their holding. Cooperatives are often affected by social dynamics that are not explained merely by a drive for profits (Ruiz, 2006). The experts therefore proposed carrying out research on the sociological, economic and anthropological mechanisms that influence the internal dynamics of cooperatives and transferring the results.
Second-tier cooperatives (cooperatives made up of two or more cooperatives) are a tool for joint marketing of first-tier cooperatives. However, there was not a consensus amongst the experts on the role they should play. While some thought it was positive to encourage their creation others believed it was important to begin by promoting first-tier cooperatives that are sufficiently large and professional.

Figure 10 outlines the outcome of the strategic participation workshop on cooperatives and the business organisation of the olive oil mill industry.

Objective: better understanding of organisational structures
- Research on successful collective and institutional organisational models in the Spanish olive oil sector
- Research and transfer of findings on the factors - sociological, psychological, anthropological and economic - that help or hinder improved internal organisation of cooperatives
- Studies on the opportunities for concentric diversification of olive oil cooperative mills
- Research on new organisational needs for new bioenergy uses

Objective: policies to encourage business association and to disseminate business organisation knowledge
- Design and launch of industry education and awareness campaigns on business association integration and collective action
- Programmes to train and take on managers and salespersons at cooperatives
- Programme to conduct applied research and encourage cooperatives and second-tier marketers to merge and introduce new collective services

Quality certification and designations of origin
The experts pointed out that product differentiation is not made by producers but exists in the minds of consumers. In concrete, differential quality certification strategies such as protected designations of origin (PDOs), organic olive growing or integrated production have to become more demand-oriented; in Spain, this has not been the case as often as might have been wished. The general debate on oil differentiation revealed that it had possibly become too segmented as regards consumer ability to recognise and appreciate the differential attributes of an oil:

“Is organic a differential element? Yes, without a doubt. Are PDOs a differential element? Yes. Is integrated production a differential element? Yes ... sometimes we think of differential attributes as if they were for ourselves (experts and connoisseurs) ... but we make up only a very minor part of the market. The success of a differentiation strategy is basically dependent on demand, not supply.”

Firstly, it was proposed researching into the environmental differentiation attributes of olive oil and the market niches and segments that seek these attributes: this is the potential case of the organic oil and integrated production segments17, although the latter is barely known to consumers.

Secondly, consumers consider designation of origin labels to offer guarantees of sensory quality although this does not necessarily imply that the DO regulations feature stricter requirements for DO oils than for extra virgin product, which is the case, however, of some protected designations of origin (PDOs). Olive oil PDOs have spread rapidly in Spain in recent years, especially since 2000 and by 2014, there were 28 recognised PDOs18. The discussion analysed the factors limiting the efficiency of the current Spanish model of olive oil PDOs. Many designations are not becoming a tool for integration and commercial promotion; as a result, olive farmers who expect more immediate benefits may consider PDO membership to be an extra cost. Although consumers have a positive perception of “origin”, PDO oils are not managing to become well known:

“In various surveys on olive oil consumption, “origin” has systematically come up 3 to 4 points ahead of PDO while “PDO” has been in the tail group of factors.”

When considering the achievements of PDOs, the experts highlighted that they have created producer and consumer awareness of oil quality, which has brought indirect beneficial effects for the entire sector. They also acknowledged that one of the most positive consequences

17 See section on organic olive growing, integrated production and biodiversity.
18 Research on interbranch and institutional activity in regard to olive oil PDOs in Spain includes papers by Coq et al. (2014), Sanz-Canada (2009) and Sanz-Canada and Macías-Vázquez (2005).
of institutional PDO activity has been to encourage local interbranch olive oil organisations. This is particularly effective in hitherto disadvantaged areas without any unifying institutions for local olive oil development\textsuperscript{19}. It was proposed encouraging research into the socio-economic and cultural factors that promote the unification of the local producing and commercial sector, on the basis of successful experiences. It was also suggested investigating what attributes of PDO oils ought to be used in marketing strategies and how to incorporate them into territorial promotion as a whole.

The strategic participation workshop on quality certification and designations of origin gave the results shown in Figure 11, together with those now outlined in the next section.

\textbf{Figure 11:} Strategic recommendations on quality certification, designations of origin, multi-functionality and olive landscapes

\textit{Multi-functionality and olive landscapes}

Analysis of the \textit{multi-functionality} of olive growing and olive oil production figured prominently in the panel discussion and may have considerable implications for public policies\textsuperscript{19}. The experts agreed that in their capacity as the producers of public goods, local production systems where low-yield, mountain olive growing is practised are the areas in greatest need of public policies. Such marginal olive orchards are not able to convert to irrigated cultivation; moreover, their profitability is seriously hampered by the physical environment. According to the experts, almost one-third of Spain's olive orchards (800,000 ha) fall into this category.

As a producer of public goods, mountain olive growing fulfils purposes demanded by society as regards the landscape, environment, biodiversity, land occupation, curb on rural depopulation, income supplementation, etc. Consequently, if it complies with environmental and sustainable development requirements, it has the social legitimacy to be funded under public policies. In such circumstances, it is hard for marginal olive grow-

\textsuperscript{19} When discussing regional and environmental policies, the experts recommended annually updating the study on Olive Growing in Andalusia (Junta de Andalucía, 2003), as well as making it nationwide in scope. This study quantified a series of variables at territorial level by type of cultivation system: characteristics of the physical environment, agricultural structures, levels of productivity, etc. It provides very significant information for policy making.
ing to compete price-wise with the new intensive and superintensive form of olive cultivation that is expanding worldwide.

These problem areas prompted applied research to evaluate the extent to which olive growing in Spain is physically marginal. According to Guzmán Álvarez (2004) one-fifth of the olive orchards in Andalusia could be considered marginal (200,000 ha) on the basis of physical marginality criteria relating to land slope and soil type. However, the absence of an appraisal of the physical and economic marginality of all of Spain’s olive orchards is currently a shortcoming for the implementation of multi-functional policies.

In this respect, the experts mentioned the importance of researching into the profitability thresholds at which olive farms may be abandoned in different olive growing districts according to the features of the physical environment, productive yield, agricultural structures, extent of public policy support, etc. Another important research topic would be to design environmental and economic alternatives for olive orchards with the greatest likelihood of being abandoned.

It was also considered advisable to set in motion an RDI programme to appraise and classify the roles of olive growing when viewed as a public good²⁰, as well as to determine the type of requirements to lay down for low-yield olive orchards:

“*What arguments should be taken into account when considering what to do with marginal olive orchards? On the one hand, there are emotional and aesthetic arguments linked to the landscape; on the other, there are arguments linked to society and people, and lastly the idea that these olive orchards are an agro-environmental public good. So, what public goods do these orchards offer? This should be the focus of research work.*”

Nevertheless, there was some dissent about the advisability of using public money to reward the reduction of negative environmental externalities in more marginal olive orchards. Some experts proposed allowing certain marginal olive orchards to turn into dehesa grassland:

“*Major olive orchard conversion is necessary to modernise orchards in many places. But there are also many areas where olive growing does not make sense … the best thing that could happen in such cases would be to allow the orchards to revert to dehesa grassland which they should never have stopped being.*”

Lastly, some of the specialists mooted the possibility of applying public agro-environmental policies not just to hilly orchards but also to medium-yielding, rainfed orchards which are the most frequent type found in Spain (more than 1 200,000 ha, according to the experts).

*Olive tourism* and local differential quality strategies can achieve joint synergies in promoting intangible territorial assets and complement each other in generating income. The experts also pointed to the loss of important architectural heritage, especially typical farmhouses which were models of rural architecture and which could be more closely involved in the expansion of olive tourism.

**Closing remarks**

The working basis of the in-person expert panels was to gradually reach a degree of consensus in interactive dialogue and the formulation of strategic recommendations.

From a cross-sectional standpoint, a consensus first emerged on the general dearth of action in transferring innovations and knowledge from the national RDI system to businesses and farmers. Generally speaking, in many of the theme areas, transferring innovations and knowledge is more urgent than conducting research in the strict sense of the word. This finding is quite patent in the case of RDI to correct environmental externalities in olive growing and olive oil production, as well as regarding consumer behaviour, quality practices, innovations in processing methods or other aspects. The national system needs to find a solution to this bottleneck in future development, especially since nowadays Spanish olive oil companies are not inclined to be demand-oriented or to take on board innovations.

A second widespread opinion is that it is necessary to take interdisciplinary and transdisciplinary approaches to RDI involving researchers with different specialities. The issues the national system has to grapple with are becoming increasingly complex, as is only too evident in spheres such as quality, food safety, sustainability or multi-functionality. In actual fact, action so far has been disciplinary in approach. Upon analysis, it emerged that the disciplinary and longitudinal approach taken in this article needed to be supplemented by interdisciplinary analysis. For this reason, the sequence of social research methods led to a third phase of the research

---

²⁰ Arriaza and Nekhay (2010), Carmona-Torres et al. (2014), Gómez-Limón (2010), Parra-López et al. (2004) and Pérez and Pérez et al. (2013) have written recent research papers appraising the functions of local olive oil systems as public goods.
project based on the cross-sectional, transdisciplinary relationship between technical knowledge (agricultural, processing, ecological, etc.) and knowledge in the field of the social sciences.

Agreement also emerged on the urgent need to adopt a territorial approach to resolving environmental and rural development problems in the olive and olive oil sector. Applied research and transfer programmes need to take into account the heterogeneity of the environment and management practices and the large degree of diversity in the socio-economic, cultural and institutional environment of the geography of olive growing in Spain.

In short, a process of interactive dialogue between researchers and experts from a wide range of subject areas aimed at identifying important issues in the olive and olive oil sector and offering sustainability-oriented knowledge highlighted the importance of transdisciplinary research in the search for solutions to complex problems. The practices employed and underlying principles fall under what Lang et al. (2012) term sustainable science. The outcome of this process was a consensus on the need to drive RDI policies and programmes for the Spanish olive oil sector to ensure that Spain’s world leadership in olive oil production also goes coupled with leadership not only in research but also in innovation and transfer. Furthermore, the structural changes in the olive oil chain and consumption and the new direction of the 2014/2020 Common Agricultural Policy call for special efforts to design programmes that overcome the current excessive fragmentation of research teams and disciplines. Doing so would help to find answers to complex problems, although its success will depend on involving the scientific community, industry stakeholders and territorial development institutions in the decision-making process.

REFERENCES


Ministerio de Agricultura, Alimentación y Medio

21 See Figure 1.

22 The methodology in the third phase entailed carrying out two Delphi analyses on a large number of experts (85 in all) in two major cross-sectional and interdisciplinary theme areas: i) value chain, quality, food safety and consumption (food chain approach) and; ii) sustainability, territory and rural development (territorial and environmental approaches).


Príncipe de Vergara, 154.
28002 Madrid, Spain
Tel.: 34-915 903 638
Fax: 34-915 631 263
E-mail: iooc@internationaloliveoil.org
www.internationaloliveoil.org