3 PART II: Overview of the apiculture sector

The overview of the apiculture sector is structured into six main sections:

- **The place of the EU in the worldwide honey market:** trends (main producing countries, policies and trade), prices and quantities, quality and production of honey.
- **Main threats for the sector:** the sector is facing threats directly affecting the bees but also coming from adverse processing and marketing practices. The main ones will be briefly tackled in this section.
- **Opportunities to increase profitability of the sector:** description of solutions to the threats described in the previous section as well as an overview of opportunities provided by pollination and the valorisation of other beehive products.
- **The EU honey production systems:** this part of the report first describes some particular territorial characteristics such as the races of bees and floral availability. Based on available data, it also provides an overview of the main characteristics of production factors: the differences between professional and non-professional beekeepers, age categories of beekeepers, relation with land management, variation in levels of production and a description of the modernisation of the sector.
- **The marketing structures of EU honey producing beekeepers:** marketing systems and organisations, price formation in the markets; specialisation and quality labelling.
- **An overview of the execution of the measures** at EU level.

This is based on the information and data available at EU, international and worldwide level. The origin of the figures and facts described in this section is systematically detailed together with eventual missing information and bias in existing data.

**The place of the EU in the worldwide honey market**

It is essential for the evaluation to understand the current EU position in the honey global market. The main world market figures analysed in the first part of this section show that the EU has contributed to the general honey production increase and plays an important role as a main producer and importer of honey. The increase in the EU self-sufficiency rate that has been observed since 2000 is due to the accessions of several honey producing countries such as Hungary, Bulgaria, Poland and Romania. The self-sufficiency rate has been fairly stable after the accessions.

The second part (Other market characteristics) describes some rules set at the EU level for honey imports which have a great influence on the origin of importations. Among others, only countries listed on the so-called “third-countries list” are allowed to export honey to the EU.

The last part of this section provides a broad picture of the EU production, highlighting the declining number of beekeepers and beeives as well as the existing contrasts among EU countries. After these quantitative aspects, some qualitative specificities of EU honey production are presented (physico-chemical properties, floral origin and quality labelling).
The main world market figures

The main world market figures have been chosen according to their relevance for the evaluation carried out. The main statistical sources are FAOSTAT and the Eurostat Comext database (from primary and secondary sources). The analysis deals with production trends worldwide as well as several trading patterns.

The worldwide production of honey has globally increased to amount to 1.5 million tonnes in 2010. The 10 biggest producers are: China (400 000 tonnes), Turkey and the USA (80 000 tonnes each), Ukraine (70 000 tonnes), Argentina (60 000 tonnes), Mexico and Ethiopia (55 000 tonnes each), Russia and Iran (50 000 tonnes each) and India (40 000 tonnes). Among Member States, Spain ranks 13th, with a production of 34 000 tonnes.

As shown in the figure below, the increase in production is especially important in Asia, which counts for 43% of the global production. Following Asia, the EU is the second major global producer of honey producing 23% of the global production. The increase of EU production is mainly due to the accession of countries from Central- and Eastern-Europe between 2000 and 2010.
Figure 3 Trend in honey production across continents

Source: FAOSTAT

Cointegration between honey production levels shown in figure 3 and beehives numbers shown in figure 4 below indicates a clear link between the amount of honey produced and the evolution of the number of hives in each continent. This link is particularly strong for the Asian and European curves.13

Figure 4 Trends in beehives number across continents

Source: FAOSTAT

13 The results of the Johansen cointegration test show that a cointegrating relationship exists between the number of beehives and honey production both in Europe and in Asia. In Europe, the test value for Europe is 19.8, whereas the critical value for a level of significance of 0.05 is 15.43. For Asia, the test value is 21.28, whilst the critical value for a 5% significance level is 15.43. The results are similar using the Least Squares method to calculate correlation. For Europe, the correlation coefficient between the number of beehives and honey production is 0.21; the coefficient for the beehives variable is 16.54 (meaning that on average a hived produces 16.5 kg of honey in Europe), with a clearly significant t-statistic of 18.0. For Asia, the correlation coefficient is 0.99 with a value for the coefficient of the beehives variable of 15.11 and a significant t-statistic of 14.68. Augmented Dickey-Fuller tests show that production is rather stationary for Europe, but not for Asia. The Granger causality test shows that the number of beehives “Granger causes” honey production in Asia (F-test value 2.35, probability 0.246) whilst for Europe honey production “Granger causes” the number of beehives (F-test value 10.02, probability 0.047)—which can indicate that the number of beehives can be largely estimated by honey production.
Over the period 1965-2010 Europe and Asia have produced a similar amount of honey, with a yearly average of 321000 tonnes for Asia and 326000 tonnes for Europe.

When looking at the worldwide honey consumption patterns, one can see that the three major consumers are the EU (20-25% of global consumption), China (approximately 15%) and the US (approximately 10%).

The production and consumption shares presented above are reflected in the export and import figures of honey (Figure 6 and 7 below). These figures also highlight a clear net import balance for the EU, the main importing area in the world (38.2% of the total imported amount of honey), followed by North America (30.1%). In absolute terms, the EU has imported 142 000 tons in 2008 and 146 000 tons in 2011.
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Figure 5 Exports share per region in 2010

Source: EUROSTAT Comext

Figure 6 Imports share per region in 2010

Source: EUROSTAT Comext

Figure 7 Imports into the EU by country of origin in 2011 (tonnes)

Source: EUROSTAT Comext

Going further on the description of the honey imports in EU, figure 7 above demonstrates that developing countries together supply 41% of total EU honey imports. Argentina was the traditional leading supplier to the EU. However, the value of supplies from Argentina decreased significantly in the period 2003-2007 and, in 2008 and early 2009, supply volumes
decreased sharply\textsuperscript{14}. The Chinese share of EU imports has increased to overtake Argentina in 2010.

Imports are regularly subject to bans from the EU. For example: Chinese honey was banned from 2002 to 2004 because chloramphenicol was found in the honey; in 2011, Chinese, Argentinean and Chilean honey were temporarily banned because GMO pollen were found in the honey; in 2007, a ban was imposed on honey from Brazil because no agreement could be made on testing procedures and standards. These bans have huge impacts on international trade and prices.

Despite of being a net importer of honey, Figure 8 below shows that the EU has also a small share of the worldwide exports (3.3%). EU honey is mainly exported to Switzerland (20%), Japan (16%), the USA (10%) and Saudi Arabia (10%). It is interesting to note the significant difference between import prices and export prices. Both prices are rising. In 2011, the average EU import price for honey amounted to €2.08/kg while the average export was €5.04/kg (EUROSTAT data, Comext). This price gap is mainly due to differences in honey quality between exported and imported honey. While imported honey is mostly polyfloral, the EU largely exports monofloral honey.

\textit{Figure 8 EU exports by destination country in 2011 (tons)}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{EU_exports.png}
\caption{EU exports by destination country in 2011 (tons)}
\end{figure}

\textit{Source: EUROSTAT Comext}

As it will be further analysed in the “EU Production” section, since 2000, the larger growth in EU honey production is to be identified in Central- and Eastern Europe, notably Hungary and Poland. Bulgaria and Romania also increased their production significantly. The accession of these countries to the EU made the EU self-sufficiency rate increase from 54% to 61\textsuperscript{15}.

\textsuperscript{14} CBI market Survey, The honey and other bees products market in the EU, 2009

\textsuperscript{15} http://www.beesfordevelopment.org/portal/article.php?id=1275
Table 1: EU market balance data

<table>
<thead>
<tr>
<th>Year</th>
<th>Usable production (1000 t)</th>
<th>Imports (1000 t)</th>
<th>Exports (1000 t)</th>
<th>Population (million)</th>
<th>Consumption (1000 t) (kg/head)</th>
<th>Self-Sufficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>200</td>
<td>142</td>
<td>10</td>
<td>495</td>
<td>332</td>
<td>0.6</td>
</tr>
<tr>
<td>2009</td>
<td>203</td>
<td>137</td>
<td>9</td>
<td>499</td>
<td>331</td>
<td>0.6</td>
</tr>
<tr>
<td>2010</td>
<td>224</td>
<td>148</td>
<td>11</td>
<td>501</td>
<td>361</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: data coming from the European Commission Advisory Group on Honey report 2012

Only a few EU countries are completely self-sufficient: Spain, Hungary and Romania. The import of honey is very low in Hungary; its volume is negligible. However over 2/3 of the Hungarian production is exported.

Member States are also trading honey among each other. Germany, Hungary and Spain are leading suppliers of honey. Germany is a major importer and a leading exporter at the same time. The German exports consist both of honey produced in Germany and honey from other countries, meaning export of importing honey. Other exporting countries are Poland, Latvia and Romania. Italy is exporting as much honey as it is importing. Considering only EU trade, the other countries are net importers. The Comext database provides information about the intra-EU trade of honey. Data are missing for several countries, including Germany and Spain. Looking at the results for the year 2012, some main trends can be observed. On average for the EU, export and import prices are similar and are around €3.2/kg. Some countries however export at significant higher price than they import: France, UK and Greece (difference = €1-1.5/kg).

The Spanish case study also provides interesting data to illustrate this section:

Spain has become in the last few years (since 2007) a net exporter of honey. More honey is produced than it is consumed in Spain. This being said, the majority of honey consumed from Spain is imported (while the majority of the national production is exported and consumed abroad). Exports are mainly destined to the EU while imports come mainly from third countries. In 2011, 88.6% of the honey exports went to EU countries, with France and Germany as the main destinations. Outside the EU, Algeria, Morocco and Israel were the most important destinations. On the import side, 75% came from outside the EU. China was by far the largest origin, followed by Argentina. Among other EU countries, Spain imported principally from Portugal, Germany and France.
Table 5 shows the evolution of honey consumption per capita in Spain as well as the level of self-sufficiency (rate of national production vs. national consumption of honey):

Table 5 – Evolution of honey consumption per capita and the self-sufficiency rate in Spain

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per capita</td>
<td>0.9</td>
<td>0.8</td>
<td>0.9</td>
<td>0.8</td>
<td>0.9</td>
<td>0.7</td>
<td>0.8</td>
<td>0.6</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>consumption (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-</td>
<td>84</td>
<td>84.3</td>
<td>82.8</td>
<td>112</td>
<td>102</td>
<td>90.7</td>
<td>84.2</td>
<td>82.7</td>
<td>112</td>
<td>98.8</td>
<td>102</td>
<td>113</td>
</tr>
<tr>
<td>sufficiency (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other Market characteristics**

Honey production and distribution is subject to the European General Food Law which represents the legislative basic requirements on ‘safe food’: food safety management systems, rapid alert system, responsibilities within the food supply chain, the application of HACCP and traceability principles as well as requirements about labelling and packaging.

In addition, Directive 2001/110/EC specifies additional requirements applied to honey market which are particularly influencing the trade within and towards the EU: honey definition, the recognition of specific types of honey, composition and labelling requirements.

First of all, the European definition of honey (presented below) is based on the definition provided by the Codex Alimentarius. The most important difference is that it specifies honey as being produced only by one species of bees, *Apis mellifera*. It therefore excludes all type of honeys produced by other species, meaning excluding most types of honey produced in Asia and several types of honey produced in Africa.

**Honey** is the natural sweet substance produced by *Apis mellifera* bees from the nectar of plants or from secretions of living parts of plants or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature\(^\text{16}\).

Secondly, the Directive recognises several types of honey, which have been designated with specific product names (honeydew honey, chunk honey, bakers’ honey, etc.). Only these types of honey may be placed on the EU market as honey intended for human consumption. The table below presents the designated product names and the three designation criteria: origin, mode of production or presentation. The Directive also defines industrial honey also called bakers’ honey.

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\(^{16}\) Directive 2001/110/EC
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Honey intended to human consumption also has to comply with composition requirements listed in the same Directive 2001/110/EC. These requirements have been developed for food safety issues and are one of the bases on which importers and producers are analysing honey together with the legislation on maximum levels of residues of pesticides, antibiotics, heavy metals and sulphamidates.

<table>
<thead>
<tr>
<th>Designated product names</th>
</tr>
</thead>
<tbody>
<tr>
<td>According to origin</td>
</tr>
<tr>
<td>i) blossom honey or nectar honey: obtained from the nectar of plants</td>
</tr>
<tr>
<td>ii) honeydew honey: obtained mainly from excretions of plant sucking insects (Hymenoptera) on the living part of plants or secretions of living parts of plants</td>
</tr>
<tr>
<td>According to mode of production and/or presentation</td>
</tr>
<tr>
<td>i) comb honey: stored by bees in the cells of freshly built broodless combs or thin comb foundation sheets made solely of beeswax and sold in sealed whole combs or sections of such combs</td>
</tr>
<tr>
<td>ii) chunk honey or cut comb in honey: contains one or more pieces of comb honey</td>
</tr>
<tr>
<td>iii) drained honey: obtained by draining decapped broodless combs</td>
</tr>
<tr>
<td>iv) extracted honey: obtained by centrifuging decapped broodless combs</td>
</tr>
<tr>
<td>v) pressed honey: obtained by pressing broodless combs with or without the application of moderate heat not exceeding 45°C</td>
</tr>
<tr>
<td>vi) filtered honey: obtained by removing foreign inorganic or organic matter in such a way as to result in the significant removal of pollen</td>
</tr>
<tr>
<td>Baker’s honey</td>
</tr>
<tr>
<td>Suitable for industrial use or as an ingredient in other foods which are then processed. Baker’s honey may have:</td>
</tr>
<tr>
<td>a) foreign taste or odour, or</td>
</tr>
<tr>
<td>b) begun to ferment or have fermented, or</td>
</tr>
<tr>
<td>c) been overheated</td>
</tr>
</tbody>
</table>

Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar content</td>
</tr>
<tr>
<td>1) Fructose and glucose content (sum of both):</td>
</tr>
<tr>
<td>- blossom honey not less than 60g/100g</td>
</tr>
<tr>
<td>- honeydew honey, blends of honeydew honey with blossom honey not less than 45g/100g</td>
</tr>
<tr>
<td>2) Sucrose content:</td>
</tr>
<tr>
<td>- in general not more than 50/100g</td>
</tr>
<tr>
<td>- false acacia (Robinia pseudoacacia), alfalfa (Medicago sativa), Menzies Banksia (Banksia menziesii), French honeysuckle (Hedysarum), red gum (Eucalyptus camaldulensis), leatherwood (Eucryphia lucida, Eucryphia millijamii), Citrus spp. not more than 10/100g</td>
</tr>
<tr>
<td>- lavender (Lavandula spp.), borago (Borago officinalis) not more than 15g/100g</td>
</tr>
<tr>
<td>Moisture content:</td>
</tr>
<tr>
<td>- in general not more than 20%</td>
</tr>
<tr>
<td>- heather (Calluna) an baker's honey in general not more than 23%</td>
</tr>
<tr>
<td>- baker's honey from heather (Calluna) not more than 25%</td>
</tr>
<tr>
<td>Water-insoluble content:</td>
</tr>
<tr>
<td>- in general not more than 0.5g/100g</td>
</tr>
<tr>
<td>- pressed honey not more than 0.5g/100g</td>
</tr>
<tr>
<td>Electrical conductivity:</td>
</tr>
<tr>
<td>- honey not listed above, and blends of these honeys not more than 0.8 mS/cm</td>
</tr>
<tr>
<td>- honeydew and chestnut honey and blends of these except with those listed above not more than 0.8 mS/cm</td>
</tr>
<tr>
<td>- exceptions: strawberry tree (Arbutus unedo), bell heather (Erica), eucalyptus, lime (Tilia spp.), ling heather (Calluna vulgaris), manuka or jelly bush (Leptospermum), tea tree (Melaleuca spp.)</td>
</tr>
<tr>
<td>Free acid:</td>
</tr>
<tr>
<td>- in general not more than 50 milli-equivalents acid per 1000 grams</td>
</tr>
</tbody>
</table>

Diastase activity and hydroxymethylfurural content (HMF) determined after processing and blending

| Diastase activity (Schade scale): |
| - in general, except baker's honey not less than 8 |
| - honeys with low natural enzyme content (e.g. citrus honeys) and an HMF content of not more than 15 mg/kg not less than 3 |
| Hydroxymethylfurural content (HMF): |
| - in general, except baker's honey not more than 40 mg/kg (subject to the provisions of (a), second bullet) |
| - honeys of declared origin from regions with tropical climate and blends of these honeys not more than 80 mg/kg |
Finally, in addition to general labelling requirements for all food products, the Directive establishes specific requirements for honey intended for human consumption: product names, “intended for cooking” if baker’s honey and country of origin.

In addition to these specific rules at the product level and again for food safety purposes, exports of honey to the EU are restricted to countries which are on the so-called ‘third country list’. The list states the non-EU countries which are allowed to export honey to the EU (2012/302/EU). Countries not on the list are not allowed to supply honey to the EU. In order to be on the list, a country should have a Residue Monitoring Plan for the analysis of residues of antibiotics, sulphonamides, pesticides and heavy metals.

The list was updated in the Annex issued on 16 March 2011 (India was removed from the previous list).

The 38 recognised countries are: Argentina, Australia, Brazil, Belize, Cameroun, Canada, Chile, China, Croatia, Cuba, El Salvador, Ethiopia, French Polynesia, Guatemala, Israel, Jamaica, Kyrgyzstan, Macedonia, Mexico, Moldova, Montenegro, New Caledonia, New Zealand, Nicaragua, Pitcairn, Russia, San Marino, Serbia, Switzerland, Tanzania, Taiwan, Thailand, Turkey, Uganda, Ukraine, Uruguay, USA and Zambia.

In addition of being on the list, each batch of honey must be accompanied by a health certificate signed and stamped by an authorised veterinary officer of the national competent authority.

According to several stakeholders, issues about the quality of imported honey do exist despite this requirements framework. Honey can be adulterated by being mixed with sugar and syrup in proportions which are not detectable by current analysis methods. Moreover, it will be further explained later in this report that honey can be over-filtrated to eliminate pollen and destroy all proves of its origin. Some examples are provided in the section dealing with the main threats on the sector.

**EU Production**

1. **Quantitative aspects**

This section focuses on EU honey production and first considers quantitatively production factors (beehives and beekeepers) in order to understand better production levels. Data provided by FAOSTAT show a decline in the number of beehives as well as very different trends in honey production among the Member States.

According to the Member States national apiculture programmes for 2011-2013, there are approximately 500 000 beekeepers in the EU, holding around 14 million hives.

The distinction between professional and non-professional beekeepers is a challenging issue because, as pointed out elsewhere in the report, yields, costs and therefore, profitability thresholds are very different from one country to the other.

A threshold of 150 hives has been set in Spain. Following current regulation the same is applied to all EU Member States, which can be considered as quite arbitrary as it does not reflect the factual situation in most Member States. For example, in order to stick better to international situation, the reports published under the COLOSS network consider a beekeeper as professional if he has more than 50 hives. On the other hand family beekeeping
is in fact sometimes non-professional despite the fact that the number of hives exceeds twice the administrative EU threshold mentioned before.

According to the EU definition (>150 hives), around 95% are non-professional beekeepers, who keep approximately 60% of EU hives. Non-professional beekeepers are not exclusively hobby beekeepers because most of them are depending on beekeeping for living while the economic incentive and profit is not usually the primary interest of hobby beekeepers.

Several sources reported that the overall trend for Europe has been a decline in the number of beekeepers\textsuperscript{17} since 1965\textsuperscript{18}. Related to this fact, the number of beehives has fallen by 25% between 1965 and 2010 in Europe (FAOSTAT data).

The bee colony decline is not uniform around Europe. Indeed, since 1965 the number of bee colonies maintained by beekeepers has decreased in Central and Western Europe while in Mediterranean countries (especially Spain, Greece, Italy and Portugal) a slight increase took place between 1965 and 2005 (according to the figures presented in “Declines of managed honey bees and beekeepers in Europe”). Figure 9 below shows the development of beehives in Europe since 1990.

\textit{Figure 9: Total number of beehives EU wide since 1990}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{beehives_eu.png}
\caption{Total number of beehives EU wide since 1990}
\end{figure}

\textit{Source: FAOSTAT, 2010}

In order to detail this general trend, Figures 10 and 11 below show two categories of countries: counting less than 100,000 beehives in 2010 and more than 100 000 beehives. They show that trends can be very different from one country to the other and therefore justify the importance of cases study data collection.

\textsuperscript{17} ECPA/ELO/RefCon/E-Sycon, Pollinators and Agriculture, 2011
\textsuperscript{18} Figures form 1965 are used in the descriptive part of the report to make it possible to appreciate long-term trends. This also allows a sufficient number of observations for certain statistical test.
\textsuperscript{19} Simon G. Potts, Stuart P M Roberts, Robin Dean, Gay Marris, Mike A Brown, Richard Jones, Peter Neumann and Josef Settele, “Declines of managed honey bees and beekeepers in Europe”, 2009
Countries counting more than 100 000 hives are among the major producers of honey in the EU, notably Spain, Germany, Romania, Hungary, France, Greece, Poland, Bulgaria and Italy.
Figure 12 and table 2 below show the amounts produced by country and provide a view of the recent trend in production.

**Figure 12: EU Honey production**

Source: FAOSTAT, 2010
Levels of production per farm evidently depend on the number of hives and on the bee health situation but also on a lot of other factors such as the type of hive, the density of bee colonies in the area and availability of proper and healthy habitats and food.

Unfavourable years with low production are not occurring uniformly on EU territory and the figures presented above do not show particular problematic decreases in honey production. For individual countries these adverse situations do however occur, as mentioned in the case studies. In Greece, the particularly hot summer in 2007 together with the fires of the previous years had damaging consequences on beekeeping. According to the special committee formed for this reason by the Greek Agricultural Insurance (ELGA), production decreased in 2007 in comparison to normal levels by: 45% in the North and Central Greece, 50% in South Greece and Ionian Islands and 55% in Aegean Islands and Crete.

Source: FAOSTAT
As mentioned in the case study on Greece, the country has a high number of bee colonies per beekeeper: 70. As for Hungary, the average number of hives per family has been estimated to 35-40 and in Belgium it has been estimated to 14 hives/beekeeper.

FAOSTAT data allow for calculating average production per hive for several countries. Although slightly different from data reported in the case studies, the results in table 3 show that the highest yields are often observed in Northern countries:

Table 3: Average production per hive (kg/hive)

<table>
<thead>
<tr>
<th>Countries</th>
<th>Average honey production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland</td>
<td>9</td>
</tr>
<tr>
<td>Greece</td>
<td>11</td>
</tr>
<tr>
<td>Spain</td>
<td>14</td>
</tr>
<tr>
<td>Czech</td>
<td>14</td>
</tr>
<tr>
<td>Cyprus</td>
<td>15</td>
</tr>
<tr>
<td>Austria</td>
<td>16</td>
</tr>
<tr>
<td>France</td>
<td>16</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>17</td>
</tr>
<tr>
<td>Lithuania</td>
<td>17</td>
</tr>
<tr>
<td>Italy</td>
<td>19</td>
</tr>
<tr>
<td>Slovakia</td>
<td>19</td>
</tr>
<tr>
<td>Romania</td>
<td>21</td>
</tr>
<tr>
<td>Portugal</td>
<td>23</td>
</tr>
<tr>
<td>Estonia</td>
<td>25</td>
</tr>
<tr>
<td>Germany</td>
<td>34</td>
</tr>
<tr>
<td>Hungary</td>
<td>38</td>
</tr>
<tr>
<td>Slovenia</td>
<td>43</td>
</tr>
<tr>
<td>Finland</td>
<td>46</td>
</tr>
<tr>
<td>Sweden</td>
<td>51</td>
</tr>
</tbody>
</table>

Source: FAOSTAT, 2010

This variability in yields is due to several differences in the environment (climate, nectar quantities, density of bee colonies, etc.) but also to the variable size and forms of the hives used in each region. For instance, the most extended model of beehive in Spain is the Layens model. It has been traditionally prevalent in Spain, particularly as it is easy to handle for transhumance purposes. Layens hives are horizontally arranged. In the Northern area, top bar hive types such as the Langstroth (widely used around the world) and the Dadant types prevail. These vertically arranged hives facilitate the treatment of hives against diseases without risking that the products employed also affect the honey, and usually produce higher yields. In Greece, beekeepers are using Langstroth hives which technically provides inferior yields compared to Dadant hives because of the shape of the hive and the frames. In Hungary, the majority of beekeepers are using traditional technology (only about 1/3 of the hives can be considered as more modern mobile hives).
In Greece, the case study reports an average yield of 17-20kg/hive and the highest density of hives of Europe (10 colonies/km²). In the case study for Hungary, the average yield for 2010 has been estimated to be 27.4 kg. In Belgium the observed average yield was rather low in 2012: 17.9 kg/hive. Finally, in Spain, the yield per hive amounted to only 14.0 kg/hive in 2010, representing an increase from 2006 (12.5 kg/hive). This level is however still considerably lower than previous historical levels. To put these figures into historical perspective; during the 1960s the average productivity in Spain was around 20kg/hive (per year).

2. Qualitative aspects

The EU as a whole produces mainly polyfloral honey but beekeepers often maximise the production of monofloral honey. This is especially possible in some countries such as Hungary which have an environment favourable to monofloral production (see table 4 below). To provide another example, multi-flower honey is the most common variety produced in the large majority of Spanish regions, partly due to transhumance. However, 4 regions out of 17 have specialised honey production: for the same time period, orange-blossom honey was the most produced variety in Murcia and Valencia, while in Cantabria it was heather honey; in Catalonia, the production of monofloral honey includes a range of floral origins including heather, eucalyptus, orange blossom, honeydew and forest. In the Region of Valencia, beekeepers do produce almost 20% of the Spanish production.

Table 4 Ratio of different types of honey in Hungarian production

<table>
<thead>
<tr>
<th>Year</th>
<th>1999-2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Rapes</td>
<td>11</td>
<td>19</td>
<td>19</td>
<td>9</td>
<td>18</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Acacia</td>
<td>54</td>
<td>50</td>
<td>32</td>
<td>35</td>
<td>50</td>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>Sunflower</td>
<td>14</td>
<td>11</td>
<td>18</td>
<td>30</td>
<td>12</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Mixed flower</td>
<td>13</td>
<td>9</td>
<td>20</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>15</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: Hungarian National Beekeeping Program 2010-2013

Research undertaken in the framework of the German case study estimates that 1/3 of German honeys are sold as monofloral honey. The report states that a higher quantity could be sold as monofloral quality if the necessary physico-chemical analysis were not so expensive.

The main monofloral honey produced in the EU is Acacia honey, as the black locust tree from which it is obtained is widely planted in Europe. The main producers of Acacia honey in Europe are Hungary, Bulgaria and Romania, although it is also produced in other EU
countries. Other types are linden blossom, heather, lavender, rosemary, thyme, orange blossom, sunflower and forest honey20.

In some countries such as Greece, honeydew honey represents the major part of produced honey (namely 70% according to case study data).

Honey attributes such as geographical origin or specified floral origins often lead to a premium price due to their organoleptic or pharmacoactive properties. In addition, the increased importance of quality, integrity, sanitation and nutritional value of honeys also contribute to a rising demand for organic honey. Statistical data to demonstrate these facts are however missing. These will therefore only be illustrated with a few examples based on the case studies and observations.

In the EU, 16 categories of honey have been recognised as Protected Designation of Origin and three categories as Protected Geographical Indication. One such category comes from Greece: Vanilla Fir Tree of Mainalo Mountain (PDO). Examples in Spain include three Protected Designations of Origin (Miel de Granada – since 2005-, Miel de Tenerife – since 2005- and Miel de La Alcarria – granted in 2012-) and one Protected Geographical Indication (Miel de Galicia – since 2007-).

The research undertaken in the framework of the German case study mentions an average price for honey around €8/kg, while prices for honeys from specific botanical origin go up to €16/kg. In Hungary, in the case of Acacia honey the characteristic consumer price of one kilogram is around €7-7.5/kg while it is only around €4.5/kg in the case of polyfloral honey. Prices for special quality honeys are significantly higher than mixed flower honeys.

The apiculture programmes evaluated here are directly linked to the identification of honey specific properties and therefore to the development of labels, as measure 4 provide facilities for physico-chemical analysis of honey. The analysis presented in the Spanish case study however highlights the application limits existing in relation with geographical designations: as a result of transhumance, it is hard to comply with the rules demanding production in a specific location, according to local characteristics. This is why Autonomous Regions are giving place to a wide array of regional quality certifications; all together, these quality honeys accounted for almost 3% of total honey production in Spain in 2009.

The only data available about prices for all EU countries are coming from FAOSTAT and are not distinguishing specific honey types. For countries in Southern and Eastern Europe, the price varies generally in the range of €1200-2800/ton with the exception of Greece where the price is higher. For Northern European countries the average price is in the range of €3200-5600/ton, with the exception of UK where the price since 2004 is above €6 400/ton to reach €9600/ton in 2010. For the Western European countries, the price has fluctuated generally between €4800 and €6400/ton in the reference period. The Opera Research Centre’s study on bee health has found that accession to the EU of the 10 New Member States in 2004, and the additional two in 2007, has not made any significant impact on these gaps in prices21.

\[20\] CBI, The honey and other bee products market in the EU
\[21\] Opera Research Centre, Bee Health in Europe – Facts and Figures, 2012
Threats for the sector

The main threats facing the sector are linked to honeybee health issues. These will be therefore the main focus of this section after a brief insight on economic considerations.

In this section, it will firstly be highlighted that high and unpredictable rates of colony losses threatens the sustainability of the European production systems.

Concerning bee health issues, there is currently a consensus amongst the scientific community: the causes of colony losses in Europe and USA are multifactorial (combination of factors at one place and different factors involved according to place and period considered). In other words, researchers agree that even if infestation with *Varroa* spp. is one of the major factors, a multi-factorial origin of the observed colony losses is most likely to be the cause for bee mortality. Other factors include a multitude of diseases and parasites, hive management and beekeeping practices, climatic factors, queen health issues, nutritional problems, loss of genetic diversity, and environmental factors such as the structure of modern agricultural landscapes. The critical literature review implemented to provide information to EFSA classifies them into four groups of factors, all considered as probably contributing to colony losses: biological factors, chemical factors, environmental factors and beekeeping practices. This section is structured according to this classification.

Economic causes for the decline of the number of beehives in Europe

This section aims to highlight the simple fact that, despite many factors seriously impacting honeybee health, the number of colonies in some areas is also linked to the number of beekeepers. One example provided by the Opera Research Centre’s report on bee health is the dramatic decline in bee colonies in Eastern Europe in the 1990’s which occurred because many beekeepers had abandoned their activity because of disappearance of state support.

An overwinter colony loss rate of 10% is usually considered as normal in bee production systems. Higher rates of loss occurring in some areas are causing important economic losses and its unpredictable nature is a source of uncertainty which could limit recruitment of a new generation of beekeepers. The decline in the number of bee colonies can consequently be considered both as a cause and an effect of the decline in the number of beekeepers.

Another element reducing the profitability of the sector is that the price of treating bee diseases has increased to the extent that the cost treatments may equal or exceed the income from a colony for an entire year.

The fact that the relative profitability of beekeeping operations is likely to be a major influence on the number of managed colonies has been reported in several reports. However, interviews with stakeholders have confirmed that little or no systematic information can be found on the economic aspects and challenges of beekeeping in Europe. While some national evaluations might be available, there is no comprehensive EU wide study publicly available to evaluate the economic situation of the beekeeping sector. It is therefore difficult to go further in this economic analysis.

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22 Hendriksen et al., Scientific report submitted to EFSA « Bee mortality and bee surveillance in Europe », December 2009
23 EFSA plans to launch an EU-wide collective study on CCD. This requires an EU-wide literature review on the topic and description of active surveillance systems.
Beyond economic threats related to production, several reports mention the existence of marketing difficulties faced by European beekeepers. Among other difficulties, some stakeholders have mentioned the difficulties to compete with the low prices of imported honey. Additionally, the professional European agricultural association COPA COGECA pointed out that the marketing problems that beekeeping is facing in Europe are related to the lack of market information, such as market statistics and forecasts, and to the difficulties in placing the products on the market. The last one is exacerbated by the heterogeneous marketing standards for certain hive products, by unfair practices of adulteration of honey and by residues in hive products.

**Biological threats**

This section describes pests and diseases that are considered as the most damaging factors to bee colonies. Viruses are the biological agents most frequently mentioned in the scientific literature. This is because a high number of viruses are infecting bees and often co-infecting them. After viruses, varroa, nosema and Acarapis woodi are the three other most commonly mentioned biological factors. American and European foulbrood have been more studied in the past than now. Finally, the recent accidental introduction of the Asian hornet (Vespa velutina) into Europe (south-west of France) represents a new threat to pollinators, mainly honeybees. This new problem will therefore also be described briefly.

As for viral pathogens, at least 18 viruses have been identified that affect brood and/or adult honeybees but their full significance remains largely unexplored. Even healthy colonies are usually covertly infected by several viruses. *V. destructor* has been shown to be an important vector for several of these viruses. Likewise, a number of viruses seem to be closely linked to *Nosema* infections. The most well-researched and potentially problematic viruses to date are: Deformed Wing Virus (DWV) Black Queen Cell Virus (BQCV) Israel Acute Paralysis Virus (IAPV). The last is the most frequently mentioned in the scientific literature and sometimes considered as a “marker” of CCD in USA.

The parasitic mite *Varroa destructor* is a highly specialised parasite of the honeybee. It reproduces in the brood cell; with a preference for the male brood cell. The male developing cycle is indeed longer and corresponds better to the development cycle of the *Varroa*. Although the mite causes little damage to its original host, the Asian honeybee *Apis cerana*, it has more severe effects for European *Apis mellifera* colonies to which it was transferred more than 30 years ago.

Varroa mite control presents a range of challenges: it has to be timely, efficient, repeatable (often actually repeated several times) and profitable. One of the major problems about *Varroa* mite control is that a lot of chemicals used by beekeepers end up as residues in honey and other bee products. Under the “Technical Assistance measure” in Belgium, a global overview of existing treatments has been distributed to the members of several beekeeping associations. This document gathers results of research and provides information about residues and effectiveness of each treatment. Highly effective treatments were found in the biotechnical, the natural and “delicate synthetic” treatment categories (e.g. heat, powder sugar, oxalic acid). None of the “strong synthetic” treatments reaches the highest level of efficiency. The most effective treatments are therefore also the ones with the lowest level of

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26 Hendrickx et al., Scientific report submitted to EFSA « Bee mortality and bee surveillance in Europe », December 2009
27 Varroase, quels traitements choisir?, CARI 2012 (l’essentiel du programme européen miel)
residues. This observation offers good perspectives regarding the efficiency and residue challenges in Varroa control.

In the “Applied research” section of the apiculture programmes, another positive perspective will be dealt with: the genetic selection of Varroa resistant bees. There are indeed several tiny populations of European honeybees that survive Varroa mites without chemical control. This offers a window of opportunity for further research on the topic.

Nosema fungi are widespread microsporidian gut parasites of adult honeybees. Two species have been reported in Apis mellifera: Nosema apis and Nosema ceranae. Nosema apis is well established in the EU and causing moderated damage. Nosema ceranae has recently been introduced into European honeybee population via the apicultural trade around the globe.

Many cases of infection by Nosema ceranae have been reported in Spain and a study is being conducted by the Agriculture Centre of Marchamalo in Ciudad Real (Castile-La Mancha), a world-renowned centre, particularly regarding the study of Nosema ceranae, covering 2,000 apicultural holdings spread over the territory of Spain. While other studies had documented the large spread of Nosema in Spain, finding its presence in around 90% of the apiaries analysed, they had not been able to establish a direct link with the mortality of bee hives. What had been documented previously, however, was the negative effect of Nosema on treatments against varroa (such treatments proved significantly less effective in bee hives with high levels of Nosema parasites). The high colony level virulence of Nosema ceranae in Spain may be a regional phenomenon; however, similar preoccupations have emerged in Greece where Nosema infections were associated with average winter losses of 15.8% (3.6% higher than the annual average). Between February 2007 and February 2009, 125 bee samples from the whole country were sent to the Hellenic Institute of Apiculture to be analysed for Nosema infection, providing an idea of the prevalence of the parasite in the country. Almost half of the samples (48%) were collected from apiaries reporting high losses and a high average number of Nosema spores per bee. These apiaries had losses (reported by the beekeepers to the Greek Agricultural Insurance Organisation) ranging from 30 to 50% (Hatjina et al., 2010).

Again, the impact of Nosema on bee mortality is not easy to demonstrate as several viruses are associated with Nosema infections that can significantly affect the apparent virulence of Nosema.

American foulbrood (AFB) and European Foulbrood (EFB) are caused by fungi spores and are two of the most destructive diseases for bee brood. EFB can be treated by antibiotic treatments. AFB being a lot more dangerous, it consequently leads to the destruction of contaminated hives. In most European countries, the legislation requires to report any infection by AFB to Authorities.

After having accidentally been introduced in Europe before 2004, the Asian hornet (Vespa velutina) that originated from northern India to the Indochinese Peninsula, Taiwan and Indonesia, seems to have itself well adapted to its new environment and have spread very quickly in France and Spain. This is why the scientific community has concluded it was no longer possible to eradicate it and that further expansion is likely to occur into other European countries where the hornet can find a suitable environment.

Hornets attack honeybee colonies to feed their brood. Vespa velutina is characterized by a larger size of nests and colonies; it is therefore more competitive than the two other hornets

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28 Mortiz et al., Research strategies to improve honeybee health in Europe, 2010
specie present in Europe (crabro and orientalis). Its attacks can lead to the death of the bee colony and therefore represents one more serious economic risk for the beekeepers. Efficient defence technics have been observed on several bee species and subspecies (Apis mellifera cypria, Apis florea, etc.). However, native European honeybees (e.g., mellifera, ligustica, carnica ssp.) may not be able to compete with the new invader, as confirmed by observations made in the field on Apis mellifera and Vespa velutina in France.

Only a collective strategy based on further research on hornets’ biological cycles could succeed in controlling hornet’s population. It therefore relies on efficient and timely alert systems. Alert systems should rapidly evolve to take into account the surveillance of the evolution of hornet distribution area and contribute to further field observations. Alert systems should also be designed to help preventing similar intrusion of other damaging species which is currently facilitated by globalization and climate changes.

**Chemical threats**

The honeybee is unusually sensitive to a range of chemical insecticides, most likely due to a relative deficit of detoxification enzymes. Foraging bees can encounter lethal and sub-lethal pesticide levels when foraging but they can also bring back contaminated nectar and pollen to the hive. In addition to the pesticides the bees are exposed to during foraging, beekeepers also use various acaricides to control mite infections, particularly Vespa destructor.

Most of agricultural and apicultural pesticides are lipophilic and accumulate in the wax, increasingly contaminating the combs where the brood develops and where honey is produced.

As for agricultural pesticides, three neonicotinoid insecticides are particularly considered as damageable for bees and pollinators. In March 2012, the European Commission has asked EFSA to assess the risks associated with the use of clothianidin, imidacloprid and thiamethoxam as seed treatment or as granules. Results published in January 2013 conclude that risks do exist but for some of the uses authorised in the EU, it was not possible to conclude because of the existence of a number of data gaps that would have to be filled to allow further evaluation. The recent opinions published by EFSA’s Panel on Plant Protection Products and their Residues therefore recommend a much more comprehensive risk assessment for bees in the pesticides registration procedures and also introduced a higher level of scrutiny for interpretation of field studies. Until now, the EU directive 91/414 Section 2.5.3 regulates the use of pesticides in the context of apiculture:

“... no authorization will be granted if the hazard quotients for oral or contact exposure of honeybees are greater than 50, unless it is clearly established through appropriate risk assessment that under field conditions there are no unacceptable effects on honeybee larvae, honeybee behaviour, or colony survival and development after the use of plant protections product according to the proposed conditions of use”.

In 2008 and 2009 several Member States reported accidental releases of clothianidin, thiamethoxam, fipronil and imidacloprid, resulting in substantial losses of honey bee colonies. For example, the Greek case study reports colony losses during the spring and summer of 2008 (approximately 3-6%), thought to be due to plant protection products. Of these, 70% occurred on cotton fields, where imidacloprid is sprayed or used as a seed dressing.

The Commission started implementing measures by reinforcing in Commission Directive 2010/21/EU the conditions for the placing on the market and the use of those active
substances. Furthermore, this Directive requires Member States to initiate specific monitoring programmes to verify the real exposure of honeybees to those active substances.

EFSA is now developing a guidance document for the risk assessment of plant protection products and bees\(^{29}\). The aim is to adapt the Directive mentioned above in order to impose more comprehensive tests in the procedure preceding approval of pesticides.

In March 2013, the European Commission has responded to the last EFSA report published in January 2013 submitting a proposition for a ban on three pesticides (neonicotinoids (NNI) - clothianidin, imidacloprid and thiametoxam) to Member States' experts meeting at a Standing Committee on the Food Chain and Animal Health. The European Council decided in April 2013 to impose a temporary ban of the three neonicotinoid insecticides to be reviewed after two years.

Pesticides can cause acute mortality which is easily diagnosed by the presence of many dead bees in front of the hive. In other cases, lethal effects of pesticides can induce slow mortality which is more difficult to detect. Furthermore, pesticides are also affecting longevity or behaviour and such sub-lethal effects can cause disruptions in social interactions that are essential for colony function and productivity. These are also more difficult to detect.

In addition, a study undertaken within the BEE DOC research network\(^{30}\) highlights that nothing was known yet about the interactions between agricultural pesticides foraged on by bees, the acaricides applied by the beekeeper, and pests and pathogens.

For example, since many pathogens have similar sub-lethal effects on longevity and behaviour, the cumulative impact of different sub-lethal effects may be significant at colony level, even when they are not immediately apparent when studied in isolation, and at individual bee level.

Even though, as described above, measures are currently undertaken to monitor and prevent adverse effects of some pesticides (neonicotinoids), there is such a wide range of agrochemicals currently used in agriculture that it is clearly impossible to implement experiments to test the effects and interactions of all of those compounds.

For example the BEE DOC research network will focus only on two major compounds, one neonicotinoid agro-pesticide, thiacloprid, and one pyrethroid acaricide, τ-fluvalinate. Thiacloprid and τ-fluvalinate therefore represent the two most important and common pesticide groups (pyrethroids and neonicotinoids) with different modes of action on the target organisms\(^{31}\).

The fact that only acute mortality is easily diagnosed allows for using the argument of weak correlation between the use of pesticides and colony losses to maintain the use of most products. Among others, the Opera Research Centre’s study\(^{32}\) considers that none of the pesticide-related bee monitoring in real-life conditions of use have, so far, found a clear connection between bee colony mortality as a general phenomenon and the exposure of bees to the pesticides.

The divergence of opinions and the knowledge limits reflected in the above paragraphs illustrates why the issue of the effect of pesticides on bee colonies decline is really


\(^{30}\) Mortiz et al., Research strategies to improve honeybee health in Europe, 2010

\(^{31}\) Mortiz et al., Research strategies to improve honeybee health in Europe, 2010

\(^{32}\) Opera Research Centre, Bee Health in Europe – Facts and Figures, 2011
controversial. There is a lack of objective data and conclusions of the studies carried out so far are not always straightforward. Among others this is why a lot of stakeholders are insisting for a better application of the precaution principle and several are pointing out the lack of independence of the reference expertise bodies and individual experts on the topic. The effect of pesticides on bee mortality will not be further analysed in this report as it is not directly linked to the evaluation scope.

**Environmental threats**

The above sections have already pointed out concerns about the decline of honeybee colonies in many EU regions. In addition to the potential factors previously described, environmental threats do contribute to honeybee and wild pollinators decline. The anthropogenic degradation of the environment indeed induces the disappearance of appropriate habitats providing healthy food and shelter for pollinators. As already explained, it is often difficult to determine the causes and the consequences of pollinators decline. However, for all pollinators, especially wild bees, the composition of landscapes and the availability of suitable habitats are key factors influencing the survival and the development of bee populations (Potts et al., 2010). The importance of environmental quality in maintaining colonies in a high health status has been confirmed by pesticides post registration and multifactorial studies.

The two main environmental factors of bee decline mentioned in the literature are the role of climate and the incidence of the lack of biodiversity (both on a qualitative and a quantitative way)\(^3\). Cropping regimes and land management have therefore a significant impact on pollinators decline. Indeed, a communication of the European Commission\(^4\) highlights that there is growing scientific evidence that bees which have access to a mixture of pollen from different plants are healthier than those fed only with one type of pollen and that an environment with sufficient biodiversity is critical for bee health.

In several reports\(^5\), it is recommended to use multifunctional landscaping and active management of the areas adjacent to the cropped fields, to provide additional food and habitat resources for pollinators. They are recommending the connection of habitats by the management of flower strips, the provision of nesting sites for wild bees (dead wood, etc.), the application of crop rotation using flowering plants in intensified uniform agricultural landscapes, etc.

Without entering in the above mentioned debate on effects of pesticides, if this kind of measures should actually ensure resources to pollinators, areas adjacent to cropped fields are also contaminated by pesticides and would therefore contribute to increase residues in beehive products and undesired effects on pollinators. This kind of measures should therefore be promoted in pesticide free areas or when the harmlessness of registered pesticides has been proven for animal and human health.

With respect to its multiple impacts on the quality of environment, agriculture plays an important role in the preservation of pollinators on which a large number of crops depend on. This is why a growing number of governments recognize the need to include ecosystem services in economic accounts. The importance of the pollination services and the need for

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33 Hendriks et al., Scientific report submitted to EFSA « Bee mortality and bee surveillance in Europe », December 2009
34 COM(2010) 714 Final
their valuation is largely discussed in the section about the opportunities for the sector (next section).

**Beekeeping and processing practices**

Beekeeping practices themselves are considered as possibilities of “opening the door” to biological agents and thus contributing to the appearance of colony losses. Apiary management, nutrition and migration conditions as well as sanitary treatments can stress the colonies. Moreover the use of inappropriate treatment measures are influencing the levels of pathogen infestation in colonies and is therefore often suspected to contribute to colony losses. However, none of the factors related to beekeeping practices have been proven to be linked to events of colony losses tackled in the scientific papers analysed in the framework of the Scientific Report submitted to EFSA on Bee Mortality and Bee Surveillance in Europe. From a totally different perspective, another threat for the sector is induced by processing practices leading to adulterated forms of honey. Adulteration generally consists in adding cheaper similar substances to honey or in pushing thermic treatments too far.

Honey adulteration is a complex problem which has undeniable nutritional and organoleptic consequences but which is usually not injurious for health. The main problem of honey adulteration is the significant economic impacts it induces. Adulterated forms of honey are competing with quality products, pushing prices down. Compulsory analysis undertaken before commercialization should help to highlight honey quality and to fix the prices objectively. Several stakeholders however complain about the competition of adulterated honey on the market. European beekeepers are especially suspicious about imported honey but importers are on their side guaranteeing importing honey respects the same quality criteria as European honeys.

The issue of adulteration of honey also impacts the demand, inducing suspicious behaviours from consumers. Suspicion can be justified or not but in every case it kills consumers’ confidence. For example, in several countries, although it is not true, the belief that crystallisation of honey is a sign of adulteration can be widely spread.

**Opportunities for the sector**

Opportunities for the sector encompass ways to reduce the above mentioned threats (monitoring systems, applied research) but also take into account other solutions to increase the profitability of apiculture. This section will therefore present the importance of bees in terms of pollination as well as the foreseen opportunities related to commercialisation of other beehive products.
The role of the bees in pollination

Biotic pollination is the result of the movement of pollen by living organisms; it is the most common form of pollination and accounts for an estimated 90% of pollination of all flowering plants. Several of Earth’s animal families have developed pollination capacities and specialisation; not only insects, but in Europe, only insects act as pollinators.

When wild bees do not visit agricultural fields, managed honey bee hives are often the only solution for farmers to ensure crop pollination. Indeed, *Apis mellifera* remains the most economically valuable pollinator of crop monocultures worldwide.

It is estimated that 35% of the human food consumption depends directly or indirectly on insect mediated pollination: for 87 out of 115 leading global crops, fruit or seed numbers or quality were increased through animal pollination. In the US, the pollination services are a source of income for many professional beekeepers, e.g. in almond pollination, the cost of renting a single honey bee colony increased from $35 in the early 1990’s to $150 in 2007 due to honey bee health problems. In the EU it far less common that beekeepers are paid for pollination services.

Pursuing with economic considerations, several estimations of the value of crop pollination by animal pollinators are presented in the next paragraph. However, there is still no generally accepted valuation method to measure this positive externality.

In 2005, for the then 15 members of the EU, the total added value to crops due to pollination services has been estimated at €14.2 billion (€22 billion in 2006 according to TEEB report, 2010) while the direct value of the honey produced annually by the bee industry in the EU is about €140 million (calculated from producer prices). In their study, Gallai et al. demonstrate that the total economic value of pollination by honeybee colonies worldwide amounted to €153 billion in 2005 and the Millennium Ecosystem Assessment project estimates the global annual monetary value of pollination to be many hundreds of billions of dollars. Gallai et al. have based their valuation on a bioeconomic approach which integrated the production dependence ratio on pollinators for 100 crops used directly for human food worldwide. To complete their conclusion, additional calculations show that the production of three crop categories whose yields are particularly sensitive to adequate pollination (fruits, vegetables and stimulants) will be clearly below the current consumption level at the world scale after pollinator loss.

Some will claim underestimation of the value presented here for not taking into account costs of health problems engendered by the lack of nutritional food, others will claim overestimation for not subtracting the cost of inputs from the value of pollination.

The objective here is not to find the most uncontroversial value but to show that research is done to raise awareness of the dependence of our natural and artificial ecosystems on pollinators. The multiplication of research on pollination services valuation also respond to the growing demand from governments to include their value in decision making. However, from a more general point of view, the value of insect pollination to biodiversity is simply inestimable. In light of the constant decline of wild non-honeybee pollinators, the importance

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37 ECPA/ELO/RifCon/E-Sycon, Pollinators and Agriculture, 2011
38 Klein et al., “Importance of pollinators in changing landscapes for world crops”, 2007
40 Hendrikx et al., Scientific report submitted to EFSA « Bee mortality and bee surveillance in Europe », December 2009
of beekeepers and managed bees is greater today than ever.\textsuperscript{41} Other authors will say that given current declines in populations of managed honeybees, and abandonment of beekeeping in regions affected by “Africanisation” of honeybees, the importance of wild pollination is likely to increase\textsuperscript{42}.

In order to provide a more detailed point of view, some studies tried to differentiate the pollination service provided by wild pollinators from the service provided by managed honeybees; the results of two of them are described here. The first one\textsuperscript{43} shows that native bees provide 62\% of the pollen deposited on female watermelon flowers while honeybees only provide 38\%. The results of the second study, which has surveyed 41 crops in 600 fields from different regions of the world, shows that wild pollinators tend to perform better than honeybees in contributing to increased fruits yields. The study also concludes that high abundance of managed honey bees supplemented, rather than substituted for, pollination by wild insects\textsuperscript{44}. While there are claims that managed bees can be competitors with wild non-honeybee pollinators and even drive their decline, others will say that the service provided by wild insects is enhanced by the presence of managed honeybees. Since biodiversity losses contribute to the decline of both wild insects and managed bees, it may not be of first importance to determine each contribution before undertaking actions to protect pollinators.

Being aware of the economic importance of biodiversity, the European Commission has set up a number of initiatives that are relevant for the apiculture sector, such as the \textit{EU Biodiversity Strategy to 2020}. The latter promotes the full implementation of EU nature legislation to protect biodiversity, better protection for ecosystems and more use of green infrastructure, more sustainable agriculture and forestry, better management of fish stocks, tighter controls on invasive alien species and a bigger EU contribution to averting global biodiversity loss.

The important points in the framework of the present evaluation is that the valuation of pollination services can help in establishing a fair remuneration to beekeepers and that pollination services on specific crops such as rape or orange orchards provide the production of monofloral honey with higher value-added. This is also why remuneration of pollination services is not automatically occurring at the same level. In the USA, transhumance of hives in widely used for pollination of almond crops from which bees do nearly not harvest nectar, the production losses of the beekeepers have therefore to be more compensated. In France, when this system of pollination is used on rape crops, beekeepers can harvest a particularly tasty and creamy honey that meets strong demand from consumers. The beekeepers do not encounter any losses and are therefore not remunerated. In Germany, the fee paid to beekeepers varies between €20/colony in oilseed rape crops to €50/colony in orchards. In Greece, because of the high density of honey bee colonies there is high availability of honey bees for pollination purposes all year round and no need for farmers to rent hives for pollination purposes. In Spain, according to the latest data published by the Ministry of Agriculture, in April 2012 there were, out of 24 230 beekeeping holdings, a total of 322 apicultural holdings dedicated mainly to pollination (i.e., pollination was their principal activity).

\textsuperscript{41}Mortiz et al., Research strategies to improve honeybee health in Europe, 2010
\textsuperscript{42}TEEB report, 2010
\textsuperscript{43}Winfree et al., Valuing pollination services to agriculture, 2011
\textsuperscript{44}Garibaldi et al., Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance, 2013
Existing monitoring systems

The availability of reliable data sets is necessary to demonstrate and quantify bee colony decline as well as to identify its causes and solutions. From 2003, several research projects have been launched worldwide to study the decline of pollinators. Examples of non-concluding results for the existence of important data gaps are numerous and usually provide recommendations for the adoption of standardised methodologies for surveys, standardised criteria and protocols to assign actual or probable causes of loss and the development of coordinated research program.

The COLOSS network, to be presented in the next section, has been created to improve knowledge and prevent large scale losses of honey bee colonies taking these recommendations into account. As part of the process, international standards are developed for the monitoring.

In order to prepare an EU-wide collective study on bee mortality, EFSA has decided to launch a project targeted on the assessment of existing surveillance systems. A survey established on the basis of the Surveillance Network Analysis Tool (SNAT) has been directed to each European country; 25 questionnaires from 24 countries have been collected. The answers allow describing and critically analysing the existing monitoring systems, it is interesting in the framework of this evaluation to take into account the fact that existing monitoring systems should be improved in order to provide data to better identify the mechanisms of colony losses and to develop adequate solutions. This is why some results of the study undertaken for EFSA are presented here.

Two countries with no surveillance systems have not completed the questionnaire: Portugal and the Republic of Ireland. Some interesting results presented in the report are:

- half of the systems still have room for improvement in the important area of the relevance of their surveillance objectives;
- the majority of pests and diseases targeted by the surveillance systems are notifiable, for example AFB, EFB, Tropilaelaps spp., and the Small hive beetle (Aethina tumida). Other pathologies such as Varroasis, Acarapisosis or Nosemosis are also monitored in a high proportion;
- less than half of the systems were found to have a steering committee, which is an important decision making level in the monitoring;
- most of the surveillance systems appear to have a small human resources input;
- only around 30% of systems were found to have dedicated field agents or provincial units;
- over one third of surveillance systems covered by this study were found to have no laboratory facilities to support them;
- the majority of surveillance systems lack a consistent definition of what constitutes colony losses;
- the level of training for field staff is very low: only 14% of surveillance systems implementing it;
- only six systems do generate representative data: Germany, Denmark, Finland, England and Wales, Italy and Sweden.

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Hendrikx et al., Scientific report submitted to EFSA « Bee mortality and bee surveillance in Europe », December 2009
The European Commission has published a thematic Communication on Honeybee Health in 2010 setting up or financing a number of initiatives on a wide range of areas influencing bee health (most of which are described in the other sections). For instance, the Agence Nationale de Sécurité Sanitaire de l’alimentation, de l’environnement et du travail (ANSES) has been designated as the EU reference laboratory in the field of bee health. The main task is to implement a pilot monitoring project over the EU to assess the situation and then to propose a framework for the implementation of a harmonized monitoring system. A concrete monitoring project involving 17 European countries has been launched by ANSES. In Belgium, it is implemented through AFSCA and involves beekeepers who receive a dedicated training program. This partnership is promising in terms of standardization of data and improvement of the relations between beekeepers and the controlling agency.

**Applied research perspectives**

Looking at what has been described above, research results on control of Varroasis and investigations on the causing factors of pollinators decline should help reducing crucial knowledge gaps and therefore contribute to the sustainability of the apiculture sector in Europe.

This section first presents the recent research developments at EU level and then, focuses on Varroa control and on the importance of better understanding the interactions between pollinators and agriculture. It finally deals with research efforts regarding the characterisation of honey.

Key knowledge gaps in the research on pollinators have been identified and addressed by the scientific community in different projects. In addition to the difficulty to gather evidence to pollinator decline, the problems lie in the fact that the causes for colony death are not only multi-factorial but also interacting with each other. This current consensus justifies the complexity of the problem and the lack of clear results from research implemented at individual country level. Recent developments at EU and international levels, especially the creation of research networks on the topic try to provide answers. For instance, the COLOSS network has been set up by the EU to standardize and use inter-regional data in order to improve detection, further understanding, and mitigation of the drivers of colony losses and losses of bees.

1. **Recent development at EU level**

Long-term research efforts have been focused on developing ways to manage landscapes to safeguard pollinators and allow them to continue to provide pollination services, which benefit everyone. To meet these goals, there are several large-scale global research programs, including projects specific to pollinator research and many more on biodiversity and climate change impacts.

On top of the applied research programmes co-funded by the apiculture support measures, a number of basic and fundamental research projects related to bees have been financed by the EU. The bee-related projects funded by DG RTD include:

- ALARM (Assessing Large-scale Environmental Risks for Biodiversity with Tested Methods) (FP6): the ALARM project quantified the declines in European wild bees

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46 COM(2010) 714 final
Evaluation of the CAP measures related to apiculture
Agriculture and Rural Development DG- Final Report

and other insect pollinators. It also assessed the drivers responsible for the observed losses of bees, including habitat loss, fragmentation, pesticides, invasive species and climate change. It was carried out between 2004 and 2009 and counted with a budget of €12 million.

- BRAVE (Bee Research and Virology in Europe) (SSA FP6): running on a budget of €0.9 million and conducted in 2009, the BRAVE project intended to assess the level of risk and the likely consequences for honeybees and other closely related pollinators of the introduction of bee viruses to European colonies of honeybees and ecosystems. It also aimed at knowledge transfer between experts with a broad base of skills in insect virology, diagnosis, immunology, epidemiology, international trade and risk management, along with scientists involved in fundamental and applied research on bees and related pollinator species. Two meetings were held in 2005 in France (Sophia-Antipolis and Tortour), producing as a result the book “Virology and the Honey Bee”.

- BEE-SHOP (IP FP6): The main goal of BEE SHOP was to reduce potential sources of honey contamination due to both foraging contaminated nectar and chemotherapy of honeybee diseases. As such, it addressed specific issues related to honey contamination by pesticides and treatments used to combat pests and pathogens in the hive. The project produced a manual for beekeepers on the best husbandry practices to preserve the hygiene of the hive and a number of outcomes on the potential to increase bee resistance to viruses and parasites. It was conducted between 2006 and 2009 with a budget of €1.8 million.

- Bee DOC (Bees in Europe and the Decline of honey bee colonies,) (CP FP7): The BEE DOC research project comprises a network of eleven partners from honeybee pathology, chemistry, genetics and apicultural extension aiming to improve colony health of honeybees. The aim of BEE DOC is to empirically and experimentally fill knowledge gaps in honeybee pests and diseases, including the 'colony collapse disorder' and quantify the impact of interactions between parasites, pathogens and pesticides on honeybee mortality. In particular interactions affecting individual bees and colonies are studied through several models: two model parasites (Nosema and Varroa mites), three model viruses (Deformed Wing Virus, Black Queen Cell Virus, Israel Acute Paralysis Virus) and two model pesticides (thiacloprid, t-fluvalinate). The project started in 2010 and is scheduled to end in 2013. Its budget is €1,8 million.

- CLEANHIVE (FP7 (SME)): The objective of the project was to develop an efficient and cost-effective tool for the detection and identification of both Nosema species under field conditions to stop the spread of Nosema ceranae. It was based on studies linking Nosema ceranae to deaths of large amounts of bees, and on the spread of the pathogen (initially restricted to Asiatic bees). The project, developed from 2008 to 2012, was endowed with a €2,4 million budget.

- DISCONTOOLS (Disease control tools for varroa) (FP7): The DISCONTOOLS project is a joint initiative of industry and a wide range of stakeholders including the research community, regulators, users and others. It aims, inter alia, at improving the tools for the detection, diagnosis and treatment of varroasis. It should also provide a mechanism for focusing and prioritising research that ultimately delivers new and

http://www2.biologie.uni-halle.de/zool/mol_ecol/bee-shop/index.html
http://www.bee-doc.eu/
improved vaccines, pharmaceuticals and diagnostic tests. The project started the 1st of March 2008 with an expected life of five years.

SWARMONITOR (*FP7 (SME)*): started in 2012 and scheduled to end in October 2015, the project aims to develop a monitoring tool capable of detecting changes in honey bee activity within the beehive for the effective management of bees. The tool would allow beekeepers to remotely diagnose colony status without the invasive opening of hives for physical inspection. Several benefits for both small and hobby beekeepers, on one hand, and commercial beekeepers, on the other hand, could stem from the project. €1,4 million out of the expected total cost of €1,8 million are funded by the EU.

The International Research Network COLOSS (*COST action*): The COLOSS network (Prevention of Honey Bee Colony LOSSes), created in 2008, consists of 150 partners in 41 countries. It has been formed by honey bee experts from Europe and the USA and is now one of the main initiatives implemented to prevent large scale losses of honeybee colonies. In June 2008 COLOSS obtained four years support from the EU and was designed as COST Action FA0803 – COLOSS. A common questionnaire was designed and data is collected on this basis in several regions: Europe, USA, China. This work is organised around four working groups focusing on: i) monitoring and diagnosis; ii) pests and pathogens; iii) environment and beekeeping; and iv) diversity and vitality. At present this network is not financed by the EU anymore. The experts however continue to meet each other and are trying to find new financing sources to continue their research and their work on data standardisation.

STEP* (Status and Trends of European Pollinators) (*FP7*): based on the work of the ALRM project, STEP is an on-going project that is assessing the impacts that pollinator declines are having on agriculture, biodiversity and the wider society. The project is developing mitigation strategies to ensure pollinators are protected and managed for sustainable pollination services. STEP should provide evidence to help adapt existing policies and management practices and also develop novel policies where needed. The project started in 2010 and will end in 2015. It has a budget of €3.5 million.

2. **Focus on Varroa**

The parasitic Varroa mite remains the main cause of colony health problems, and it is generally accepted that more could be done to control the impact of the mite on European bee hives. There are already several tools at the disposal of beekeepers, such as synthetic and natural chemical treatments, including modern application technologies where developments are on-going. The physical removal of heavily infested (often drone) cells is a common intervention.

In its study on Pollinators and Agriculture, ECPA considers continued research and development of chemical treatments as a realistic option for future improvements in Varroa management. It also insists on the necessary precise monitoring of the Varroa infestation rate by the beekeepers.

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*Opera Research Center, Bee Health in Europe – Facts and Figures, 2011

*http://www.step-project.net/

ECPA/EL0/RiCon/E-Sycon, Pollinators and Agriculture, 2011
However, even with proper management it is impossible to keep apiaries 100% free from Varroa mites. Nevertheless, some strategies have been proven to be successful, the most efficient being collective action within an entire area with coinciding treatments, but require extensive knowledge in order to manage the possibilities and limitations of the different treatments. This statement confirms the importance of having a precise monitoring basis in order to organise effective collective action.

Another solution being studied and often considered as ideal is the honeybee selection towards Varroa resistance. This has been recognised as a relevant selection criterion in most European bee breeding programs.

The rich variety of native honeybee subspecies and ecotypes in Europe offers a good genetic resource for selection towards Varroa resistance. There are some examples of mite resistance that have developed as a consequence of natural selection in wild and managed European populations. However, most colonies are influenced by selective breeding and are intensively managed, including the regular use of miticides.

In Belgium, a group of beekeepers is trying to stabilize the Varroa Sensitive Hygiene related genes in the local bee genome. An American laboratory has indeed bred bees that hygienically remove mite-infested pupae from capped worker brood. This ability is called varroa sensitive hygiene, and bees expressing high levels of this behaviour are called VSH bees. According several beekeepers, this kind of selection can be very promising.

In most European countries, selection and breeding activities are mainly realised by numerous small-scale beekeepers with or without the support governmental institutions. In most countries, specialised bee-breeding associations have been formed, and selection guidelines have been compiled by beekeeper associations and governmental authorities to coordinate activities.

Most breeding programs use pure subspecies and are oriented towards preserving and improving local populations. Recently, significant progress has been achieved by establishing a genetic evaluation of performance test data, based on a BLUP animal model adapted to the peculiarities of honey bee genetics and reproduction.

The European Commission has recently launched a call for projects aiming to understand natural resistance mechanisms to infectious and parasitic diseases (varroa as a parasite and a virus vector) in honey bees (new call KBBE.2013.1.3-02: Sustainable apiculture and conservation of honey bee genetic diversity). Moreover, this kind of research is also one of the fields that was dealt with in the past in the framework of the COLOSS network.

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52 Büchler et al., Breeding for resistance to Varroa destructor in Europe, 2010 (COLOSS network)
53 USDA-ARS Baton Rouge Bee Lab
54 Büchler et al., Breeding for resistance to Varroa destructor in Europe, 2010 (COLOSS network)
3. Research on qualitative properties of honey

In the framework of the evaluation, it is also important to deal with applied research implemented with the aim to better identify and highlight specific honey properties. It has been observed that honey of particular botanical origin or containing higher poly-phenols rates can be sold at higher prices. In Belgium, within the framework of the measure on applied research, two projects have been emphasised:

1) Infra-red analysis to specify botanical origin
2) Poly-phenols content to differentiation of products

By facilitating physico-chemical analysis of honey, apiculture measure 4 has also contributed to the creation of labels in Germany, Luxembourg, Poland, Czech Republic and Slovenia.

Diversification perspectives

By diversification, we mean here, production and marketing of other apiculture products. In Spain, the official registry, on which registration is mandatory to benefit from any aid or publicly funded programme, distinguishes four main types of beekeeping holdings depending on their predominant activities: production of apiculture products; selection and breeding of queen bees; pollination; mixed (when the holding is alternate with similar importance more than one of the previously mentioned activities). There is also a category of “other”, for those whose main activity does not fit into the previous categories, and a residual category of beekeeping holdings “without classification”. Detailed statistics on beekeepers’ specialisation, however, do not exist in other EU countries.

1. Trade of live bees

In terms of intra-community trade, the general conditions that apply to ‘other’ live animals also apply to bees. Hence consignment of bees must conform to the general animal health conditions laid down in Council Directive 92/65/EC before they can be traded in the EU. The Directive also lays down a model health certificate for bees which must be completed by the competent authority to signify that the health conditions as laid down in the Directive are met. This certificate must accompany consignments of bees when they enter intra-community trade within the EU.

Among others rules includes the verification about the origin of the bees. It should

- come from an area not subject to an American foulbrood prohibition order;
- come from an area of at least 100km radius which is not subject to restrictions associated with the suspicion or confirmed occurrence of the small hive beetle or the Tropilaelaps mite;
- as well as their packaging, have undergone a visual examination to detect the occurrence of the small hive beetle or other infestations affecting bees.

More recently, the European Commission has set up a new animal health strategy for the European Union. It provides a harmonised framework to update the animal disease control. It aims to replace existing series of linked and interrelated policy actions by a single policy framework. One of the objectives is to involve stakeholders, encourage risk-reducing behaviour from all parties and better identify responsibilities to implement sound compensation schemes. The implementation of this strategy could theoretically lead to changes in regulations related to trade and import of live bees.
Comext database for 2012 shows that very few countries are active in intra-EU trade of live bees: France, UK, Hungary, The Netherlands, Portugal and Slovenia are importing bees while Sweden does import and export live bees. FAOSTAT data about intra-EU trade of live bees shows an increase of about 9% in the number of traded consignments from 2012 compared to 2006. This is however not totally due to an increase in trade but also to better compliance in registration.

About extra-EU trade, it is also important to note that import of bee colonies or swarms in the EU is prohibited and bee import is limited to cages containing one queen with 20 accompanying bees. Regulation 206/2010, article 7, sets the general conditions for the introduction into the Union of certain species of bees. Only Apis mellifera and Bombus spp. can be imported from countries listed in Annex II part I of the above mentioned regulation.

These rules designed for animal health reasons do not impede movements of subspecies which can be considered as damaging in general because the hybrid generations of bees do often loose desired characteristics. This is why Member States do implement specific rules for the conservation of local subspecies:

- Italy has laws to protect the local subspecies (Apis mellifera ligustica).
- Slovenia has a specific line in the act officialising its adherence to EU to preserve their native bee subspecies Apis mellifera carnica. This bee itself is of high value and the program, via measure 1 (technical assistance), is contributed to its preservation.

According to the results of interviews, trade of live bees offers opportunities to secure profitability of apiculture businesses: the production of swarms is directly linked to the necessity of restocking and queen breeding activities are targeted towards more resistant and adapted bees. Rules on trading have been settled to preserve animal health. If well organised, trade of live bees at regional level can also contribute to spread selected bees resistant to Varroa and other pathogens.

It should be always borne in mind when trading live bees that it should always take hybridisation risks with the local subspecies living in the introduction area. Each type of bee is good for a certain environment, but not for others. The problem has been often highlighted in case studies and interviews. In Greece for instance, the importation of queens from other races jeopardises the conservation of the characteristics of the local populations.

In Spain, beekeepers usually breed their own bees; beekeepers dedicated to breeding are therefore very scarce. As evidence, according to the latest data published by the Ministry of Agriculture, of the 24,230 apiculture holding registered in Spain in April 2012, only 37 were dedicated to the selection and breeding of bees. This figure has been stable in the last three years after a big drop in 2010 (the number of breeding holdings fell from a total of 83 in 2009 (52 were located in the Basque Country), to 41 in 2010, 43 in 2011 and 37 in 2012).

In Hungary, the centralisation of bee breeding and trading can be seen as a way to keep control of the dissemination of specimens. The Hungarian Bee Breeders National Association (MMOE, Hungarian abbreviation) is the only organisation responsible for breeding and trading of live bees of Krajna type live bees (Apis mellifera carnica). The supervisors of this association are: Ministry of Rural Development, National Agricultural Qualifying Institute (OMMI), and Institute for Small Animals Research and Coordination Centre for Gene Conservation (KÁTKI). The basis of the control is the Law of Hungarian act of animal breeding. Those breeders who are not satisfying this law or a special legislation: honey bee „production evaluation codex” or breed a in an inappropriate variety can be sanctioned under
this legislation\textsuperscript{55}. FAOSTAT data shows that Hungary is exporting very few live bees. Breeding efforts are therefore mostly directed to local improvement of subspecies.

2. Other hive products

All apiculture products are important for the stability of revenues and not only honey (20 years ago, it was only honey in EU). However, other products are difficult to study because some of them (propolis, royal jelly) have no definition and are therefore not registered. It would be impossible to find any (custom) statistics about these products.

This section is providing information about each apiculture product and its possible use.

\textit{Wax} is produced by glands of worker bees and is used in cosmetics, pharmaceuticals and candles. It is also of course used by the beekeepers to renew their frames.

\textit{Propolis} is a resin coming from trees. It contains components that suppresses bacteria and other microorganisms and is recognised for its anti-bacterial, anti-virus and anti-fungal properties. It is use through dermal and internal application in naturopathic treatments.

\textit{Pollen} is the flowers’ anthers. It is a highly nutrient product containing proteins, amino acids and B vitamins. It is sold as a food additive.

\textit{Royal jelly} is produced by glands in the throats of worker bees. It is also a highly nutrient product containing among others carbohydrates, proteins, B vitamins, sugar and water. It has various applications in naturopathy for its strengthening effects and anti-depressive properties.

\textit{Venom} is coming from abdominal glands of female bees. It contains a large variety of proteins (melittin, apamin and others) which act as neurotoxins. Its positive effects have been recognised and proven in ‘apitherapy’ procedures for the treatment of complaints such as multiple sclerosis, rheumatism and sciatica. These procedures are frequently used in the USA and Asia but not broadly recognised in Europe yet.

In order to provide a broad idea of prices for other apiculture products, some observations from short commercialising chains are presented here. Prices for brown raw propolis vary from €10 to €15/10g, for royal jelly from €8 to €25/10g, for pollen from €15 to €80/kg.

It is important to note that, as for honey, other hive products have a wide range of qualities depending on origin, storage forms, etc. Moreover, the production of some products is not compatible with honey production. Producing royal jelly and swarms cannot be done with the hives dedicated to honey production. Beekeepers therefore require market information in order to make the right diversification decisions. As for propolis, the levels of production depends on the availability of resins, the form of hives and bee subspecies and valuable properties depends on the tree species on which bees are collecting resins.

In order to compensate the lack of statistical data, local experts provided the evaluators with observations on this topic.

In Hungary, other apicultural products are not very important both in production and consumption. They make up only a few per cent of the bee production.

In Germany, very few beekeepers are harvesting propolis for commercial reasons and pollen supply is just sufficient to meet the needs of colonies and is therefore not harvested. As for royal jelly, only a very limited number of beekeepers have specialised themselves as

\textsuperscript{55} More information can be found on www.katki.hu
producers. The current estimate is less than twenty of such producers in Germany. Approximately 5% of beekeepers have specialised in the sale of colonies or swarms. Finally, selling queens is important as beekeepers like to change their queens from time to time. So there is a very good market for queens. Many beekeepers – estimated more than 5% - have specialised in the breeding of queens which they then sell.

In Greece, pollen and royal jelly production is increasing year after year, following consumers’ demand. Poor quality Chinese royal jelly is however also intensively imported in Greece (at lower prices) as there are no general specifications for the characteristics of the royal jelly.

In Spain, wax and pollen constitute the main apiculture products other than honey. Although production changes have been mixed across regions (waning in some but raising in others), the total production of both wax and pollen grew significantly from till 2009 (by 23% and 12.4% respectively).

Andalusia, Castile-La Mancha, Castile-Leon and Extremadura comprise around 77% of the wax production. On the other hand, Aragon (significant rise in pollen production since 2007), Castile-Leon (particularly the province of Salamanca) and Extremadura account for almost 85% of the Spanish pollen production.

The main EU honey production systems

This section aims to provide the most accurate picture possible of the main EU honey production systems. It is based on literature review, EUROSTAT data, case-studies and experts’ interviews. Each region has specificities influencing the practice of apiculture. The first part of this section describes territorial characteristics. The second part of this section provides data to characterise the farms practicing apiculture.

Territorial characteristics

To answer the evaluation questions, it is necessary to study the production systems. Beekeeping practices and production systems mostly depend on:

- bees: subspecies, number, distribution, development of the bees population, number and capacity of the hives;
- climate;
- particular flora: species and blooming period.

1. Only Apis mellifera is managed in EU

In Europe, there are at least 700 bee species but only one Apis mellifera is managed for honey production.

In Greece, natural selection and selective breeding has resulted in a number of strains specific to certain regions that may have different susceptibility to pests and diseases. For instance, the honey bee species that exist in Greece are: Apis mellifera (A.m.) adami in Crete Island, A.m. macedonica in the North part of Greece, A.m.cecropia in Central and South Greece, A.m.carnica in Ionian Islands. As mentioned earlier, commercial breeding, migratory beekeeping and uncontrolled importation of bees have affected the distribution and the existence of these species.
Also, there is high hybridisation, and A.m.ligustica is imported from Italy, A.m.carnica from Germany, and other species are imported from the neighbouring countries as well as commercial strains (Super Bee from Cyprus, Buckfast bees).

The example also shows that the natural distribution of honeybee subspecies in Europe has been significantly affected by human activities during the last century. Non-native subspecies of honeybees have been introduced and propagated, and it has been reported that native black honeybee (Apis mellifera mellifera) populations lost their identity by gene-flow or went extinct56.

2. Floral characteristics

Some Member States are recognised for producing specific monofloral honeys. These can be obtained thanks to the presence and abundance of certain floral species at some specific periods of the year. For example, top quality well-known honey types are Acacia honey from Hungary, Lavender from France, Heather from Germany and Chestnut from Italy.

In Greece, the greatest proportion of the forest honey production is the pine-tree honey, the fir-honey and the oak-honey. The most famous monofloral categories are thyme-honey, the orange-honey, erica-honey, oak-honey, and the rich in antibacterial attributes cotton-honey, the chestnut-honey. Other floral honeys derived from aromatic plants of Greek countryside as the wild-oregano, the wild-levanter, salvia etc.

Other examples on the importance of floral characteristics are provided by the Hungarian case study, among other:

Several Brassica species are important crop plants in Hungary, similarly to other temperate regions of the world. Oilseed rape provides the first mass blooming in the early spring period (Eöri 1983) and is considered to be an excellent early nectar plant that fills the gap between fruit tree and black locust bloom.

The apicultural significance of fruit trees is huge, because they bloom in spring-time when abundant availability of pollen and nectar sources are essential for adequate development of honeybee colonies (Örösi 1962). Fruit tree honey is very favourable for bee colonies, together with pollen, and honeybees usually consume it themselves. With the spread of large-scale orchards, however, there is a greater chance for extracting fruit tree honey.

Black locust usually blooms at the middle or end of May in Hungary. More than half of Hungarian honey production is Acacia honey which is recognised worldwide for its quality considered as among the highest in the world.

All over Germany oilseed rape and lime-tree honey is produced. Also more locally produced: chestnut, acacia and the famous heather honey. In the Southern part, the honey produced is mostly of the honeydew type. Other honey types produced in some regions include sunflower, dandelion and clover honeys.

These examples show that quality of monofloral honeys vary according to location and seasonal variations. Research is undertaken to better characterise specific properties and better manage the production of specific honeys. These findings help the beekeepers in formulating precise product descriptions for communication and promotion of the honeys towards the public.

56 Jensen AB et al., Varying degrees of Apis mellifera ligustica introgression in protected populations of the black honeybee, Apis mellifera mellifera, in northwest Europe. 2005
consumers. In particular, some monofloral honeys are known for their highest contents in phenolic which is a recognised qualitative criteria allowing for price determination.

**Typology of farms practising beekeeping**

As secondary data are lacking, production systems have in this evaluation been mainly studied through the case studies. In this section it is also worthwhile to deal with the production of “other apiculture products”, identifying countries relying more on these.

1. **About data availability and representativeness**

Data on apiculture sector are often not representative for the lack of standardisation as already mentioned in the section on monitoring but also because several countries do not have beekeeper registration system and even where registration is compulsory not all beekeeper do comply. For this particular section, the only data available are coming from EUROSTAT and have several pitfalls:

- Data are only available on the holdings which develop, besides beekeeping, other agricultural activities = 215 000 holdings = 31% of the European beekeeper population
- This cannot be considered as a representative sample because the population of the sample has too specific characteristics
- Data are not available for UK, Finland, Denmark, Germany, Ireland, Malta, The Netherlands, Austria, Sweden, Norway

Cases study data collection and analysis will therefore be of first importance to complete the overview in this section.

2. **Number of professional and non-professional beekeepers**

Hungary is a good example to illustrate the issue on the distinction between professional and non-professional beekeepers (section on EU Production).

The diversity of the sector is very high, which is proven by the fact that the ratio of beekeepers having more than 150 bee colonies is only 5-7%. This ratio is stagnating. Beekeepers with more than 150 hives comprise about 1/3 of the total bee colony in Hungary. The ratio of professional beekeepers is shown in figure 13 below.
Figure 13 Ratio of professional beekeepers (%) and the ratio of bee colonies run by professional beekeepers in the period 1999–2009 in Hungary

Source: Hungarian case study – input from national expert

In beekeeping the professionalization rate is generally low all over Europe. In Germany e.g. there are more than 80,000 non-professional beekeepers and less than 200 professional beekeepers. In Belgium, only 1% of beekeepers are considered as professionals.

The Hungarian case study also points out that the highest concentration of bee colonies is found in the least developed regions in the country, showing that honey production contributes to the welfare of rural families in relatively undeveloped regions. This illustrates the fact that being a non-professional beekeeper does not necessarily mean that honey do not represent a significant source of income.

In Spain, the first country to set the threshold of 150 hives to define professional beekeepers, the number of apicultural holdings per Autonomous Community in Spain was distributed as followed (table 2):

Table 2 – Number of beekeeping holdings per region (April 2012)

<table>
<thead>
<tr>
<th>Autonomous Community</th>
<th>Non professional</th>
<th>Professional</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andalusia</td>
<td>1 476</td>
<td>1 400</td>
<td>654</td>
<td>3 530</td>
</tr>
<tr>
<td>Aragon</td>
<td>1 142</td>
<td>169</td>
<td>20</td>
<td>1 331</td>
</tr>
<tr>
<td>Asturias</td>
<td>751</td>
<td>31</td>
<td>618</td>
<td>1 400</td>
</tr>
<tr>
<td>The Balearic Islands</td>
<td>476</td>
<td>12</td>
<td>0</td>
<td>488</td>
</tr>
<tr>
<td>Canary Islands</td>
<td>1 193</td>
<td>18</td>
<td>4</td>
<td>1 215</td>
</tr>
<tr>
<td>Cantabria</td>
<td>229</td>
<td>13</td>
<td>3</td>
<td>245</td>
</tr>
<tr>
<td>Castile-La Mancha</td>
<td>1 088</td>
<td>361</td>
<td>267</td>
<td>1 716</td>
</tr>
<tr>
<td>Castile-Leon</td>
<td>3 239</td>
<td>500</td>
<td>0</td>
<td>3 739</td>
</tr>
<tr>
<td>Catalonia</td>
<td>1 183</td>
<td>218</td>
<td>11</td>
<td>1 412</td>
</tr>
<tr>
<td>Extremadura</td>
<td>206</td>
<td>800</td>
<td>5</td>
<td>1 011</td>
</tr>
<tr>
<td>Galicia</td>
<td>3 433</td>
<td>82</td>
<td>10</td>
<td>3 525</td>
</tr>
<tr>
<td>Madrid</td>
<td>141</td>
<td>27</td>
<td>21</td>
<td>189</td>
</tr>
<tr>
<td>Murcia</td>
<td>311</td>
<td>158</td>
<td>1</td>
<td>470</td>
</tr>
<tr>
<td>Navarre</td>
<td>392</td>
<td>13</td>
<td>28</td>
<td>433</td>
</tr>
<tr>
<td>Basque Country</td>
<td>1 417</td>
<td>86</td>
<td>0</td>
<td>1 503</td>
</tr>
<tr>
<td>La Rioja</td>
<td>221</td>
<td>33</td>
<td>0</td>
<td>254</td>
</tr>
<tr>
<td>Valencia</td>
<td>959</td>
<td>810</td>
<td>0</td>
<td>1 769</td>
</tr>
<tr>
<td>Spain</td>
<td>17 857</td>
<td>4 731</td>
<td>1 642</td>
<td>24 230</td>
</tr>
</tbody>
</table>
3. A high proportion of the beekeepers’ population > 65 years old\textsuperscript{58}

More than half of the beekeepers are older than 55 years, less than 6\% is younger than 35 years (figure 14). The number for the over 55 year olds is slightly higher than the general average of farm holders in the EUROSTAT sample.

*Figure 14 Number of holdings practicing beekeeping by age categories*

![Number of holdings practicing beekeeping by age categories](image)

Between 2003 and 2007, the share of beekeepers older than 65 years increased stronger than the total farm holders’ sample in Belgium (+3\%), Czech Republic (1\%), Estonia (10\%), Spain (6\%), and Slovakia (6\%).

Between 2003 and 2007, the share of beekeepers older than 65 years decreased stronger than the total farm holders’ sample in Greece (-5\%), France (-3\%), Italy (-1.5\%), Hungary (-4\%), Romania (-1\%).

In these countries, the share of young beekeepers is rising in accordance with the total farm holders’ sample.

In 2007, the share of beekeepers older than 65 years is higher than the European average (34.5\%) in Bulgaria (51.2\%), Estonia (37.6\%), Croatia (40.2\%), Lithuania (48.4\%), Portugal (42.6\%), Romania (41.7\%), Slovenia (38.5\%), and Slovakia (40.9\%).

The average age of beekeepers is an issue. The entrance into the market of younger beekeepers should be fostered so as to ensure honey production levels in the future.

\textsuperscript{58} No data available for UK, Finland, Denmark, Germany, Ireland, Malta, The Netherlands, Austria, Sweden, Norway
4. Very few beekeepers manage big agricultural areas

According to EUROSTAT data presented in table 5 below, 80% of farmers practising beekeeping manage an agricultural area smaller than 10 ha⁵⁹.

Table 5: Number of agricultural holdings practising apiculture per land area

<table>
<thead>
<tr>
<th>Agricultural areas</th>
<th>Number of holdings practising beekeeping</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ha</td>
<td>10740</td>
<td>6%</td>
</tr>
<tr>
<td>&gt;0-&lt;2 ha</td>
<td>78130</td>
<td>40%</td>
</tr>
<tr>
<td>2 - &lt;5 ha</td>
<td>42470</td>
<td>22%</td>
</tr>
<tr>
<td>5 - &lt; 10 ha</td>
<td>27330</td>
<td>14%</td>
</tr>
<tr>
<td>10 - &lt;20 ha</td>
<td>18460</td>
<td>10%</td>
</tr>
<tr>
<td>20 - &lt; 30 ha</td>
<td>6280</td>
<td>3%</td>
</tr>
<tr>
<td>30 - &lt; 50 ha</td>
<td>5390</td>
<td>3%</td>
</tr>
<tr>
<td>50 - &lt; 100 ha</td>
<td>2910</td>
<td>2%</td>
</tr>
<tr>
<td>&gt;= 100 ha</td>
<td>2050</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>193760</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: EUROSTAT, 2010

EUROSTAT data allow us to pinpoint, in some countries, specific trends in the number of holdings practicing beekeeping and managing more than 100 hectares (table 6):

⁵⁹ No data available for UK, Finland, Denmark, Germany, Ireland, Malta, The Netherlands, Austria, Sweden, Norway
Table 6: Trends in the number of holdings managing more than 100ha, practising apiculture

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of holdings 2000 or 2003</th>
<th>Number of holdings 2007</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>0</td>
<td>10</td>
<td>+10</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>80</td>
<td>110</td>
<td>+30</td>
</tr>
<tr>
<td>Italy</td>
<td>90</td>
<td>110</td>
<td>+20</td>
</tr>
<tr>
<td>Latvia</td>
<td>90</td>
<td>150</td>
<td>+60</td>
</tr>
<tr>
<td>Lithuania</td>
<td>190</td>
<td>240</td>
<td>+50</td>
</tr>
<tr>
<td>France</td>
<td>520</td>
<td>490</td>
<td>-30</td>
</tr>
<tr>
<td>Portugal</td>
<td>190</td>
<td>110</td>
<td>-80</td>
</tr>
</tbody>
</table>

Source: EUROSTAT, 2010

In several countries (e.g. Germany, Belgium, France, UK) the number of apiaries located in cities has increased in larger proportions than the number of apiaries located in the countryside. Very few data do however exist to describe this new trend in a better way.

5. Modernisation of apiculture

The distinction between traditional and modern apiculture is often made and a few words on the meaning of modern apiculture are necessary here to understand the limits of modernisation of apiculture.

Modern beekeeping makes use of tools and techniques that simulate or force natural colony functions, for example:

- It is common practice to use apparatus to artificially inseminate queen bees.
- The natural reproductive cycle of a colony - the ‘swarm’ - is suppressed to prevent periods of reduced colony size and consequent reduction in hive productivity.
- Colony diseases and parasites are controlled with chemical applications.
- Targeted breeding is used to generate honey bee varieties with traits beneficial to the beekeeper, such as high disease and parasite resistance, good honey production, prolific breeding, and low aggressiveness\(^{60}\).

Nevertheless, unlike other companion animals, automation of the beekeeper’s work with the colonies, for the most part, is not possible. Automation is limited to honey extraction, filling, and labelling. Some technological advancement has been developed for moving colonies, but usually these are affordable only for professional migratory beekeeping. Modernisation of hive systems, technical support and market demands (despite the lack of sufficient forage during the year in some regions) have led to an increase in migratory beekeeping\(^{61}\).

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\(^{60}\) ECPA/ELO/RefCon/E-Sycon, Pollinators and Agriculture, 2011
\(^{61}\) Opera Research Centre, Bee Health in Europe – Facts and Figures, 2011
The marketing structures of EU honey production

This section is focusing on the description of the main marketing systems. It provides data on direct sales practiced in the case studies countries and presents the stakeholders involved in the downstream sector. Data has been mostly acquired through case studies.

Direct sales

The first part of this section is closely linked to the beekeepers typology as small-scale beekeepers only practice direct sales to consumers.

In Greece and Germany, 70% of the honey production is sold by the beekeepers themselves directly to consumers while 30% is sold via the local retailers.

The Greek case study mentions the fact that it may not be profitable for the small and medium beekeepers to sell their production to big companies or cooperatives.

The situation in Hungary is very different. According to the OMME and Bartos (2008), direct sales represent only 13% of the consumption while sales through intermediaries represents 87% of the consumption. The low rate of direct sales is certainly due to the high proportion of exports (2/3 of honey production is exported). The export sales are treated mostly by the intermediaries.

The marketing of honey in Spain is predominantly by the sale of honey to the industry or wholesalers (49%), followed by the marketing through cooperatives (29.5%). Direct sales to consumers (10.8%) and jarred sales to retailers (10.6%) split almost evenly the rest of the market. Table 9 below provides data about average prices for each commercialisation channel.

Table 9 – Honey prices in Spain (€/kg)

<table>
<thead>
<tr>
<th>Commercial mode</th>
<th>Multi-flower honey</th>
<th></th>
<th>Other honeys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct sales to consumers</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Sales through cooperatives</td>
<td>2.20</td>
<td>2.35</td>
<td>2.60</td>
<td>2.60</td>
</tr>
<tr>
<td>Jarred sales to retailers</td>
<td>3.64</td>
<td>3.57</td>
<td>3.89</td>
<td>4.10</td>
</tr>
<tr>
<td>Sales to industry or wholesalers</td>
<td>1.98</td>
<td>2.16</td>
<td>2.27</td>
<td>2.53</td>
</tr>
</tbody>
</table>

Direct sales lead to better prices but on the other hand, it implies for beekeepers to process honey and to carry out analysis at their own costs. This is why it has been judged important here to complete this part of the study with a short description of the processing operations as well as with information of beekeepers’ organisations.

1. Rather simple processing operations

After honey being collected by bees and harvested by the beekeepers, it has to pass through several processing steps which are summarised in this section.
First of all, honey needs to be purified by straining or decantation.

**Straining**: the honey is heated to 30°-35°C and then filtered through a strainer (mesh size 0.8 to 1 mm) or a tubular sieve (0.4 to 0.5 mm) and put in the honey ripener. Wax particles and foreign matter (e.g. bee fragments, small pieces of propolis, wood splinters etc.) are removed.

**Decantation**: the honey is put into the honey ripeners, maintained at 25°C, so that the air bubbles and the waxy and other impurities (except the pollen grains) come up to the surface.

The liquid honey is then kept for about 2 weeks at 15°C for ripening. The honey can then be drawn off, generally by pumping, and distributed into containers.

Honey stored in sealed containers can remain stable for a very long time. For practical purposes, a shelf life of two years is often stated. Processed honey should be stored between 18° and 24°C.

Honey can be exposed to higher temperature for brief periods. However, heat damage is cumulative, so exposure to heat should be limited. When honey is overheated, hexoses like fructose or glucose lose three molecules of water to form 5-hydroxy-2-furaldehyde also named hydroxy-methyl-furfural (HMF) (cf. section 1.2.1 for legislation on HMF content).

Some optional operations are also often practiced.

Most honeys are supersaturated with respect to glucose, which may cause glucose to crystallise spontaneously at room temperature in the form of glucose monohydrate. The rate at which crystallisation occurs depends on the composition of the honey and therefore, mostly from its floral origin. Controlled crystallisation is a common operation consisting of mixing a totally liquid honey (90%) with a fine crystallised honey (10%) at 25°-27°C. After 4-5 days, this process yields very fine crystals and a smooth product with a texture resembling peanut butter.

Honey is not often pasteurised because the exposure to heat is damaging its quality as previously explained. It is however sometimes heat-treated to prevent unwanted fermentation: 2 minutes at 77°C followed by a rapid cooling to 54°C.

Fine-filtration is not often practiced neither because the result of this operation is the removal of almost all of the extraneous solids and pollen grains. The disadvantage of this process is that it becomes impossible to determine the floral origin, and consequently the geographical origin, of such filtered honey without the pollen grains. Another risk is that the HMF level of the filtered honey may exceed the upper limit of 40 mg/kg fixed by Council Directive 2001/110/EC.

Processing of honey can be more or less concentrated or spread and very different levels of concentration can be found among EU member states. In the main producing countries, processing is usually concentrated in a few plants in order to take profit of scale economy and to facilitate the completion with quality control obligations. For instance, in Hungary there are 11 large scale honeys processing factories where the capacity is over 1000 ton per year. In addition there are more than 400 small scale honey processing plants in order to process local

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62 EC, Opinion of the scientific committee on veterinary measures relating to public health on honey and microbiological hazards, 2002
63 EC, Opinion of the scientific committee on veterinary measures relating to public health on honey and microbiological hazards, 2002
honey production. Previously the number of processors was higher but due to the strict quality control in the recent years their number decreased.

2. Beekeepers’ organisations

The description of beekeepers’ organisation is relevant in this section because, as shown in the examples provided here, organisations usually provide their members with support to commercialisation by better guaranteeing quantitative and qualitative supply than beekeepers on their own.

Germany and Hungary are clear examples of centralised organisations.

In Germany, there are two major beekeeping associations. The first organisation is the D.I.B, which consists of approximately 80 000 members (all beekeepers). Local beekeeper organisations do belong to the D.I.B. This national organisation is the head of all the federal associations.

The second national beekeepers association is the group of professional beekeepers (DBIB). This organisation has around 500 members, but not all of them are professional beekeepers. Furthermore, many of the members of DBIB are also members of the D.I.B.

The DIB has developed a quality label which is used by most beekeepers. Therefore, relatively high quality characteristics have to be fulfilled. Also those beekeepers not selling under the label of the German beekeeping association try to fulfil the quality criteria of the D.I.B.

In Hungary, the OMME is organised in every county based on voluntary and self-governance organisations. The Hungarian Professional Beekeepers Association was established recently with the main purpose of representing large scale beekeepers.

On the other hand, in Greece, there are 80 autonomous cooperatives or PASEGES members, 70 Beekeepers Associations, one Association of professional beekeepers, and the Hellenic Association of Honey Packaging/Exporters.

The situation in Spain can be characterised as in between the two extreme models described above. The largest beekeeping association in the country is the apiculture branch of C.O.A.G. (Coordinadora de Organizaciones de Agricultores y Ganaderos), the largest agriculture trade union in the country. COAG has a wide presence in the top-four producing Autonomous Communities (Andalusia Castile-Leon, Extremadura and Valencia). It has a particularly strong position in Andalucía -the largest producing region in the country- where it represents some 1800-2000 beekeepers who possess around 70% of the beehives of the region (approximately 350000 out of a total of 525000). Other relevant trade unions in the country include A.S.A.I.A. (Asociación de Jóvenes Agricultores) and U.P.A. (Unión de Pequeños Agricultores y Ganaderos).

Among the largest producing regions, cooperatives are relatively extended in Castile-Leon in Extremadura, but not so much in Andalusia and Valencia. Ayora, village in the province of Valencia, hosts the largest cooperative of Europe measured by its turnover. There are over 90 associations and cooperatives at regional and local level.

64 More information can be found on www.omme.hu
Main commercialisation chains

The honey downstream sector is very particular with a few processing and distribution structures: only 10 enterprises are managing honey conditioning in EU. It is crucial to understand how these are linked to the numerous local honey producers.

Packers are the first to intervene in the marketing chain after production. They sell the end product to wholesalers and retailers in consumer packaging. Three distinct types of packers can be found in the sector:

- packer-producers are beekeepers with facilities for processing and packing honey. They sell direct to consumers or to retailers. They are usually small businesses, and do not market imported honey;
- packer-cooperatives are groupings of beekeepers which purchase, process, pack and market honey, often under their own brand label. They sometimes purchase imported honey;
- packers purchase honey both from beekeepers and from importers. They have their own brand label, although they may pack honey for other brands. They sell both to retailers and to industry.

It is estimated that 85% of honey in the EU is sold as table honey directly to consumers or through intermediaries. About half of the honey produced in the EU is sold directly to consumers; the other half is sold to packers and conditioners.

Retailers are buying table honey from packers. Retailers often belong to big retail groups like Metro (Germany), Carrefour (France), Tesco (UK), Ahold (The Netherlands), REWE (Germany), Groupe Casino (France), Auchan (France), Delhaize Group (Belgium), Sainsbury (UK).

Due to their size, these retail groups have substantial buying power. They have used their buying power to create their own private labels, next to the brands of honey packers. The private label products are generally sold at very competitive prices and threaten the brands of honey packers. The latter generally respond by creating higher value honeys and positioning them as premium products. However, these honeys account for only a small share of supermarket sales.\textsuperscript{65}

In order to obtain acceptable table honey at acceptable prices, packers usually blend several honeys (eight on average). This type of honey is the most common honey found in retail outlets. This is why it is often labelled as “produce of EU and non EU countries”, which can be considered as rather value-free information, despite complying with the law on labelling.

Single-origin and monofloral honeys are offered in specialised retail shops which form the second retail channel for honey in EU.

Table honey is opposed to industrial honey or bakers’ honey (the remaining 15% of the consumption in the EU). Industrial honey is honey that does not meet fully all the criteria for table honey, for example, the hydroxymethylfurfural (HMF) content may be higher than 40 mg/kg. This may be because it has been heated too much, or it naturally has a high HMF, and is therefore regarded, according to the EU criteria, to be of lower quality than table honey. In this case, it still qualifies for use in the food industry, for the manufacture of bakery goods, confectionery, breakfast cereals, sauces, tobacco, and products such as honey-roasted nuts and...
pharmaceutical products. Industrial honey competes with substitute products such as sugar, invert sugar syrup and corn syrup.

The data provided in the overview of apiculture sector in Hungary/Germany reflects the overall European pattern: from the quantity of honey consumed internally (30%/80%), 90%/80% of the honey produced is consumed directly by citizens while the other 10%/20% are sold to the industry.

In Germany, a very low part (estimation < 5%) is sold to bottler / packers. There are many bottlers / packers in Germany: e.g. Fürstenreform (Bihophar, Langnese), Breitsamer, Göbber, Allos, Tuchel, Lang and Dreyer66.

Despite the emergence of low-cost substitutes, honey is still used in food products both for its characteristic taste and because there is added value in mentioning honey in the list of ingredients.

The EU honey market is characterized by a rising concentration of actors. The most important group acting in the commercialization chain is FEEDM, the European Federation of Honey Packers and Distributors (importers and wholesalers), which has been established in 1989. It is composed of fourteen national honey associations or individual companies of different European countries and one associated member from Switzerland67. The members of FEEDM represent about 80% of the total European honey imports, but also buy European honeys. Some members even buy 100% European honeys. FEEDM aims to co-ordinate the interests of the European honey business and to obtain relevant information with regard to honey.

There are important challenges for beekeepers to market their main product on the European market. First, not all beekeepers can take advantage of the same market opportunities in terms of prices. Second, their comparative advantage to imports lies in the superior quality of the honey they produce, but this is relevant only if the origin of the honey can be proven and the producer is recognised by the consumer, hence there exists local orientation of the markets. The quality aspect of honey is less important when the honey is used for processing purposes68.

**Description of the demand**

Demand is very different from one country to the other and is evolving quantitatively and qualitatively. This section will describe the broad trends and again focus on case study countries to meet the lack of secondary statistics.

The first part of the present section provides figures about the overall consumption of honey in EU member states, showing great variation within the EU. The second part is providing an overview on the new tendencies of the demand.

The description of specific qualitative properties and of the existing quality labelling honeys (AOP, IGP, organic) has been integrated to the section on the EU production.

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67 Darbo AG (Austria), Meli (Belgium), Hunajainen SAM Oy (Finland), Syndicat français des miels, Honig-Verband e.V. (Germany), SETSEM (Greece), Magyar Mézkereskedők és Csomagolók Egyesülete (Hungary), A.I.I.P.A. (Italy), De Traay B.V. (Netherlands), CORPO Sp. z o.o. S.K.A. (Poland), Apisland LDA (Portugal), Medex d.o.o. (Slovenia), Asemiel (Spain), Narimpex AG (Switzerland), British Honey Importers & Packers Association

68 Opera Research Centre, Bee Health in Europe – Facts and Figures, 2012
1. Great variation among EU countries

The EU accounts for approximately 20-25% of the world’s honey consumption. According to the data presented in table 15, Greece, Austria, Germany and Spain are the major EU consumption countries.

![Figure 15 EU honey consumption figures](image)

From a qualitative point of view, each country has got its main trends of consumers’ preferences.

For example, Hungarian consumers favour the Acacia honey which has light greenish and yellow colour and it maintains its liquid phases for the longest period of time. The majority of Hungarian consumers considers the crystallisation of the honey as a negative symptom that is why the Acacia honey (which never crystallises) is the very much preferred. The other preferred type honey is mixed flower honey, tilia honey. The sunflower honey is mostly used by the industry. The rape honey is mostly exported especially to Germany.
2. New tendencies in EU consumption

Although the honey market is generally a stable market, the market is still evolving. Market shares of monofloral and single-origin honeys are increasing and increased concerns about the effects of intensive farming on the countryside, as well as on the environment in general, have also intensified interest in organic honey.

Also, consumers are generally willing to pay more for quality honey. Each type of honey can only be sold at certain prices; consumers’ willingness to pay varies depending on the honey. Prices previously presented showed that monofloral honeys can be sold at double price compared to classic polyfloral honeys.

A fact mentioned several times by interviewees: in Spain, the difference in honey demand has been made in the sector by the massive advertising campaign the market leading brand (Miel de La Granja San Francisco) started in the 1980s. It is generally agreed that the ubiquitous advertising helped increased the consumption of honey significantly. However, the honey portrayed in the television advertisements was rather liquid, extremely liquid and not crystalized at all. If any, Spanish honey tends to be darker, more dense and prone to some degree of crystallisation. Ultimately, the honey consumed in Spain is on the majority light and liquid, but it is, for the most, imported.

The increasing health and safety concerns make specialised retail shops becoming more popular during recent years. The problem is that the production of organic honey in Europe is very limited because of the presence of the varroa and the lack of unpolluted areas.

As direct sales are already so widely spread for honey production, it would be worth studying the increased demand for products sold directly from producers to consumers and undertake actions to assure quality criteria.

Finally, the case studies are also mentioning new trends such as honeys mixed with fruits, nuts or essential oils. Such products are already widely consumed in Italy but the Hungarian consumers are quite conservative in their taste and are not especially attracted to these new products. In Germany, during the Christmas season, aromatised honey such as honey with cinnamon, nuts, and vanilla is popular. These new trends can be considered as ways to add value to honey production without undertake costly physico-chemical analysis to prove floral origin, phenolic content or any organoleptic property.

Apiculture measures

Different measures concerning honey have been introduced by the EU, notably measures to improve the efficiency of production and marketing of honey, but also to prevent varroasis and restock hives. The Council Regulation (EC) No 1221/1997 first defined the rules for the Commission to provide co-financing of 50% to the national apiculture programmes developed by Member States. These rules have been settled while varroa was the main threat to beekeeping, generating an additional cost which was meant to be compensated by the Member States programs. All diseases and pests control but varroa are managed by DG SANCO. Varroa is an exception because it is, according to present scientific knowledge, an ineradicable parasite, meaning that it is only possible to reduce its population to an acceptable level. Council Regulation 797/2004, which was later, included as articles 105 to 110 in Council Regulation (EC) No 1234/2007, added aid for hive restocking to the previously defined measures. A number of simplification measures were also introduced by the
Commission in 2007 to enable greater flexibility of the programmes to respond adequately to unforeseen difficulties upon elaboration of the programmes.

The measures that can be included in the national programmes developed by Member States are the following:

- Technical assistance to beekeepers and groupings of beekeepers (A)
- Control of varroasis (B)
- Rationalisation of transhumance (C)
- Measures to support laboratories carrying out analyses of the physico-chemical properties of honey (D)
- Measures to support the restocking of hives in the Community (E)
- Cooperation with specialised bodies for the implementation of applied research programmes in the field of beekeeping and apiculture products (F)

This section will first present overall figures on the execution of the measures at EU level and then focus on the cases study countries by summarising their National Programs.

**Overall expenditure figures**

As provided for in Article 2 of Regulation (EC) No 917/2004, Member States provide notification of their programmes to the Commission before 15 April once ever three years.

On the basis of Member States’ expenditure forecasts, Commission budget funds available are distributed with reference to each Member State’s share in the total number of beehives in the Community, as shown in Annex I to Regulation (EC) No 917/2004. The hives belonging to each Member State, calculated as a percentage of the total number of hives, determine the theoretical maximum percentage of the budget to which each Member State is entitled, before any allocation of amounts not requested.

It is important to note that all Member States, without exception, have provided notification of an apiculture programme; this is indicative of their interest in this area and the needs of the European apiculture sector.

Overall, Member States expressed a high satisfaction with the programme and made extensive use of the allocated budget (88% in 2009). The most commonly used measures during the period 2007-2009 remained varroasis prevention (although a sharp drop, of 10% points to reach 27% of the used budget, has been registered during the period), and technical assistance, which represented 26-27% of the budget used. With regards to the other measures, the ones designed to ensure rationalisation of transhumance accounted for 19% of total expenditure, while hive restocking measures represented 15%, with an increase of 5 points in the period. Restocking of hives is the most recent of the eligible measures for co-financing offered by the EU as it was introduced only in 2005. However, since its introduction, the portion of national budgets earmarked for these measures has substantially increased from the 6.2% share allocated to it in 2005, reflecting the growing concern for bee population decline. Finally, measures in favour of honey analysis and applied research represented 6-7% of
expenditure in 2009. Figure 16 presents an overview of the budget spent over the six measures in the period 2005-2013.

Figure 16 – Execution of beekeeping measures from FY2005 to FY2013 by measure (EC, Financial management of the EAGF)

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71 This corresponds with an amount of approximately € 60 million since the introduction of the measures.