



INTEGRATED BIOMASS LOGISTICS CENTRES FOR THE AGRO-INDUSTRY

## Executive report from the active multi-actor participation including show cases. Replication potential

Deliverable D7.3

**Project AGROinLOG** “Demonstration of innovative integrated biomass logistics centres for the Agro-industry sector in Europe”

**Grant agreement:** 727961

From November 2016 to April 2020

Prepared by: SPANISH CO-OPS


Date: 30/04/2020

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## Approvals

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## ABBREVIATIONS

**IBLC:** Integrated Biomass Logistic Centre

**CEFS:** European Association of Sugar Manufacturers.

## PARTNERS SHORT NAMES

**CIRCE:** Fundación CIRCE

**WFBR:** Stichting Wageningen Research

**ZLC:** Fundación Zaragoza Logistics Centre

**CERTH:** Ethniko Kentro Erevnas Kai Technologikis Anaptyxis

**RISE:** RISE Reaserch Institutes of Sweden AB

**CREA:** Consiglio per la Ricerca in Agricoltura e L'analisi dell' Economia Agraria

**APS:** Agroindustrial Pascual Sanz S.L

**NUTRIA:** Anonymi Biomichaniki Etairia Typopiisis Kai Emporias Agrotikon Proionton

**LANTMÄNNEN:** Lantmännen Ekonomisk Forening

**PROCESSUM:** RISE Processum AB


**Spanish Co-ops:** Cooperativas Agro-Alimentarias de España. Sociedad Cooperativa

**INASO-PASEGES:** Institouto Agrotikis Kai Synetairistikis Oikonomias INASO PASEGES

**AESA:** Agriconsulting Europe S.A

**UCAB:** Association Ukrainian Agribusinessclub

**UBFME:** University of Belgrade. Faculty of Mechanical Engineering

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## EXECUTIVE SUMMARY

The main objective of the WP7 was to foster the AGROinLOG innovation process through stakeholder interaction approaches to deliver solutions well adapted to the actual circumstances of the targeted sectors, supported by a multi-actor methodology.

In order to fulfil the specific objective of translating the findings of WP6, in relation to the 6 specific sectors and their regional focus in Europe, tasks were developed regarding the replicability of the IBLC concept.

The main objective of this tasks was to transfer the most important result of the project to other regions in selected sectors with a high potential for replicability of IBLC concept, therefore allowing to put in real context the results and conclusions achieved during the project.


For this purpose, a methodology was developed, consisting of 3 steps:

1. Preliminary identification of regions with high potential for IBLC development from the experience gathered in the AGROinLOG project.
2. Interview with agro-industries and high-level contacts in the selected region on regional potential, barriers and incentives for IBLC implementation allowed to extract valuable information regarding these topics.
3. Workshops with regional stakeholders where the findings from the task were shared and feedback sought

This stage started by identifying the sectors with regional potential. This selection was based on project findings from previous tasks and on the experience gathered by the project's country teams. This task required country teams to reflect on all the information collected during the project to decide what regions have, a priori, the best conditions for IBLC implementation related to a specific sector.

In particular, Deliverable 6.2 *Basic analysis of targeted agricultural sectors* raised doubts on the IBLC potential on vegetable oils and sugar sector. The vegetable oils sector was excluded because it had low potential and no interest was detected in any of the partners countries. For the sugar sector, despite low potential and interest in most countries assessed, in Sweden a large sugar company did show interest and a reasonable potential to implement the IBLC concept therefore, it was decided to still consider the sector and to give it a different approach. In this case, dealing with the sector through contact with the European organization, CEFS (European Association of Sugar Manufacturers). Moreover, Spanish Co-ops, in the frame of AGROINLOG project, collaborated with a Spanish cooperative of the sugar sector trying to provide it insights about the best ways to orientate its future investment, taking advantage of their current facilities.

As explained in the methodology above, the first step that was taken after the determination of countries and sectors involved, was the identification of regions with high potential for IBLC development.

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Finally, the planned distribution in relation to the countries, sectors and regions involved in this phase was as shown in the table below:


Distribution on countries, sectors and regions					
Country/sector Region	Wine	Feed & Fodder	Olive oil	Grain	Sugar
Sweden				Skåne County	X
Greece			Crete (Chania)		
Spain	Castilla – La Mancha	Aragón	Castilla – La Mancha		X
Ukraine				Poltava	
Serbia	Šumadija-Great Morava region (Lapovo) and West Morava region (Aleksandrovac)				

The result of this first phase information was shared in interviews with high level contacts and agro-industries. The objective was to identify the main obstacles for IBLCs development and the measures that can be applied to foster its implementation.

In addition, workshops were organized with regional stakeholders to share project findings and gather information about barriers and the potential for replication of the IBLC concept.


After all the individual analyses of each of the sectors, the main obstacles were identified to illustrate an overall picture at EU level.

In addition, the factors that were considered to be potentially beneficial to the replicability of the IBLC concept in Europe were also revealed.

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## 1 INTRODUCTION AND METHODOLOGICAL APPROACH

The main objective of this task is to transfer the most important result of the project to other regions in which selected sectors present a high potential for replicability of IBLC concept, therefore allowing to put in real context the results and conclusions achieved during the project. This task builds on project findings and uses the insight and opinion of regional stakeholders to identify these regions. The information collected by the different teams also allowed to identify, according to the aim of the task 7.5, **the most promising innovation approaches for replicability that agro-industries can follow to create new IBLCs in their region** (some promising opportunities but also challenging barriers for IBLC implementation in these regions).

For this aim the process followed included three steps:

1. *Preliminary identification of regions with high potential for IBLC development from the experience gathered in the AGROinLOG project.*

First action within this task was to search and define the region/s with high potential for replicability of IBLCs according to the sectors agreed in this task for each country. To do that, a list of criteria, set out in the table below, was suggested for the selection of regions:

*Table 1. Proposed criteria for the identification of regions with high potential for IBLC development. Source: Elaborated by Spanish Co-ops.*


Identification of regions
Proposed criteria
Sector relevance in the selected region (coherence with task 6.2 sectoral analysis).
Amount of industries, size, production, etc.
Biomass market state (bioenergy/bioproducs). Existence of related business, potential consumers, etc.
Interest on IBLC concept (farmers, policy makers, current activity, etc)
Regulation frame (favourable or not), e.g. emissions limitation,
Support mechanism to innovation (grant, public agencies, private funding, etc)
Partner background on collaboration and access to information (contacts, workshops, etc) in region and sector.
Existence of 2 collaborative agro-industries
Any other

2. *Interviews with agro-industries and high-level contacts in the selected region on regional potential, barriers and incentives for IBLC implementation allowed to extract valuable information regarding these topics.*

The "high-level contacts" allowed an approach to the sector through interviews with regional representatives, relevant companies and other key players.

These interviews were carried out through meetings and round tables where the following issues were addressed:




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- Chances from biomass market in the region.
- Are there any regional regulations that could endanger or encourage the start-up of an IBLC?
- Regional support mechanisms for innovation into agro-industry that could be utilised to carry-out new pioneering facilities.
- Knowledge/thoughts about innovative initiatives in the region.
- Proposals to encourage the IBLC concept (which is innovative itself).

Similarly, additional interaction with two agro-industries were carried out in order to support or refute the conclusions drawn from the interviews with the "high-level contacts" about the possibilities of development of IBLCs in the selected regions, but also to examine the existence of different points of view among the various actors. Moreover, specific information about the sector and the related project findings were also discussed.

Additional support was provided for the interaction with the agro-industries in order to focus the discussion towards relevant aspects such as:

- Knowledge and opportunities in the regional biomass market:
  - What types of solid biomass are used at this time? (i.e. forestry or agricultural origin, from industrial processes, etc.)
  - In which format? (i.e., chips, pellets, etc.)
  - Who are the main consumers? (i.e., households, industries, etc.)
  - Do you think there will be a market development in short term or it too much stuck right now?
  - Are you aware if there is availability of suitable boilers/burners for optimal work?
- Is there any regional legislation that could threat or encourage the start-up of an IBLC?
  - Is it necessary to own environmental permissions to run these logistic centres? (i.e. gas emissions, dust, noise, etc.)
  - Is there any ban related to agricultural practices that could enhance the start-up of the IBLC's? (i.e., burning of prunings, etc.)
  - Is there any framework that is currently encouraging the use of alternative fuels?
  - Is there any framework that is currently encouraging the valorisation of agricultural wastes/by-products either for energy consumption or bio-products manufacturing?
  - Are non-food crops well established on the regions?
  - Is there any regional tool for the support of innovation at the agro-industry which could be used to start-up new pioneer facilities? (i.e.: Rural development, local employment, promotion of initiatives with environmental links, etc.)
- Knowledge and assessment of other innovative initiatives in the region for the valorisation of agricultural by-products/residues.
- Proposals to promote the concept of Biomass Logistics Centres (barriers and opportunities).

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- Do you have in mind to start working using your agricultural/agribusiness by-products?
- As an IBLC? Or just start providing your agricultural/agribusiness by-products to another IBLC?
- What barriers do you observe?
- Do you consider it an opportunity in any case?

3. *Workshops with regional stakeholders where the findings from the task were shared and feedback sought.*

At this stage, all project teams were required to share the findings from the previous steps in workshops with a broader audience and collect feedback on how to encourage the regional development of IBLCs in the corresponding sectors.


In order to make the workshops as fruitful and useful as possible for AGROinLOG, the content of the workshops was proposed by each partner in each country and for the sector targeted based on their best knowledge of the situation in their area, region and sector.

Prior to these workshops, Spanish Co-ops as leader of the task, in coordination with AESA, provided support to the partner to guarantee that useful results were achieved regarding how to implement/encourage the replication of IBLC centres in each specific region, and that EC recommendations would be followed.

More specifically a document was prepared by Spanish Co-ops with different proposals to address the main topics to be discussed. The document was share with the partners involved and AESA provided an adaptation of the methodology previously developed.

In general, it was suggested that partners developed the workshops according to the following structure:

- 1- Presentation the project (project [video](#) recommended).
- 2- Brief summary of project findings and results (relevant for the workshop stakeholders). Practice abstracts could be a useful material to support partners in this action.
- 3- Explanation of the objective of the task.
- 4- Share findings from interviews with high-level contacts and agro-industries with workshop attendants, leading a discussion that will inquire for new emerging ideas and possible discordances.
- 5- Provide a brief report with the main outcomes and recommendations aroused during the workshops.
- 6- Conclusions in relation to the most promising innovation approaches for replicability of IBLC model that agro-industries can follow to create new centers in their region.

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## 2 REPLICATION POTENTIAL ANALYSIS

### 2.1 Sectors and countries involved

This stage started by AGROinLOG identifying the sectors with regional potential. This selection was based on project findings from previous tasks and on the experience gathered by the projects' country teams.


This task required country teams to reflect on all the information collected during the project to decide what regions have, a priori, the best conditions for IBLC implementation related to a specific sector. In Deliverable 6.2 *Basic analysis of targeted agricultural sectors* doubts was raised on the IBLC potential on vegetable oils and sugar sector. The vegetable oils sector was excluded because it showed low potential and no interest was detected in any of the partners countries. For the sugar sector, despite low potential and interest in most countries assessed, in Sweden a large sugar company did show interest and a reasonable potential to implement the IBLC concept. Therefore, it was decided to still consider the sector and to give it a different approach. In this case, dealing with the sector through contact with the European organization, CEFS (European Association of Sugar Manufacturers). Moreover, Spanish Co-ops, in the frame of AGROINLOG project, collaborated with a Spanish cooperative of the sugar sector trying to provide it insights about the best ways to orientate its future investment, taking advantage of their current facilities.

As explained in the methodology above, the first step that was taken after the selection of countries and sectors addressed, was the identification of regions with high potential for IBLC development.

Finally, the planned distribution in relation to the countries, sectors and regions involved in this phase is as shown in the table below (Table 2).

Table 2. Distribution on countries, sectors and regions. Source: Elaborated by Spanish Co-ops.

Distribution on countries, sectors and regions					
Country/sector Region	Wine	Feed & Fodder	Olive oil	Grain	Sugar
Sweden				Skåne County	X
Greece			Crete (Chania)		
Spain	Castilla – La Mancha	Aragón	Castilla – La Mancha		X
Ukraine				Poltava	
Serbia	Šumadija-Great Morava region (Lapovo) and West Morava region (Aleksandrovac)				

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The result of this first phase information was shared in interviews with high level contacts and agro-industries. The objective was to identify the main obstacles for IBLCs development and the measures that can be applied to foster its implementation.

All this work will be presented in detail below in the following sections: 2.1.1, 2.1.2, 2.1.3, 2.1.4 and 2.1.5.

## 2.1.1 Wine sector

### 2.1.1.1 Castilla – La Mancha, Spain.

#### Regional analysis

Castilla - La Mancha was the region considered to have a high potential for replication of IBLCs in Spain for the wine sector (see Figure 1) according to the established criteria.

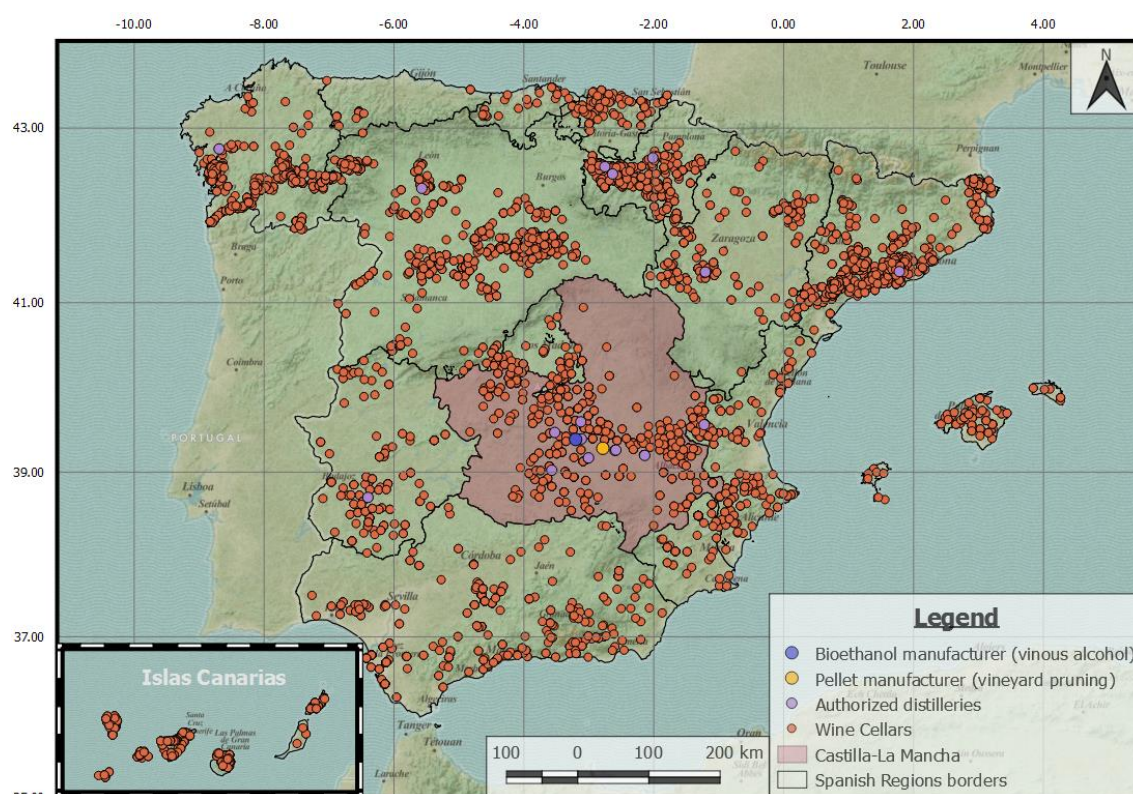



Figure 1. Spanish wine sector industries. Source: Elaborated by Spanish Co-ops.

The most relevant remarks are highlighted in the table below:

Table 3. Regional analysis for wine sector in Spain.

Regional analysis	
<i>Sector relevance</i>	Castilla-La Mancha is the first wine producer region of Spain, manufacturing more than half of the wine national production (50.6 %). In this region there are located around 600 wineries, almost 11 % of Spanish wineries. In addition, from the 18 existing distilleries in Spain, 9

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#### *Regulations/support mechanisms*

of them (50 %) are placed in Castilla-La Mancha (one is also a cooperative).

In 2017 was approved the Castilla-La Mancha Forest Biomass Regional Strategy. The aim of the Regional Government was to promote the primary sector associated with energy uses of forest biomass, developing a value chain based on sustainable management of forests associated with job creation in rural areas and, at the same time, contributing to mitigate the effects of Climate Change.

Castilla-La Mancha developed the Project "Castilla-La Mancha Bio-Economy Region" (CLAMBER Project), which lays the groundwork for turning this region into the benchmark of southern Europe regarding the research related to the use of biomass. Two different but complementary actions were carried out. Firstly, the construction of a research centre, the current CLAMBER R&D Biorefinery, which houses a Biorefinery on a demonstrative scale where companies that so wish can carry out their experiments. Secondly, an issuance of a pre-commercial Public Purchase to carry out R&D projects with the aim of taking advantage of the organic agro-food, livestock, municipal waste, etc., which are seen as a problem due to the cost associated to their management and disposal, to turn them into an opportunity and produce high added value compounds.


#### *Partner background on collaboration and access to information*

Spanish Co-ops has a local representative in Castilla-La Mancha which was interested in promoting similar initiatives to the AGROinLOG ones since this collaboration allowed them to share with the cooperatives new alternatives to diversify their business models. SIC Alimentaria, advisory firm specialized in the agri-food sector and cooperatives was considered a good potential collaborator for this task. Through them access to companies, local stakeholders and knowledge was easier. They provided all the support and contacts and made sure that all the interviews took place with the most relevant stakeholders and agro-industries.

### *High level contacts*

In Castilla - La Mancha, interviews with high-level contacts were carried out with the following objectives:

- To gather information from the policy makers and relevant stakeholders in the wine sector on how the situation of biomass management may evolve in the near future.
- To identify barriers and opportunities in order to be able to adequately design actions that allow the development of IBLCs in the wine sector in the future.

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- To discover synergies between the different actors that will make it possible to know the keys to the development of the sector in this regard.

The main findings of the interviews with policy makers were as follows:

- The reclassification of some waste as by-products is essential for some sectors to evolve properly.
- The regional legislation aims to promote the use of biomass. Circular Economy Law, Regional Forestry Biomass Strategy, Strategy on Bio-waste Management, etc.
- It is necessary to develop upgrades in biomass combustion systems that contribute to improve emission ratios, especially of particles.
- The reform of the CAP will increasingly be linked to environmental issues. The environmental maintenance aspect of agriculture will be taken into account.
- There are no plans to prohibit the burning of pruning, but to provide incentives to make pruning available so that an exploitation system can be put in place.
- These systems may represent an important opportunity for the rural world, due to the possibilities of job creation.
- Information and training for farmers on these harvesting systems is essential.
- There is a growing interest in bioplastics, and this can be a great opportunity.
- Process costs need to be adjusted to obtain these high-value products.
- The use of high-value products must be promoted instead of energy uses.
- There is ample scope for development, but research must be promoted with private funds.


The opinions of relevant stakeholders in the wine sector were also collected:

- There is an image problem with by-product management companies that use boilers. Chimneys are interpreted exclusively as a source of pollution.
- Logistics is a major drawback when managing biomass.
- Farmers fear phytosanitary problems if they do not burn the pruning remains.
- In the end, the use of agricultural residues will be imposed. The transition period must be accompanied by incentives rather than penalties.
- There have been several projects in the past that have not been successful and have created mistrust in the sector.

The analysis of the information drawn from all the interviews conducted allowed to conclude the following:

- Everything points to the fact that it will be essential to manage by-products in the short to medium term.
- The collection and use systems are increasingly efficient and will mark the viability of the systems.
- Cooperatives have a great potential to become essential elements in the by-product supply and treatment chain.



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- It is essential that the culture of research permeates the sectors and that they have their own initiatives in this respect.
- Society and public policies will increasingly influence the path of the circular economy, efficiency and use of resources.
- It is important to prepare for the changes that are coming, counting on professionals with experience in a sector that the cooperatives do not know about.

### *Interviews with the agro-industries*

For the wine sector, a distillery was interviewed on behalf of the agro-industries. Furthermore, other relevant agents in this sector were also interviewed and visited their facilities, such as:

- A Company that owns a logistic centre for the collection of the vineyard pruning
- A demonstrative biorefinery dedicated to scientific research, scaling experiments and the development of new bioprocesses and bioproducts from the use of wet fermentable or lignocellulosic biomass, both residual and cultivated
- A Spanish SME dedicated to the research, development, manufacture and marketing of natural ingredients using different kind of agro-food biomasses as raw materials, such as those derived from the wine production.

The conclusions on the latter were already set out in the previous point.


In relation to the distilleries, the following conclusions were drawn:

- They receive a significant amount of by-products from the wineries they process in their facilities: skin, grape pips, stalks, lees, filter paste and pomace. They consider that there is even more room to make these by-products more productive, which could represent an opportunity for the sector in the development of the ILBC concept.
- Most distilleries use 100 % of their own biomass with water tube boilers. So they would be very interested in increasing the use of biomass for energy purposes.
- Their activities take place mainly from October to May, so they showed interest in completing their periods of inactivity in order to increase their productivity.
- This kind of agro-industries has available machinery and qualified human resources to carry out the necessary processing operations related to IBLCs concept.
- One of the barriers they point out is that the market prices are distorted due to some operators offer the by-products for free. In other countries, such as France, operators do not pay for this, as they are considered to be doing a service to the wineries by removing the material.

### *Workshop with relevant stakeholders: opportunities and barriers*

The event was attended by a total of about 50 people, from productive sectors, biomass management companies, stakeholders related to the wine sector, policy makers, etc.

The main opportunities that arose are set out below:

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- There is a large potential for the use of by-products from the agro-food industry. An adequate research strategy, also with private funds which allow the optimization of processes so that costs are reduced, will be fundamental in order to achieve successful projects that obtain high value products at an adequate price.
- Systems for the use of by-products are a great opportunity for the rural world. They have a great potential for job creation and, therefore, for fixing the population in the rural environment.
- The current and especially future production paradigm will be based on the circular economy, efficiency and the use of resources. All of this will favour the development of activities such as those presented at the conference, which make use of materials that have been discarded until now.
- Environmental regulations are increasingly demanding, and everything points to the fact that the management of pruning waste will be based on its use and not on the current burning of it.
- Cooperatives have a very considerable potential to become management logistics centres. They have their own by-products, they can manage those produced by their members, and they have facilities that are underused most of the year, as the campaigns are concentrated in time. If profitability to the system is found, it is very likely that some cooperatives will become involved in this activity.

Some barriers emerged in the discussion:


- A change in the regulations is needed to allow the classification of some waste as by-products to be changed. In this way, it will be possible to simplify the procedures for their management and, therefore, their use.
- Logistics is a key point in the effectiveness of the system. If the costs of logistics can be reduced, with the development of new technologies, the increase in profitability will make the development of projects grow in proportion to their profitability.
- The training for farmers is a key factor in the success of projects related to the by-products of the primary sector. In many occasions the ignorance of the alternatives, or the fear of phytosanitary problems can be an impediment to collect the raw material. Improved logistics will also alleviate this problem.
- Improving the capacity of the agrifood sector to adapt to change is essential, as change is taking place ever more rapidly and many activities in the rural environment will not survive otherwise.

#### 2.1.1.2 Šumadija-Great Morava region and West Morava region, Serbia.

##### *Regional analysis*

In Serbia, two regions were selected to be studied in relation to the potential for replication of IBLCs (see Figure 2).



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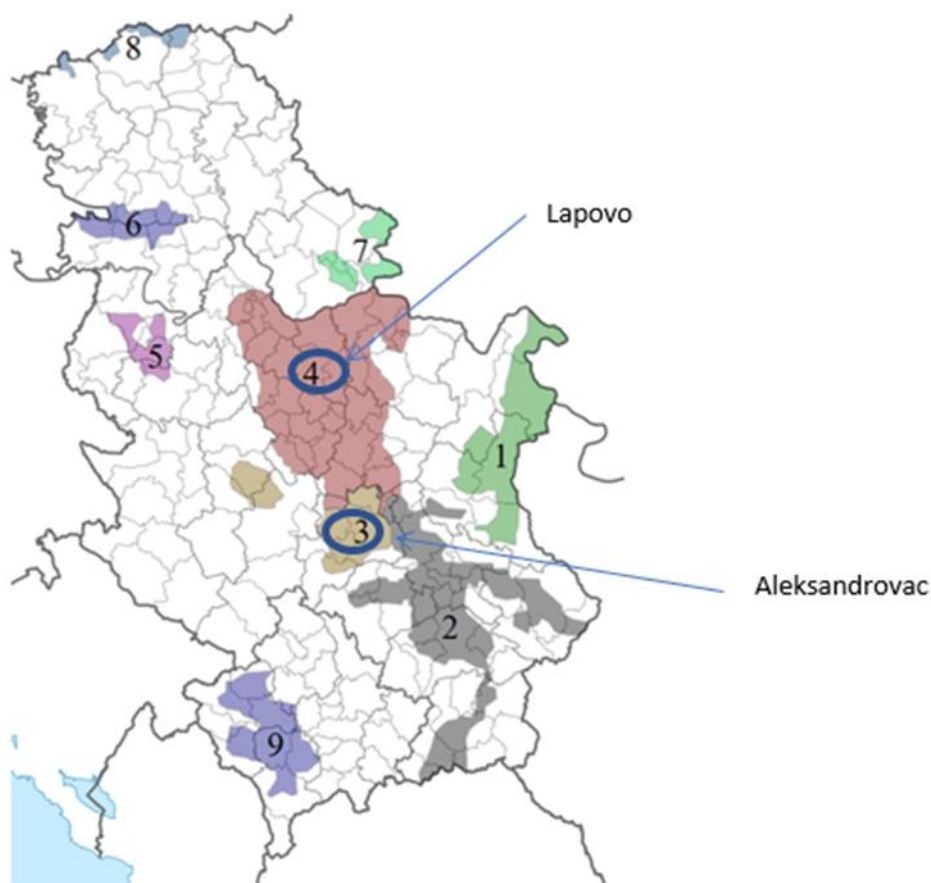



Figure 2. Regions selected in Serbia.

The country team relied on the following considerations shown below in the table:

Table 4. Regional analysis for wine sector in Serbia.

Regional analysis	
<i>Sector relevance</i>	<ul style="list-style-type: none"> <li>- West Morava region (3) is represented by municipality of Aleksandrovac. This region is one of the areas of the Morava region. In West Morava region 3,414 farms are engaged in the production of grape. The total area for grape production is 1,535.45 hectares from which 97.5% of the total area are vineyards dedicated to wine production. In this region there are the largest number of wine producers - almost every family produces wine for its own needs, there is a large number of commercial winery, and large wine systems.</li> <li>- Šumadija-Great Morava region (4) is represented by municipality of Lapovo. In the Šumadija region there are 1,119.79 hectares of vineyard, of which 534.21 hectares are cultivated with grape for wine production and 5,000 farms are engaged in grape production. Some famous</li> </ul>

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<p><i>Interest on IBLC concept</i></p> <p><i>Partner background on collaboration and access to information</i></p>	<p>Serbian wineries use for their production the grape grown in this region [Census of Agriculture, 2012].</p>
	<p>Regions were selected based on the Country Report of Serbia (two out of the nine main regions – Region 3 (Aleksandrovac) and Region 4 (Lapovo)- as they are relevant regarding the number of medium and small private producers which are interested in IBLC development).</p> <p>UBFME has a good network of contacts related to the wine sector, in this sense they confirmed the interest of representatives of wine sector, especially wineries aiming to develop the IBCL concept identified during workshop (workshop hold in Belgrade on 2<sup>nd</sup> October 2018 at the Faculty of Mechanical Engineering) and other promotion campaign (Belgrade Tourism Fair hold in February 2019 in Belgrade). In the existing wineries the IBLC concept does not exist currently and as the main percentage of the wineries are private, the owners are aware of the importance of IBLC concept for their production and further improvement and development.</p>

### *High level contacts and interviews with agro-industries*

The sector interviews were carried out in the region of Lapovo and high level contacts and agro-industries were performed through round table with all important stakeholders from wine producers, policy makers to other relevant stakeholders in the wine sector such as representatives of associations and relevant companies dealing with biomass and renewables.

The most relevant outcomes of these interviews were:

- There is an interest regarding the ILBC concept among grape, wine and fruit producers. They consider that, despite being small, they are well organized in a society that allows them to carry out dissemination actions, propose new innovative initiatives and have a good dialogue with policy makers. They also have good contacts with biomass companies interested in developing projects. For all these reasons, they consider that this society could be one of the most important actors in the implementation of the ILBC concept.
- The awareness of small producers in the region should be increased regarding the possible development of IBLC concept in order to change the traditional habits for using the waste from grape, fruit and wine production.
- Communications among small producers, associations and cooperatives should be improved, especially considering they are key actors for the implementation of the IBLC concept in the Lapovo region.
- The region of Šumadija-Gran Morava has great potential for biomass. So far, the market for woody biomass is the most developed, with widespread use at the domestic level. However there is a significant availability of agricultural biomass that may present an opportunity (heat production for some municipal buildings or complexes of buildings and for other purposes).

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- The infrastructure of the roads in Lapovo region (Lapovo city and surrounding area) should be improved to facilitate and reduce the costs of biomass logistic.
- Policy makers could be a good ally for the development of the IBLC concept since they are responsible for regulation, pricing of the different products (electricity price which is kept on very low level) and improving the conditions to foster innovation. State government and local authorities should clearly identify the possibilities of developing the IBLC concept in the Lapovo region by establishing a legal framework at local and municipal level to promote it. Moreover, they could support some activities related to developing the IBLC concept through some funds, applying for projects (national and international), project participation and raising awareness.
- Companies dealing with biomass and renewable energy sources should share the information regarding the activities planned related to the use of biomass waste and establish connections with biomass producers with the intention of introducing long-term biomass supply.

### *Workshop with relevant stakeholders: opportunities and barriers*

The Workshop in the Lapovo municipality was held on 4 February 2020. The main opportunities that were identified are listed below:

- Lapovo is a good location for IBLC implementation as it is near the Corridor 10 (highway).
- There is a potential opportunity for Lapovo municipality to become the IBLC center for the surrounding area considering a 50-60 km radius.
- A large amount of good quality residues is obtained. The residues are not contaminated with other materials or stones, but only organic residues from pruning.
- The construction of biomass plants using all the residues from viticulture and fruit growing for heating schools, churches, kindergartens, sports halls could be a very attractive initiative for the municipality of Lapovo. Also, other residues could be used for this purpose, such as feed livestock, baled straw.
- IBLC concept could be used not only on vineyards and orchards but also taking into account the amount of land around Lapovo available for the implementation of this type of initiatives. The municipality of Svilajnac (about 15km away from Lapovo) accounts with a heating system installed at the school which uses the residue from the agricultural production. Certainly, any crop residue can be used. In the case of lower quantity or worst quality of residue, a lack of raw material could be overcome by using the materials from other activities/sectors in the municipality.
- As another opportunity for pruning residues, it was proposed to use them for the production of mushrooms, particularly for the production of compost. In this way, compost could be made from the pruning residues available in the region and the price of mushroom production could decrease.

Some barriers to the development of IBLCs were also identified:

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- There is little interest from the young people due to the low awareness regarding the new approaches in agriculture and improved logistical issues. Besides, regulatory restrictions regarding the minimum planting area for new crops pose an additional obstacle to them in starting up the agricultural business because their investment costs are then higher.
- There is a large amount of waste available but there are problems related to the waste storage.
- There is a lack of legal regulation which could support activities related to development of IBLC (regulation in agriculture, environment protection, energy sector etc.).

## 2.1.2 Feed and fodder sector

### 2.1.2.1 Aragón, Spain.

#### Regional analysis

Aragón was the region selected in Spain to study the potential replicability of the IBLC for the feed and fodder sector (see Figure 3).



Figure 3. Spanish Feed&fodder sector industries. Source: Elaborated by Spanish Co-ops..

The following aspects show in the table below underpinned this decision.



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Table 5. Regional analysis for feed and fodder sector in Spain.

Regional analysis	
<i>Sector relevance</i>	<p>Feedstuff production in Spain reached 23.3 million tonnes in 2015. In Aragón the total feed production added 4.78 million tonnes in 2017 ranking the third production region in Spain.</p> <p>Dehydrated fodder production in Spain was 1.61 million tonnes in 2016-2017. In Aragón 1.36 million tonnes were produced in 2017. Aragón is the main production area for alfalfa in Spain, around 60 % of the crop surface and around 65 % of the national production is concentrated in the Valle del Ebro area (Aragón). Additionally, the sector assessment performed in the project framework pointed out the dehydrated fodder industries as the ones with the highest potential for IBLC implementation.</p> <p>Feed and fodder sector accounts with around 70 fodder dehydrator industries and almost 1,500 feed industrial manufacturers. Most fodder dehydrator industries are agglomerated in the north-east of Spain (Aragón, Navarra, Cataluña, etc.).</p> <p>Since not very much potential for the implementation of IBLC's was found in the Spanish feedstuff industries this regional analysis is based in the fodder dehydration industries.</p>
<i>Biomass market</i>	<p>More than 60 % fodder dehydration industries use different type of biomass for self-consumption.</p> <p>Regarding the pellet market, AVEBIOM annual report pointed out that in Aragón 8,508 heating installations operated in 2017 (stoves and boilers) were fed with biomass, showing an annual increase of 24 % and one percentage point higher than the national average (23 %). According to AVEBIOM it shows the dynamism of Aragón's sector, also in terms of turnover in 2017 it reached 46 million (in Spain 855.5 million).</p> <p>Additionally, in terms of employment the sector provided jobs for about 427 persons in the region. This figure positions again Aragón region over the national average. The jobs created are distributed among the marketing and installation of stoves and boilers, equipment maintenance and biofuel supply (wood chips, pellet and other types of biomass) activities.</p> <p>The consumption of biomass in Aragón has increased through the years and this evolution is reflected in the energy framework newsletter issued by the General Council of Aragón. In 2012 there was a great increase of the biomass consumption from the 153,000 equivalent tonnes of petrol to the 294,000 consumed in 2017. Installed power capacity represents in the region around 5 % of the total renewable power.</p> <p>Interest on IBLC concept: in 2017 was founded the Energy Cluster of Aragón comprising initially 37 companies aiming to promote a sector that brings together over 400 companies (direct and indirectly), among them</p>

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### *Regulation frame and support mechanisms*

companies producing energy with biomass. The cluster gather a large number of relevant stakeholders and seeks to create synergies among its actors to promote initiatives in renewable energies or energy efficiency fields among other.

Aragón Government promoted with the grant programme “plan Renove” the replacement of old and inefficient appliances or equipment producing heat, cold or hot water, therefore including boilers, by new ones more efficient from the energy point of view and less polluting in order to promote biomass boilers installation in the region.

Also, 2019 Announcement of Grants in Aragón related to saving and diversification of energy sources, rational use of energy and harnessing of indigenous and renewable resources co-financed by the European Regional Development Fund includes in the call a section dedicated to biomass projects (use of forestry and agricultural residues, livestock waste, energy crops and its exploitation for energy purposes).

Aragón also accounts with a Rural Development Programme that sets the priorities to distribute the 907 million euros of public funding available for the period 2014-2020.

### *High level contacts*

To test the opinions of high-level contacts in relation to the fodder sector, both policy makers and associations related to this sector were interviewed. Interesting conclusions were reached, which are summarized below.


Those provided by the policy makers were as follows:

- As key point: Importance of the existence of "real examples" and availability to visit these experiences, so that they can be disseminated.
- In relation to incentives, aid, subsidies, the policy makers consider that there is no restrictive legislation from the point of view of energy use.
- As for the barriers:
  - o It is considered that opening up the use of biomass for other purposes than energy can be an opportunity, but it also means adding even more complexity to the value chain.
  - o As example, the case of shared energy use between two or more companies (thermal use, co-generation of industrial estates, etc.) can generate conflicts, due to the dependence of their process on this circumstance.

Important sector associations also contributed with their vision. These were the main remarks:

- As advantages, the following were highlighted:
  - o It is considered that the implementation of IBLCs in agro-industries of this sector may be viable and may represent an opportunity for diversification.



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- These agro-industries have acquired knowledge on material handling and already account with a network of contacts that could be useful.
  - The implementation of this type of initiative is considered complicated, although aspects such as the circular economy could favour it.
  - A priori there is no regulation applying to straw that could constitute a difficulty for the supply to a plant that would implement the IBLC model.
  - Contribution to the stabilization or generation of employment.
- Some barriers were also identified:
- A key point is the commitment in the supply, especially considering that the straw is a complex product and it also tends to undergo a very significant price variation from one year to another.
  - The lack of knowledge regarding the possibilities of new bioproducts in terms of the market was identified as one of the main barriers to develop such initiatives (opportunities opening in new markets different from the energy market).
  - The only legal barrier identified that could occur is related to possible cross-contamination once producing again the main product for animal feeding a consequence of the new raw materials used to manufacture the new product.
  - Importance of bringing together the agents in the value chain, suppliers and plants.

### *Interviews with agro-industries*

Two relevant agro-industries related to this sector were interviewed and the most relevant aspects resulting from the high-level contacts were discussed.

The feedback provided was as follows:

- As for the advantages:
  - The development of a secondary activity would be interesting as long as it allows for an extra in profitability and income for the agro-industry, especially those with waste or surplus production.
  - It would be an interesting alternative for agro-industries to explore alternatives to avoid seasonality in their production along the year (idle period).
  - These new activities would help to maintain staff in companies with seasonal activity, rather than the creation of new jobs.
- As for the barriers:
  - They accuse the need to disseminate success stories so that these types of initiatives are known and can serve as an incentive.
  - The greatest barrier to be overcome is considered to be the initial economic investment that would have to be made linked to the acquisition of machinery.
  - Legislation concerning biomass is, at the moment, not very developed.


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### *Workshop with relevant stakeholders: opportunities and barriers*

A workshop was held with relevant stakeholders of the fodder sector. The barriers that were presented to the audience based on the inputs compiled for the event were the following:

- Need to raise awareness of the sector regarding the importance to explore alternatives to diversify their business line.
- Increase the stability of the personnel due to the extension of the manufacturing period along the year, therefore avoiding firing valid personnel.
- Reducing the impact of the idle period on the agro-industry's economic balance.
- Blend pellet could be an interesting alternative to cover heat demand of the agro-industry (self-consumption scheme).
- The IBLC economic balance will highly depend on the raw material price. In this sense the IBLC scheme allows a high flexibility compared to usual pellet plant.
- The agro-industry already accounts with a contact network that can be very useful to successfully implement the new business line (raw material suppliers, distributors, etc.).
- Lack of knowledge regarding the energy market.
- Lack of information regarding the European initiatives/tools to promote such type of initiatives.
- The alignment of all stakeholders involved in the value chain is key.
- It is crucial to guarantee the raw material supply which can be challenging considering the raw material availability can greatly vary from one year to another.
- One of the first steps to implement an IBLC should be to assess the raw material availability in the surrounding area.
- Bio-commodities for different application should consider that the raw material can increase its price significantly and any additional transformation will increase therefore even more the final price of the final product.
- Biomaterials and biochemicals markets open new alternatives that should be consider to diversify the business even though the technology used can lead to a significant increase of the final product price.
- Successful cases examples should be communicated/promoted to reinforce the feasibility of such initiatives.
- Importance to identify the equipment needed and possible use of already existing equipment at the agro-industry for the new production line.



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## 2.1.3 Olive oil sector

### 2.1.3.1 Castilla – La Mancha, Spain.

#### Regional analysis

For the olive oil sector and according to the criteria mentioned below in the table, Castilla - La Mancha was the region selected to be analyzed with regard to the possibility of replicating IBLCs (see Figure 4).

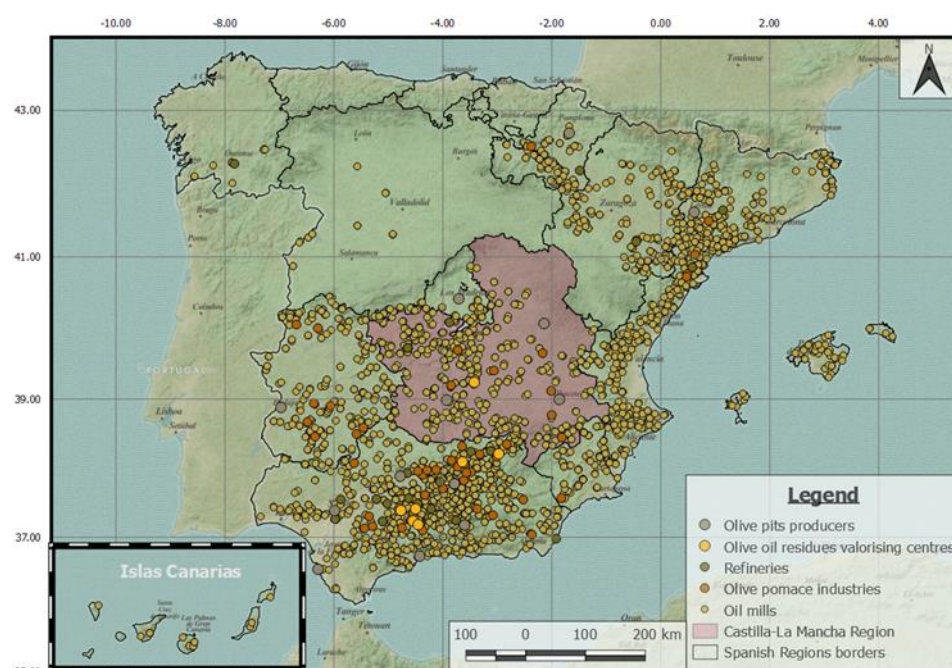



Figure 4. Spanish olive oil sector industries. Source: Elaborated by Spanish Co-ops.

Table 6. Regional analysis for olive oil sector in Spain.

Regional analysis	
<i>Sector relevance</i>	Most olive oil sector industries are agglomerated on the southern and eastern costs of Spain. Even though, Castilla-La Mancha is the second autonomous community with more oil mills and olive oil production, its large territory favours the spreading of these industries. There are around 250 oil mills which represent around 14 % in the country. It is also the second region with highest olive oil production, representing about 9 % at national level. In addition, there are also 7 oil pomace industries located in this region.
<i>Regulation frame and support mechanisms</i>	In 2017 it was approved the Castilla-La Mancha Forest Biomass Regional Strategy. The aim of the Regional Government was to promote the primary sector associated with energy uses of forest biomass, developing a value chain based on sustainable management of forests associated

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	<p>with job creation in rural areas and, at the same time, contributing to mitigate the effects of Climate Change.</p> <p>Castilla-La Mancha developed the Project "Castilla-La Mancha Bio-Economy Region" (CLAMBER Project), which lays the groundwork for turning this region into the benchmark of southern Europe in research related to the use of biomass. Two different but complementary actions were carried out. Firstly, the construction of a research centre, the current CLAMBER R&amp;D Biorefinery, which houses a Biorefinery on a demonstrative scale where companies that so wish can carry out their experiments. Secondly, an issuance of a pre-commercial Public Purchase to carry out R&amp;D projects with the aim of taking advantage of the organic agro-food, livestock, municipal waste, etc., which are a problem, to turn them into an opportunity and produce high added value compounds.</p>
<i>Support mechanism of innovation</i>	<p>There is a national Interbranch Organisation (Aceites de Oliva de España) which, among other R+D+I projects, is carrying out a study to determine how to valorise the liquid wastewaters generated in the olive oil extraction process.</p>
<i>Existence of interesting initiatives related to the IBLs</i>	<p>There is an energy valorisation plant located in this region (Enemansa, owned by Ence company) which produces energy from exhausted olive pomace, an agricultural waste generated in the olive oil sector.</p>
<i>Partner background on collaboration and access to information</i>	<p>Spanish Co-ops has a local representative in Castilla-La Mancha which was interested in promoting similar initiatives to the AGROinLOG ones since this collaboration allowed them to share with the cooperatives new alternatives to diversify their business models. SIC Alimentaria, advisory firm specialized in the agri-food sector and cooperatives was considered a good potential collaborator for this task. Through them access to companies, local stakeholders and knowledge was easier. They provided all the support and contacts and made sure that all the interviews took place with the most relevant stakeholders and agro-industries.</p>


### High level contacts

In Castilla-La Mancha the aspects discussed in relation to the wine sector are very similar to those of the olive oil sector because the advantages and difficulties offered by both are practically the same.

In the interview with the policy makers, aspects related to both sectors were discussed.

With regard to opportunities, the following were identified:

- The regional legislation aims to promote the use of biomass. Circular Economy Law, Regional Forestry Biomass Strategy, Strategy on Bio-waste Management, etc.
- The reform of the CAP will increasingly be linked to environmental issues. The environmental maintenance aspect of agriculture will be taken into account.

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- These systems may represent an important opportunity for the rural world, due to the possibilities of job creation.
- There is a growing interest in bioplastics, and this can be a great opportunity.

But the following barriers were also identified:


- The reclassification of some waste as by-products is essential for some sectors to evolve properly.
- It is necessary to develop upgrades in biomass combustion systems that contribute to improve emission ratios, especially of particles.
- There are no plans to prohibit the burning of pruning, but to provide incentives to make pruning available so that an exploitation system can be put in place.
- Information and training for farmers on these harvesting systems is essential.
- Process costs need to be adjusted to obtain these high-value products.
- The use of high-value products must be promoted instead of energy use.
- There is ample scope for development, but research must be promoted with private funds.

Relevant agents in the sector were interviewed in the same way. The main barriers identified were the following:

- There is an image problem with by-product management companies that use boilers. Chimneys are interpreted exclusively as a source of pollution.
- Logistics is a major drawback when managing biomass.
- Farmers fear phytosanitary problems if they do not burn the pruning remains.
- In the end, the use of agricultural residues will be imposed. The transition period must be accompanied by incentives rather than penalties.
- There have been several projects in the past that have not been successful and have created mistrust in the sector.

Some advantages were also revealed:

- Everything points to the fact that it will be essential to manage by-products in the short to medium term.
- The collection and use systems are increasingly efficient and will mark the viability of the systems.
- Cooperatives have a great potential to become essential elements in the by-product supply and treatment chain.
- It is essential that the culture of research permeates the sectors and that they have their own initiatives in this respect.
- Society and public policies will increasingly influence the path of the circular economy, efficiency and use of resources.
- It is important to prepare for the changes that are coming, counting on professionals with experience in a sector that the cooperatives do not know about.

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### *Interviews with the agro-industries*

Two interesting cooperatives in the olive oil sector were interviewed and gave their valuable opinions, since they had also been involved in projects related to this type of initiatives.

In addition, other relevant agents in the olive oil sector were also interviewed and visited their facilities, such as:


- A demonstrative biorefinery dedicated to scientific research, scaling experiments and the development of new bioprocesses and bioproducts from the use of wet fermentable or lignocellulosic biomass, both residual and cultivated, and
- A Spanish SME dedicated to the research, development, manufacture and marketing of natural ingredients using different kind of agro-food biomasses as raw materials, such as those derived from the olive oil production.

As barriers, they pointed out the following:

- The costs of logistics are too significant for such initiatives to be developed effectively.
- Phytosanitary problems could arise if pruning of the olive grove is not carried out in a fairly short time.
- Considering sector's wastes as by-products, would facilitate the administrative procedures that olive oil mills must carry out to manage it, thus facilitating its use.
- Negative image of the activity due to the issue of emissions when by-products are used for energy purposes. This is due to lack of knowledge.
- Difficulty of legally regularizing installations when the combustion of by-products is proposed due to air emission regulations.
- The ashes are another concern. Remains in the boilers must be properly managed and alternatives for reuse that go beyond agronomic use must be investigated.

Some advantages were also highlighted:

- The biomass exploitation potential in the region is very high.
- There has been a significant increase in demand and use of the olive stone by olive mills, individuals and public establishments.
- There has been an increase in biomass boiler installations, which has been very notable in recent years.
- Alternatives for other by-products are being sought. Tests have been carried out with the pulp remaining after passing through the continuous pitting machine and mixed with earthworms, a high quality organic fertilizer is produced.
- These initiatives are very well considered by society, as they would contribute to improve the environmental performance of the activity, create jobs and, in principle, generate richness from a material for which until then there was no other expectation than to burn it.
- The local councils would also be willing to participate, facilitating the management and even providing land for the facilities installation that would be necessary.

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As general conclusion of these interviews the following were proposed:

- The regulations must give priority to make available to the system the biomass generated by the farmers; burning should not be strictly prohibited, but rather the alternative management should be encouraged, always in a positive way.
- The implementation of a biomass management system will cause the reactivation of the economic activity in the rural environment and will fix the local population. Therefore, the administrations must support and encourage this type of project so that it can be carried out and will need to do so until the profitability allows its autonomous operation.

### *Workshop with relevant stakeholders: opportunities and barriers*

The workshop was held jointly with that of the wine sector in Castilla - La Mancha, presenting interesting cases from both sectors. The debate was very interesting, and the overall conclusions were the same as those previously presented for the wine sector in the section 2.1.1.1.

#### 2.1.3.2 Crete, county of Chania, Greece.

### *Regional analysis*

In Greece the region of Crete and more specifically the county of Chania was selected for the replicability of IBLC in the sector of Olive oil (see Figure 5).

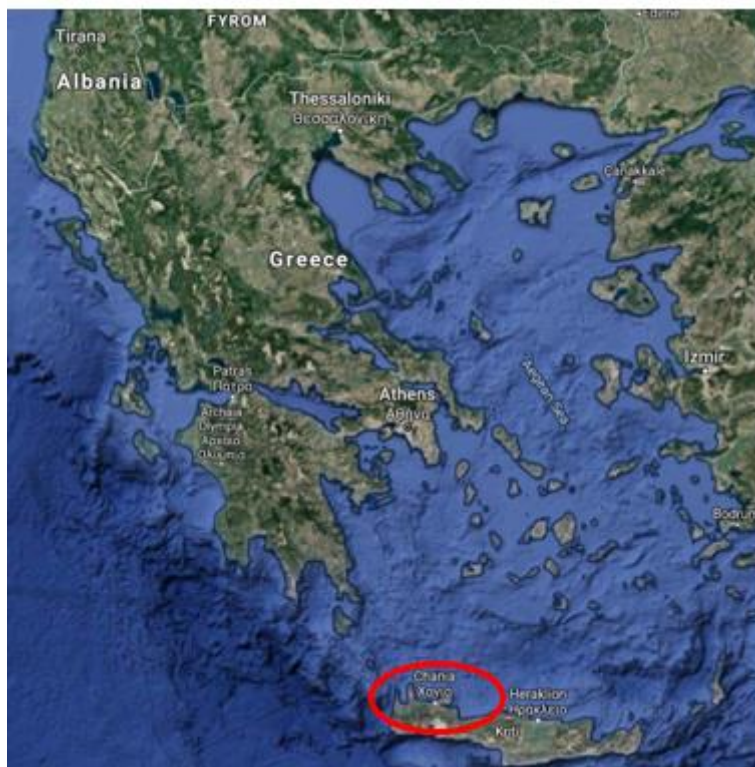



Figure 5. Region selected in Greece.

The criteria for selection were as shown in the table below:

Table 7. Regional analysis for olive oil sector in Greece.

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## Regional analysis

### Sector relevance

The region of Crete is one of the biggest olive oil producer in the Greek territory, with a total cultivated area that reaches over 188,000 kha of olive trees according to statistic data of 2017 from ELSTAT (while the total cultivated area for Chania region is 43,713 ha of olive trees) and an olive oil production that goes beyond the 72 ktonnes of olive oil, as it is depicted in the *table 8*. In general, the majority of olive mills (36.5 %) are located in Peloponnese, however significant amount of the total national olive mills (around 550 olive oil mills) are concentrated in Crete. This depicts the high share of the total cultivated olive groves that Crete owns (around 24.7 %) and thus the large available potential of residual olive tree prunings that yet has not been exploited.

Currently farmers in their majority follow the technique of the open burning with their prunings, thus leaving the prunings unexploited. In this sense, by implementing the potential IBLC concept, these quantities of prunings could be used for the production of marketable biofuels such as hog fuel or pellets deriving from prunings. According to MyGIS platform (GIS tool that calculates olive pruning biomass in the olive areas of Greece, developed in the framework of AGROinLOG project by CERTH) the annual residual olive tree prunings in the wide area of Chania, can reach the 92,307 dry tonnes (while Crete concentrates in total around 473,925 dry tonnes of olive tree pruning biomass).


*Table 8. Olive Oil Production based on geographical areas in Greece 2017. Source: ELSTAT (2017)*

Olive Oil Production based on geographic regions for 2017		
	Olive Oil Production (kt)	Percentage (%)
Peloponnese	88.4	28.4
Crete	72.9	23.4
Central Greece	24.9	8.0
Northern Greece	16.0	5.1
Western Greece	96.7	31.0
Aegean Islands	12.8	4.1
Total	311.7	100

### Biomass market

Concerning the final bio-based products of the future IBLC (e.g. olive tree pruning pellets) the region of Chania accounts many agro-industries such as greenhouses and nurseries that constitute potential end- users. Moreover, there is also interest from other sectors in the wide area of Chania, such as cheese producers, bakeries, pools, hotels and laundries, who already consumes solid biofuels (exhausted olive cake) and can potentially use some of the new bio-based products. Furthermore, OTP



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#### *Interest on IBLC concept/existence of agro-industries*

(olive tree pruning) pellets could even be used by domestic boilers with appropriate ash cleaning systems (due to the high ash content of the OTP pellets).


Concerning the size of the olive oil sector in Greece and after some contacts with the Mills of Crete, it was decided to study the IBLC concept on the pomace mill (ABEA) owned by the Mills of Crete. Mills of Crete have already developed sustainable and innovative solutions in the olive oil sector as they are producing “olive biomass” (as they call it) which is the woody part (separated from the flesh) of the olive pomace after extracting pomace oil. As a result, they are producing a higher quality biofuel than the ordinary exhausted olive cake. In this sense, they are searching for new opportunities offered in the olive sector and showed interest in collaborating under the framework of AGROinLOG project. Another advantage of the region is the existence of big ports that can support the transportation of the produced biofuels from Crete to the mainland or other countries if necessary. Finally, given the fact that Crete is an island, several other well-established, competitive industrial fuels, such as sunflower husk pellets, have higher price (due to higher logistic costs to reach the island) than in mainland, thus enhancing the marketability of the OTP pellets in the local market.

#### *High level contacts and Interviews with the agro-industries*

In the case of Crete region and during the framework of the high level contacts it was decided to visit an Agricultural Cooperative and one of the local Municipalities in order to check their opinions about the potential replicability of IBLC in the selected agro-industry (a pomace mill).

A representative group of policy makers (mayor and his chancellors) and technicians (an agronomist and an engineer) of the Municipality took part in the meeting providing the information about the existing needs of the local community. The following are the main conclusions that were drawn:

- As positive points were mentioned:
  - o The increasing demand for biomass for energy purposes in recent years. So far, most of the olive oil mills in the area currently use exhausted olive cake, apart from an olive oil mill in Drapania, which still uses pomace pellets as fuel. However, the opportunities for the biomass market in the region are extremely high if we consider that more and more households are increasing the demand for wood pellets or exhausted olive cake, in order to cover their heat demands. Furthermore, the large amounts of greenhouses in the wide area of Crete, and other industries, could possibly be potential end-users of solid biofuels, since their heating and cooling demands are extremely high.
  - o At present, there is no regional mechanism to support innovation activities in agribusiness that can be used to develop new pioneering facilities. However, due to the fact that Crete is included in different operational programmes of the Producer Organisations of the Rural Development Programme, perhaps future calls for

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proposals can be opened to municipalities from the Ministry of Development and Investment.

- Despite the need of the Municipality to adapt the proposed IBLC model, both of the high level contacts, found interesting this idea. The executives of the cooperative mentioned that the IBLC concept will be encouraged in the case that there is a financial gain or no loss for the producers since their members have a vast amount of prunings that they either burn or in less cases they shred and incorporate them into the soil. Moreover, members of the Municipality discussed the idea to actually be part of this value chain as final consumer of the produced biomass from the agricultural prunings, since heat demands can be covered for municipal buildings such as schools, the town hall, etc.
- As important remark, they mentioned the following:
  - IBLC concept could be encouraged in the case that there was an economic benefit, or at least no loss, for all the stakeholders involved in the value chain.

In order to contrast the point of view of policy makers, two agro-industries related to the olive oil sector (olive oil and pomace mill) were visited. The main conclusions are shown below:

- The proposed idea of the IBLC concept is very interesting since vast amounts of prunings are available from a wide area.
- The demand for biomass for energy purposes is increasing. So far, in the region of Chania all the olive mills operate with exhausted olive cake. However, regarding the demand for domestic use, and more specifically for domestic heating in the last years, pellets and briquettes have also entered the market.
- So far, there aren't any special regulations for the county of Chania or for Crete. However, they believe that the Greening Support from the CAP can help towards this direction by prohibiting the olive oil growers to burn their prunings, so they would need to look for alternatives uses.
- The regulation of 2018 about the foundation of Energy Communities, which enhances initiatives related to the use of alternative forms of energy, intends to promote collaborative schemes to redefine business, as well as environmental goals.
- The operational programmes of the Producer Organisations of the Rural Development Programme can provide an incentive for this type of initiative.
- The IBLC concept will be encouraged if there is a financial gain or no loss for the producers and all stakeholders involved in the value chain.
- It is considered interesting to take advantage of other residues/by-products of the olive grove, such as the leaf, which is currently not being used.
- Logistical aspects are the main limitation, due to the costs caused by the morphology of the land, among other aspects.




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### *Workshop with relevant stakeholders: opportunities and barriers*

Unfortunately, due to the difficult situation with the corona virus, the planned Greek workshop could not be carried out in the region of Chania. For that reason, it was thought that the best option will be to summarize the information gathered in other previous events implemented in the framework of AGROinLOG project and based on the so far experience created throughout the duration of the project. Main information was gathered first of all from the workshop implemented cover the data needs to be able to review of sector analysis and opportunities activity planned (Task 7.4 ) at EDOE's offices in which significant representatives from the olive oil sector have taken place. Among these stakeholders a) the Association of Greek Olive Oil Standardization Industries, b) the Panhellenic Association of Olive-pomace oil, c) the Panhellenic Association of Olive Mills, d) the Greek Association of Olive Oil Manufacturers, e) the Union of Agricultural Cooperatives, f) the Policy maker - New Panhellenic Federation of Agricultural Cooperatives, etc.). Secondly inputs were gathered from the set of meetings that took place at national level to cover the inputs data to gather in the meeting with key representatives of targeted sector and multiple bilateral meetings with agro-industries (Task 7.3). Moreover, information was also included from all the workshops and the demonstration activities implemented in the framework of the replicability- show cases activities (Task 7.6) in the wide area of Agios Konstantinos.

In all of the above mentioned cases, stakeholders presented particular interest regarding the exploitation of olive prunings and the general idea of the IBLC concept. The overall conclusions from these events are summarized below:

- All stakeholders from different value chain step should be united with the same vision/ goals, since it is quite difficult for actors from different fields to gather around a table.
- Moreover, secured logistics and a well-organized value chain from the fields to the IBLC are also of high importance. The best logistical solutions represent the most economic and less time-consuming solutions that increase the overall performance of the IBLC. Attention should be put on the location of the IBLC and the olive groves. The IBLC should be near the olive groves to achieve lower transportation costs of raw material (prunings). Intermediate storage site should have a positive impact on the logistics. Key for the success of the IBLC in the olive sector will lie in motivating each actor involved in the value chain.
- The profitability is the major issue for collaborating with other businesses along with the environmental impact and the positive impact on the regions (new jobs in rural areas, less "smoke" and smell from burning prunings, etc.).
- Financial Incentives are needed to facilitate the investment on an IBLC along with adaptation on national legislation for converting olive oil industries into IBLC. Tax reductions for utilizing biomass along with a stricter emission monitoring system at industries will facilitate the establishment of the IBLC concept.
- The IBLC should be economically feasible, not producing losses to the stakeholders involved and the investments needed to convert an existing agro-industry into an IBLC should have a minimum risk for paying off.


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- The increasing demand for biomass for energy purposes, in recent years in Crete, offers promising opportunities for the market demand of olive tree pruning- derived biofuels.
- The IBLC in the olive sector can help the local rural area in terms of job creations and of environmental aspect (avoidance of pruning burning on fields).
- The most desirable bioenergy products that an IBLC in the olive sector can produce (compared to other alternatives like syngas, bio-oil etc.) are solid biofuels deriving from the olive oil sector (such as olive pits, pellets or chips from prunings) due to their simple-production, low investment need and their mature markets. Other biofuels such as syngas are more difficult to be developed, as they require more complex production processes and greater investment.
- System can be exploited by other crops/agro-industries residues than olive prunings and thus offer new business paths to existing agro-industries. In this sense, the existing pomace mill in Mesolongi which treats alfalfa during its idle months (October to April) could be considered as a good example.

However, some barriers also came up:

- A lot of things must change in the legislations (as far as Greece is concerned). E.g. Based on the feedback from a pomace mill owner, it is very difficult for an existing industry (e.g. pomace mill) to get a license for biogas production, in case they would produce biogas from olive residues. Several actors from other agricultural sectors have tried it but they faced barriers on getting the license for producing biogas (barriers from regional actors, local people that didn't want such activities in their area, licensing authorities etc.). Moreover, based on the conversations during the workshop, the owner of a pomace mill stated that there is a legislation that makes pomace mills work less than half the year (no authentication to work the whole year), thus, many adjustments in the national legislations are needed for implementing the IBLC concept, at least on pomace mills.
- The absence of national funding concerns only the pomace mills as the olive mills are included in such financial supporting schemes for converting their technology from three-phase into two-phase. Moreover, due to the climate-dependent production of olive, and thus pomace that is treated in the pomace mills, technologies for exploiting by-products and residues of the pomace mill are not developed.
- The training and information of farmers is a key factor in the success of the IBLC implementation related to the exploitation of the olive prunings. In this way, farmers would be advised not to perform the easy way to handle prunings via burning them, but to consider other options as well.
- The logistics of the supply chain of olive tree prunings and the morphology of the olive groves. E.g. in Chania, many olive groves are in hilly farms. For that case, other harvesting solutions (than an integrated shredder) such as static chippers can be applied.

Finally, the local acceptance of the pomace mills operation already represents a problem since residents of the nearby area expressed an optical disturbance due to the smoke (as a consequence of the moisture of the feedstock) coming out of the pomace mill, thus provoking negative feelings

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on the people living nearby. For that reason, currently there is a challenge in making pomace mills an IBLC.

## 2.1.4 Grain sector

### 2.1.4.1 Skåne, Sweden.

#### *Regional analysis*

In Sweden Skåne was selected as a county with potential for the development of IBLC within the cereal value chain (see Figure 6).




Figure 6. County selected in Sweden.

The criteria on which the selection was based were those shown in the table below:

Table 8. Regional analysis for grain sector in Sweden.

Regional analysis	
<i>Sector relevance</i>	Skåne county was selected as it has the biggest cereal production (Figure 7), the yield was in 2017 1,542,900 tonnes. Moreover, there is a lower

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competition from straw in Skåne since there is a large supply of it but low demand as less animal production is present in the county in comparison with cereal production.

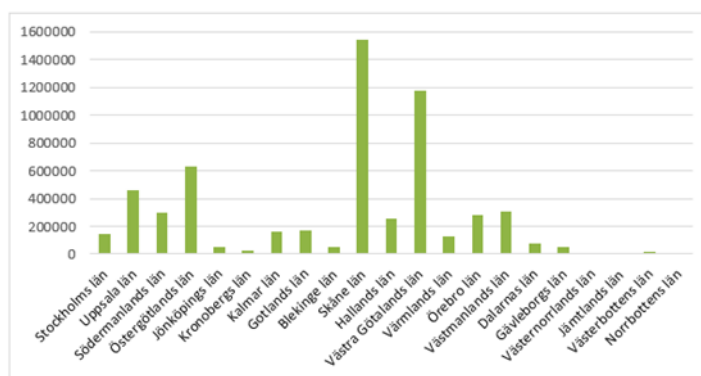


Figure 7. Cereal production in Sweden by county (län) year 2017 in ton.

#### Interest IBLC concept

As was noted in the workshops held in this region in previous phases of the project, there was interest in the IBLC concept among the relevant actors in this sector.

#### Regulation frame

Skåne has the ambitious goal to only have fossil free fuels by 2020.

#### Partner background on collaboration and access to information:

Both Lantmännen and RISE have a good network in the county. Lantmännen has their head office in the county and RISE has an office and regional contacts.


#### Existence of agro-industries

There are several large cereal mills in Skåne, including Nord Mills in Malmö, Farinas kvarn in Lilla Harrie and Skåne-möllan in Tågarp. Around 1.4 million tonnes of cereals are produced on average in Skåne every year, the share of winter wheat is around 50 %, spring barley 30 % and the other cereals between 2 and 6 % each [Jordbruksverket, 2018]. The mills produce a large number of by-products, that could be utilized for more advanced applications than today's. One interesting by-product of which there are in large quantities is wheat bran.

### High level contacts and Interviews with the agro-industries


To illustrate the IBLC concept in Skåne, the Swedish team presented a case study setting mills as new IBLC using one of their side stream (bran) to develop new activities. Interviewees mentioned a number of factors that could hinder the use of bio-based raw material for industrial processes. Answers from the high-level contacts, and the agro-industries are summarised below:

- Supply:
  - o Difficulties related to the risk of using raw material due to both the quality standards of the raw material (in comparison to fossil based commodities) but also the

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quantity as bio-based raw materials are seasonal and their availability can differ from season to season and from year to year.

- Communication:
  - o Lack of communication between suppliers or potential suppliers of bio-based raw materials and the industry and the lack of knowledge could explain the lack of trust concerning the quality and availability of bio-based raw materials.
- Regulation:
  - o It is important to have a common approach in the whole Europe concerning regulations and legislations.
  - o The Renewable Energy Directive (EU, 2018) and, in particular, its biofuel sustainability criteria limits the use of food and feed stuff to produce bioenergy.
  - o The taxation or the non-taxation of fossil-based products such as plastics hinder the attractiveness of bio-based products.
  - o As suggestion, fossil-based products should be taxed as fossil energy carriers like diesel and petrol are.
  - o Neither national nor regional legislation hinders the use of bio-based materials in Sweden. However, it was mentioned that in other countries, some regulations could hinder for instance the production of biogas based on food waste.
  - o A Vague definition of waste in the waste framework directive hinders the use of bio-based products coming from side streams.
  - o Bio-based raw material of similar quality as its fossil substitute are often more expensive and have a higher added value for instance if they are climate-neutral.
- Economy:
  - o The high investment cost to start a biorefinery or updating the current system to adjust to bio-based material is also an economic hinder. This combined with the price fluctuation due to the seasonality and the dynamics of the market where different actors compete for the same raw material could explain the reluctance of investors.
  - o Using bio-based raw material can considerably increase the cost to purify and clean the raw material to produce pure chemicals. In general, it is still a major issue today to get a cost-efficient industrial production using bio-based raw materials.
  - o Bio-based raw material of similar quality as its fossil substitute are often more expensive and have a higher added value for instance if they are climate-neutral.
- Market
  - o The market for bio-based products may be still underdeveloped and more focus should be given to it. The example of biogas, where the market often includes only one local client (public transport) showed some vulnerability on the long term.
  - o It is important to find a market with a wide range of end users to reduce the risk.
  - o A key factor is finding a market willing to pay for bio-based premium, and the consumers' limited knowledge does not promote the development of such market.

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- The interviewed industries showed interests for the biomaterial sector (production of bio-commodity for the plastic industry) and the food industry (plant-based protein products).
- Logistic:
  - It is important to keep the transport distances as short as possible and find customers close to the production site. Transporting bio-based raw material like grass, straw, or bran often means great volumes of low value products.

#### Conflict of interest:

- Interviewees were positive towards new utilizations of the bran as it is a by-product and only used in small amounts for human consumption today.
- At the moment, bran is used in the feed and fodder industry and, in small volumes in food industry. According to some interviewees, there is a lack of bran for this industry. Therefore, there could be a conflict of interest if the feedstock substituting bran would have worst environmental impacts for instance. Moreover, this could lead to an increase in the feed and fodder cost.

#### Policy support:

- Effective supportive policies and measures depend on the development stage of the sector and market. If needed, research and development should be supported to bring new and effective solutions and processes. Before investing in a production line, it is important to find a functioning business model generating profit.
- In the Skåne county, the regional board of Skåne offers different type of support to circular economy, and bioeconomy. Interviewees believed that there are other relevant support schemes at the EU and national level.
- Skåne has a long experience of innovation within the food chain sector which could be shared when relevant.
- At the moment, the renewable energy sector has a good access to support in Skåne. Skåne has developed a roadmap for biogas with supporting measures to reach their goals. Other support is also available for other types of renewable energy, for instance green biofuels. A general comment was that in general there are more support for bio-based energies than for bio-based materials and products.
- Policies should promote the use of bio-based products when feasible instead of using fossil-based products. The potential implementation of climate tolls (Carbon Boarder Adjustment system) in EU could be positive for the bio-based material sector.
- The situation within the plastic sector is moving quickly regarding the use of bio-based raw material and supportive measures should follow the trend.
- It is important that supportive policies and measures apply on a long-term timeframe to facilitate long term investments. Moreover, supports should be aligned at the EU level.

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- The product should be viable on the market without subsidy.

### *Workshop with relevant stakeholders: opportunities and barriers*

The project team suggested a desirable sustainable IBLC in the cereal processing sector in Skåne. Participants had the opportunity to comment on this.

As a starting point, it was suggested that for the development of an IBLC within the grain processing sector, it was considered that it had to be profitable in a sustainable way.

To this end, the need to articulate the following levers was agreed upon:

- The market should be developed in cases where end users are willing to pay a premium for bio-based products.
- An economy of scale should be achieved to ensure profitability, as these are low value products
- Finding synergies with other flows of biobased feedstocks should ensure that IBLC processes larger volumes and scales up, as well as reduce the risk of feedstock shortages due to climate reasons, for example.
- Start-up companies with bio-based value chain could be an interesting leading partner in this process.
- More collaboration between actors would be needed to reach a sufficient scale to be competitive.
- Future legislation and standards should favour a faster process from idea to operation in order to encourage new players.

After the above reflection it was concluded that Skåne had good potential to implement an IBLC within the grain processing sector.

As a summary it was determined that the two most innovative approaches to advance the development of an IBLC would be to first investigate the possibilities of including other raw materials and then to involve potentially interested start-ups together with the grain processing industry. Further information concerning the Swedish efforts regarding the multi-actor participation can be found in Casimir et al. (2020).

#### 2.1.4.2 Poltava, Ukraine.

### *Regional analysis*

Poltava region in Ukraine was chosen to test the potential of IBLC implementation in the grain sector (see Figure 8) based on the following criteria shown in the table below:


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Figure 8. Region selected in Ukraine.

Table 9. Regional analysis for grain sector in Ukraine.

Regional analysis

Sector relevance

The Poltava region is situated in the central part of the country and is one of the most productive agricultural regions of Ukraine in terms of volumes and yield rates.


Poltava region is one of the so-called “black-soil” regions, which are characterized by natural above-average productivity rates. The table below illustrates production volumes, as well as average yields of grain crops for Poltava region and Ukraine as a whole.

*Table 10. Production of grain and leguminous crops, million t. Source: State Statistics Service of Ukraine (2019).*

Year	Ukraine, total	Poltava region
2018	70	6,3
2017	61,9	4,2
2015	60,1	5,4
2013	63	5,6
2010	39,3	2,9

Figure 9 illustrates, the Poltava region (highlighted) was the leader in terms of grain production in Ukraine in the year 2018 - there was produced 6341.8 thousand tonnes of grain crops. As of the end of 2017, there were 2,453 agricultural enterprises, including 1,858 of private farms, which collectively have produced 78 % of all grain crops in that year.



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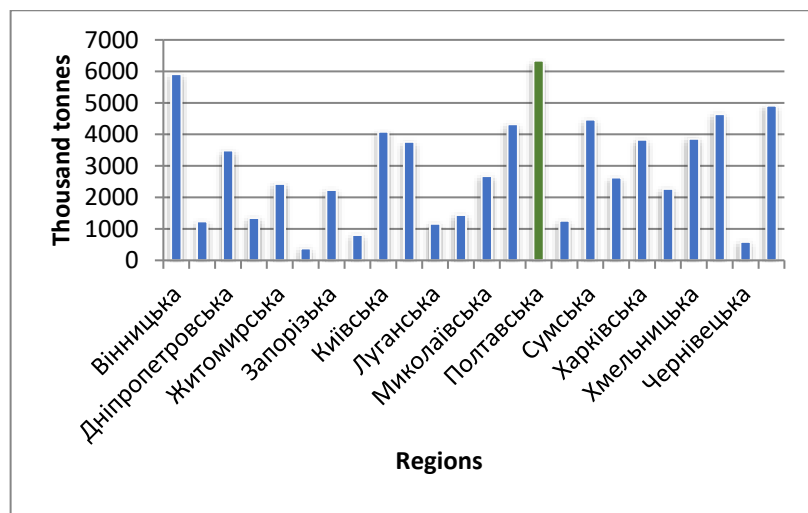


Figure 9. Grain production in Ukraine by regions, 2018, in thousand tonnes Source: State Statistics Service of Ukraine

Partner background  
on collaboration and  
access to information  
Existence of agro-  
industries


UCAB, as an association of agribusiness and farms, has contacts with agricultural producers in Poltava region.

UCAB has also contact with one of the biggest agricultural enterprises in Ukraine, which also has one of its production clusters located in Poltava region. The company has expressed a preliminary interest in AGROinLOG project and willingness to cooperate. Although the company doesn't currently process biomass, they are looking into the topic and conducting feasibility studies.

### High level contacts and Interviews with the agro-industries

A representative group of agents from the grain sector were interviewed in the Poltava region, including policy makers and agro-industries. The most relevant aspects discussed are summarized below:

- There is a general interest in the IBLC concept.
- There is currently a potential market for one product: solid biomass fuel (pellets). It could be viable as long as it is competitive, since at Poltava more than 90 % of rural households are using gas.
- There is some potential to use straw and other biomass residues from crop production in this way, in particular to feed (small) greenhouses and possibly even households. There are also possibilities to use biomass (or processed biomass) as fertiliser, again mainly for greenhouses, and these alternatives are currently being explored.
- Logistical costs or any additional processing would not make the use of biomass profitable.

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- In terms of regulations, for many specifically small and medium sized companies, which would like to test innovative technologies, one of the biggest challenges would be to integrate into the electricity grid.
- There are continuous changes in energy tariffs, as well as subsidies for households so a change in the future beneficial to the proliferation of biomass fuel use would be possible.
- Because of decentralization reform the newly formed amalgamated territorial communities possess over extended rights and powers to initialize and support innovative projects on their local level, including innovative projects dealing with handling plant-based biomass.
- There are some regulations in place since 2016-2017, specifically regarding the “green” tariff and energy generation from alternative energy sources that offer tariff advantages for certain categories of consumers of alternative energy sources.
- This concept may be adapted to the form some kind of co-operative (logistics hubs) among farmers first, primarily to satisfy their own needs. And then, should such a model proof viable, it can be extended to a more sophisticated business model with aim of bringing different biomass products to the market.


#### *Workshop with relevant stakeholders: opportunities and barriers*

The workshop in Poltava brought together an important group of relevant actors in the grain sector. Main opportunities that emerged were the following:

- There is a market potential for biomass. The most promising product could be solid fuel from biomass (pellets).
- An economically viable option might be simply collecting unutilized straw, drying it, and using it for own needs (on farm/facility/greenhouse) like heating, without even pelletizing it beforehand.
- Another opportunity could be to use biomass as fertilizers on a “small” scale – primarily for greenhouses. Some opportunities are emerging due to recently made decentralization reform in Ukraine. The newly formed amalgamated territorial communities possess over extended rights and powers to support and pursue local initiatives and innovative projects.

With regard to the barriers, the following were commented on:

- High level of gasification of rural areas in Poltava region (and in other central regions) might act as a market barrier.
- Volatile regulations in Ukraine. For example, tariffs (green tariff) and subsidies are changing frequently and might either support or hinder development of IBLCs.
- A high degree of cooperation between independent producers – a fair way of sharing costs and profits – in order to create an IBLC might be difficult to organize.
- Low level of awareness on both sides, producers (farmers) and consumers, regarding the opportunities that plant-based biomass processing offers; and also monopolized (or quasi-monopolized) supply-side of the energy market.
- Collection plant-based rests from fields would deteriorate soil quality.

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## 2.1.5 Sugar sector

The project looked to identify a promising region for IBLC development in the sugar sector. To start with, the team went back to the projects “Basic Analysis of targeted agricultural sectors” (D6.2) where France and Germany whereas the biggest producers of sugar beet (46,257 and 34,060 thousand tonnes with the next country, UK, with 9,000 thousand tonnes). Because of the production weight of these countries, efforts were made to engage with the sector in France and Germany. Unfortunately, AGROinLOG did not have partners or industrial network in either country. Nevertheless, RISE managed to attend the CEFs meeting in Berlin and presented the IBLC concept followed by a Skype meeting with a major French actor. These meetings did not lead to identify relevant collaboration task with the French sugar sector considering the AGROinLOG project’s framework and the short time perspective.

So, the approach to the sugar sector in this task was different than in other sectors. The project used the input of the most interested agro-industries in the sector in Sweden and Spain rather than the most representative in terms of volume.

### 2.1.5.1 Input from Sweden


The task team was still keen on identifying how a region could develop the IBLC concept. Sweden only collects 2,000 thousand tonnes, but the sector is interested in the IBLC concept and has contributed to other feedback tasks in AGROinLOG. The sugar sector in Sweden is represented by a single company and mostly concentrated in the southern region.

The project team developed a round table (instead of a workshop) to collect the views from this agroindustry.

The overall attitude of the attendees was positive towards an implementation of the IBLC concept in the sugar industry in the region. It is an issue that there is a large number of parallel projects going on, according to the company. Better impact could be achieved if one or fewer larger projects would be invested in. One example that was mentioned was the different projects going on in the area of green biorefineries in Denmark, this can be a lesson learned for the future project within the sugar industry.

It was mentioned that the focus has to move away from the food vs non-food conflict to the discussion on the use of arable land for all different types of utilization (including both food and biobased products of different kind). However, it is important to consider sustainable crop rotations too. It is also important to think in a Scandinavian perspective in all the Scandinavian countries and to find more collaborations.

The discussion was more focused on possibilities than obstacles and hinders. The group discussed potential projects and collaborations between the Scandinavian countries. One possible start could be a networking project on the comparison between the potential yield from different streams from the sugar industry and the grain industry focusing on land use and the yield of biobased products per hectare.

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There is a chance for an IBLC concept replication in sugar industry in the region. But the opinion of the sugar sector is to utilize the sugar as input material to the biobased processes in a first stage. There are still too many uncertainties on the market processes for the second generation biochemicals, they are still on a research scale. In the future when there is a market and a customer for the second-generation processes, then the sugar industry can utilize residues for a second-generation production.


### 2.1.5.2 Input from Spain

Sugar sector in Spain is based in the process and refinement of sugar beet juices. The second largest operator in Spain, is an active partner of Spanish Agrofood. Interactions of this sector and their companies with the bioeconomy lasted during several years, since in early 2000's it was considered as potential alternative for traditional sugar production. The steady reduction of sugar consumption concerned public authorities since this industrial sector stands for economic wellbeing on some European rural areas. CAP measures allowed and incentivised transformation of industrial facilities for becoming in biofuels plants. In northern Europe the main effort was leveraged to ethanol production, with cooperatives and companies. In Spain the main choice was the biodiesel, due to the better perspective in Iberian market for these products. Indeed, this cooperative invested in a plant for seed oil esterification together with an extraction installation.

Some of these agents are looking for being active in other more complex outputs from agricultural biomass and residues from sugar production. For instance, one French cooperative owns specific production line of intermediary biochemical agents from alcohol and sugars. Those are propylene, butadiene and isobutene, intermediate material for manufacturing of plastics and elastomers. Other agents are looking for a broad range of interesting products from 2<sup>nd</sup> generation biofuels, bioplastic, biocomposites.

In this context AGROINLOG collaborated with this Spanish cooperative trying to provide it insights about the best ways to orientate its future investment, taking advantage of their current facilities. This cooperative plan to build a plastic factory using surplus of sugar production, and with other side stream processes and crops, for instance starch from potatoes. Spanish Coops met several times in late 2019 and early 2020 to help them to study different options, for instance the best allies for this new line of business, options for funding and so on.

In addition, Spanish Coops exchanged information with providers of enzymes, evaluating potential replication in Spain of the processes for hydrolysis of biomass for bioethanol production that has been tested in Sweden under the AGROinLOG framework. The main expertise seems to be in the arable sector, specifically in use of straw as raw material. In Spain it could be more interesting the provision of prunings from agriculture.

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## 3 ADDITIONAL INPUTS TO ASSESS THE REPLICABILITY

### 3.1 Replicability – show cases

In task 7.6 the objective was to inform and raise awareness on the IBLC concept and innovative technologies and processes linked to it. Events and workshops engaged a range of European stakeholders: farmers, co-operatives, agri-businesses and Consortium partners.

The workshops organized provided the framework to discuss the barriers and potential to replicate such initiatives in the sectors targeted in the regions selected. It also supported discussions around the cooperation needed along the value chain and about the main results achieved. These events and exchanges gave ample opportunities for the AGROinLOG team to discuss different issues detected as keys for IBLC implementation during the project, advantages and main barriers to overcome and gather information useful to support the replicability potential assessment and confirm the main findings.

Workshops that included harvesting tests were particularly valued/interesting as they showcased how specific machinery can be used to collect agriculture by-products. Other events invited participants into facilities operating under an IBLC model. It was considered that these events contributed to increase the replicability potential and its assessment.

The project team identified overlaps among different tasks and sought coordination. This coordination effort prevented that the project repeatedly consulted stakeholders for similar input. Thus, when convenient, workshops were held jointly.

### 3.2 Summary conclusions by sector and country

#### 3.2.1 Fodder sector, Spain.

In Spain, for the feed and fodder sector, a joint workshop was held that brought together the collection of feedback needed for various project tasks.


The conclusions and barriers identified in relation to the implementation of IBLCs in this sector were already presented in section 2.1.2.1.

#### 3.2.2 Grain and fodder sector, France and Italy.

In relation to the grain and fodder sectors, different showcases were carried out.

One of these, referred to both the grain and fodder sectors, was held in France, where the operation of machinery for harvesting wheat chaff separately or together with straw was demonstrated in the presence of a group of stakeholders in this sector (machinery manufacturer, agro-industry, people from renewable energy research organisations and representatives of the regional authority).

The main findings of this meeting were the following:

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- The potential availability of biomass due to chaff collection with available harvesting technology was highlighted.
- Attendees expressed their interest regarding the harvesting value chain presented and, in particular, in relation to the performance of such harvesting solution, mainly in economic terms.

In relation to the potential for replication:

- Agro-industries were interested in such harvesting solution even if an economic evaluation is necessary to evaluate the payback period of the technologies and their economic sustainability.
- Member of the local chamber of commerce highlighted the interest in these technologies and the potential use of chaff in various markets that would permit an extra income for farmers.

In Italy, one of the showcases related to grain was carried out in collaboration with a sugar beet cooperative that has diversified its business from a mere sugar agribusiness to a company that manages a biomass power plant. Its members produce fiber sorghum to feed the combustion plant. Other agricultural wastes are also used to feed the plant such as wheat straw and maize stalks.

Fiber sorghum harvesting show case was performed in a field nearby the workshop site. Besides, a 15 MWe power plant that has already been in operation for one year was visited. The management of the storage of the different raw materials used as fuel was explained to the AGROinLOG members.

In general, the attendees found the experience very interesting. It became clear that the fiber sorghum allows the production of more biomass than sudan grass, so it may be worthwhile to evaluate its cultivation as a substitute for the latter, provided that the physical and chemical characteristics are adequate.


As regards replicability, it is still difficult for sorghum fibre to compete with wood chips because the latter have better characteristics and lower price.

Another of the showcases in the grain sector developed in Italy concerned the demonstration of the operation of machinery for the separate collection of maize grain and cob. Then, a visit to an agro-industry that uses the cobs for electricity production (250 kWe) through biogas technology was carried out.

Some ideas emerged during these demonstration sessions:

- The importance of exploiting maize residues as untapped products that could provide an extra income for the farmers was highlighted.
- Attendees expressed their interest regarding the corn harvesting value chain presented mainly in economic terms.

In relation to replicability, the following was concluded:

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- It was highlighted that the harvesting solutions employed in AGROinLOG can be also exploited with other agricultural residues such as wheat chaff offering new business paths to existing agro-industries.
- Local stakeholders were also interested in maize cob harvesting.


### 3.2.3 Grain sector, Sweden.

Sweden brought together an important group of farmers in order to develop a discussion workshop presenting the project and its main results but also asking their opinion about their interest in taking part in the IBLC concept. As a complement to this workshop, they made a study visit to Agroetanol's facilities.

The workshop was articulated around topics: straw supply, logistics and price setting & contract. The findings of each of these questions are summarised below.

- Hinders to the sale of straw to Lantmännen's ethanol plant:
  - o Environmental issues:
    - Soil quality properties and nutrients inputs from straw: Farmers associated the extraction of straw with the removal of valuable nutrients and the reduction of humus content. Farmers in Sweden are concerned and aware of the circularity of nutrients in their crops.
  - o Economic issues:
    - Only an opportunity if paid a fair price, including price for nutrients removal and risks: Straw would always be a side income and some farmers argued that the economic gain is only marginal considering the risk. Farmers agreed that longer contract (around 3 years long) could reduce risks.
  - o Technical issues:
    - Logistic: Logistic to collect and deliver straw could be delicate as the suppliers are dealing with a low value product and high volumes. Moreover, depending on the quality needed, the straw must be collected at the right time. Another hinder foreseen by the farmers was the short-sighted EU regulations which hinder investments.
- Organization of logistics:
  - o Hire baling services from entrepreneurs (not from Lantmännen):
    - To ensure the straw quality and that is done at the right time (not getting on the way of other farming tasks).
  - o Need of storage on farm (compensation if stored under roof):
    - Latmännen would not have enough storage capacity.
    - Some middle storage on strategic places could be possible.
  - o As little handling as possible
  - o Possibility to further process on-field or on-farm (for instance pelletize)
- Setting of the price and agreement:
  - o Contracts for selling straw should:



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- Be safe and flexible for farmers and last several years.
- Include standards for the delivery format and quality specified by Lantmännen, setting the price based on a dry content basis.
- Include “force majeure” clause to protect the farmers in case of drought, floods, or other unpredictable events
  - Do not contract 100 % of yield to the farmers.
  - Paid to the farmer for storage of the straw.

### 3.2.4 Olive oil sector, Greece.


In Greece, concerning the olive oil sector, three different show cases (mechanized harvesting of kiwi, olive tree and vineyard prunings with an integrated harvesting/shredding system) have been implemented in multiple Greek regions (Livadeia, Agrinio and Agios Konstantinos) during 2018. Moreover, another show case (as open demo day) along with a workshop were held in the middle of 2019 in Agios Konstantinos where the Greek IBLC is located, bringing together a representative group of actors from this sector (farmers, agricultural cooperatives from nearby regions, logistics operators, agro-industries, energy end-users, research organizations regarding renewable energies and representatives from regional authorities).

Based on data retrieved from all the show cases and especially from the last workshop held at Agios Konstantinos in 2019 we can summarize the followings:

- The mobilization of residual biomass (olive prunings) for energy purposes especially from regions with large availability is of high importance.
- The attending stakeholders expressed their interest in the proposed value chain of the olive prunings, specifically in relation to yield and economic aspects of the proposed harvesting scheme.
- As for the regional policy makers:
  - They showed interest in the exploitation of olive tree prunings, mentioning the local environmental benefits and highlighting the upcoming benefits of using this local source as fuel in industrial or even in public buildings.
  - They expressed the immediate need to introduce support measures and subsidies for the exploitation of agricultural biomass such as olive tree prunings and put further political pressure regarding corresponding legislations (e.g. ban of pruning burning)

With regard to the replication potential (also derived from the other three show cases performed in Greece):

- It was observed that the proposed harvesting solutions (integrated harvester/ shredder) can be also exploited in other types of agricultural residues apart from olive tree prunings, such as kiwi and vine prunings, and thus can offer new business activities to existing agro-industries of other agricultural sectors.
- Moreover, in the show case of Agrinio both the Agricultural Cooperative and local stakeholders in the wide area expressed their particular interest in such harvesting solution

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of prunings from olives and kiwi, since they plan to use the final product for self-consumption (such as in drying maize and forage in local agro-industry) in order to cover their energy demands. Furthermore, they plan to invest on a local power plant in the area and use such agricultural byproducts as fuel.


- Finally, in the show case of Livadeia actors discussed about the possibility of using the existing facilities of a pellet plant with the aim to produce pellets from the residual olive tree and vineyard prunings. In addition, representatives of the regional authorities were interested in using olive tree prunings for heating public buildings in the area or using them in local agroindustries as fuel.

## 4 GENERAL CONCLUSIONS AT EU LEVEL


### 4.1 Barriers identified

After all the individual analysis for each of the sectors assessed in this document, by way of synthesis, the main barriers identified are presented which can illustrate an overview at EU level:

	SECTORS					BARRIERS
	WINE	FEED&FODDER	OLIVE OIL	GRAIN	SUGAR	
Regulation	•	•	•	•	•	The <b>Renewable Energy Directive</b> (EU, 2018) and, in particular, its biofuel sustainability criteria limits the use of food and feed stuff to produce bioenergy.
	•	•	•	•	•	Need of <b>reclassification of some “waste”</b> as by-products in the legal frame.
	•	•	•	•	•	<b>Lack of common approach in the whole Europe</b> concerning regulations and support.
	•	•	•	•	•	<b>Absence of policies to make bio-based products attractive, promoting the use of bio-based products</b> when feasible instead of using fossil-based products. <b>Non-taxation of fossil-based products</b> such as plastics hinder the attractiveness of bio-based products.
	•	•	•	•	•	<b>Need of supportive policies and measures</b> applying on a <b>long-term time frame</b> to facilitate long-term investments.
Market	•	•	•	•	•	<b>Market for bio-based products still underdeveloped.</b>
				•	•	<b>Uncertainties on the market processes for the second generation biochemicals.</b>
Logistic	•	•	•	•	•	<b>Logistics is a major drawback</b> when managing biomass.

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	SECTORS					BARRIERS
	WINE	FEED&FODDER	OLIVE OIL	GRAIN	SUGAR	
Process	•		•			Need for adequate temporary organization of pruning collection (farmers fear phytosanitary problems if they do not burn the pruning remains in time).
	•	•	•	•	•	Needs to minimise handling to optimize the final price of the final product.
Environmental issues	•	•	•	•	•	Collecting plant-based residuals from fields could deteriorate soil quality properties and decrease the nutrient content.
Technology	•	•	•	•		Need of improvements in biomass combustion systems that improve emission ratios, especially of particles.
Awareness	•	•	•	•	•	Need of increasing awareness of small producers about the possible development of IBLC concept in agro-industries which could contribute to change the traditional habit to dispose the waste.
	•		•			Lack of information and training for farmers on harvesting systems.
	•	•	•	•	•	Need to disseminate success stories.
	•	•	•			Lack of knowledge regarding the energy market.
	•	•	•	•	•	Lack of information regarding the European initiatives/tools to promote initiatives related to the use of biomass.
	•	•	•	•	•	The use of biomass to produce high-value products instead of energy purposes should also be promoted.
Economy	•	•	•	•	•	Reluctance of investors caused by price fluctuation due to the seasonality and the dynamics of the market.
				•	•	Using bio-based raw material can increase considerably the cost to purify and clean the raw material to produce pure chemicals.
				•	•	Need of adjusting process costs to obtain high-value products.
	•	•	•	•	•	High investment needed to start up a biorefinery or to upgrade the current system to accommodate bio-based materials.
	•	•	•	•	•	Bio-based raw material of similar quality as its fossil substitute are often more expensive and have a higher added value for instance if they are climate-neutral.
Collaboration	•	•	•	•	•	More collaboration between the agents involved in the chain, suppliers and agro-industries would be needed.
Supply	•	•	•	•	•	Difficulties related to the risk of using this type of raw material due to both quality but also because of the season dependant aspect of bio-based raw material.
	•	•	•	•	•	Difficulty in establishing contracts with farmers (contract with the farmers should be safe and flexible for farmers, last several years, include delivery format requirements and specify standards for quality in order to avoid or minimize risks).
				•	•	For some final products it is difficult to transfer their high added value to the final price.

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## 4.2 Replicability

Below are those factors that have been extracted from the analysis of all the information presented throughout this document that are considered to favour the replicability of the IBLC concept.


	SECTORS					FACTORS TO FAVOUR THE IBLC CONCEPT REPLICABILITY
	WINE	FEED&FODDER	OLIVE OIL	GRAIN	SUGAR	
Regulation	•	•	•	•	•	The <b>reform of the CAP</b> will increasingly be linked to <b>environmental issues</b> . The environment maintenance in agriculture is an aspect that most likely will be considered.
	•	•	•	•	•	The <b>use of agricultural residues will be imposed</b> . The transition period must be accompanied by <b>incentives</b> rather than penalties.
	•	•	•	•	•	The <b>current</b> and especially <b>future production paradigm</b> will be based on the <b>circular economy and the efficiency in the use of resources</b> (management of agricultural residues/by-products, for example avoiding the burning of the pruning, etc.).
	•	•	•	•	•	<b>Operational programmes of the Producer Organisations of the Rural Development Programme</b> can provide an <b>incentive</b> for this type of initiative <b>related to the use of biomass</b> .
	•	•	•	•	•	<b>Potential implementation of climate tolls</b> (Carbon Boarder Adjustment system) in EU could be <b>positive for the bio-based material sector</b> .
Market/new products	•	•	•	•	•	It is considered that the <b>implementation of IBLCs in agro-industries</b> of this sector may be <b>viable</b> and may <b>represent an opportunity for diversification of the business line</b> .
	•	•	•	•	•	<b>Start-up companies within the bio-based value chain</b> could be an <b>interesting leading partner</b> .
	•		•			<b>Pruning harvesting solutions used in AGROinLOG</b> can also be <b>used for other agricultural residues</b> such as kiwi pruning and offer new lines of business to existing agro-industries.
					•	<b>Some agents</b> are interested in <b>being active in the search for other more complex products from agricultural biomass</b> and the residues obtained from its regular production process.
	•	•	•	•	•	It is considered <b>interesting to take advantage of other residues/by-products, which are currently not being used</b> .
	•	•	•	•	•	<b>Biomaterials and biochemicals market</b> open <b>new alternatives</b> that should be considered as an <b>opportunity to diversity</b> the business even though the technology used can considerably increase the price.
Technology	•		•			There has been an <b>increase in biomass boiler installations</b> , which has been very notable in recent years.

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	SECTORS					FACTORS TO FAVOUR THE IBLC CONCEPT REPLICABILITY
	WINE	FEED&FODDER	OLIVE OIL	GRAIN	SUGAR	
Awareness	•	•	•	•	•	Initiatives related to the use of biomass are very well considered by society, as they would improve the environmental performance of the activity, create jobs and, in principle, generate value from a material for which until then there was no other use than combustion without energy recovery.
	•	•	•	•	•	The IBLC concept will be encouraged if there is a financial gain or no loss for the producers and all stakeholders involved in the value chain.
Economy	•	•	•	•	•	Initiatives for the use of by-products are a great opportunity for the rural world. Having a great potential for the maintenance of staff in companies with seasonal activity or, even, creation of new jobs, therefore, for fixing the population in the rural environment.
	•	•	•	•	•	There is a significant potential for the use of by-products from the agro-food industry. An adequate research strategy, also with private funds, which allow the optimization of processes so that costs are reduced, will be fundamental in order to achieve successful projects that obtain high value products at an adequate price.
	•	•	•	•	•	The development of a secondary activity would be interesting as long as it allows an increase in profitability and income for the agro-industry, especially those related to waste or by-products.
	•	•	•	•	•	It is essential to find the right business model, and the cooperative system could be interesting to share the profit with the farmers.
	•	•	•	•	•	Agro-industries willing to implement the IBLC concept have knowledge of material handling and a network of contacts that could be useful to successfully implement the new business line (raw material suppliers, distributors, etc.).
Collaboration	•	•	•	•	•	Cooperatives have a very considerable potential to become IBLCs. They have their own by-products, they can manage those of their members, and they have facilities that are underused most of the year, as the campaigns are concentrated in time. If profitability to the system is found, it is very likely that some cooperatives will become involved in this activity.
	•	•	•	•	•	Society and public policies will increasingly influence the path of the circular economy, efficiency and use of resources.
	•	•	•	•	•	Some local councils would also be willing to get involved, facilitating management and even providing land to build the necessary facilities, as well as helping to promote the use of biofuels in public buildings.
	•	•	•	•	•	Finding synergies with other flows of biobased feedstocks should ensure that the IBLC processes larger volumes and scales up, as
Supply	•	•	•	•	•	

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SECTORS						FACTORS TO FAVOUR THE IBLC CONCEPT REPLICABILITY
WINE	FEED&FODDER	OLIVE OIL	GRAIN	SUGAR		
						well as <b>reduce the risk of feedstock shortages</b> due to climate reasons, for example.

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