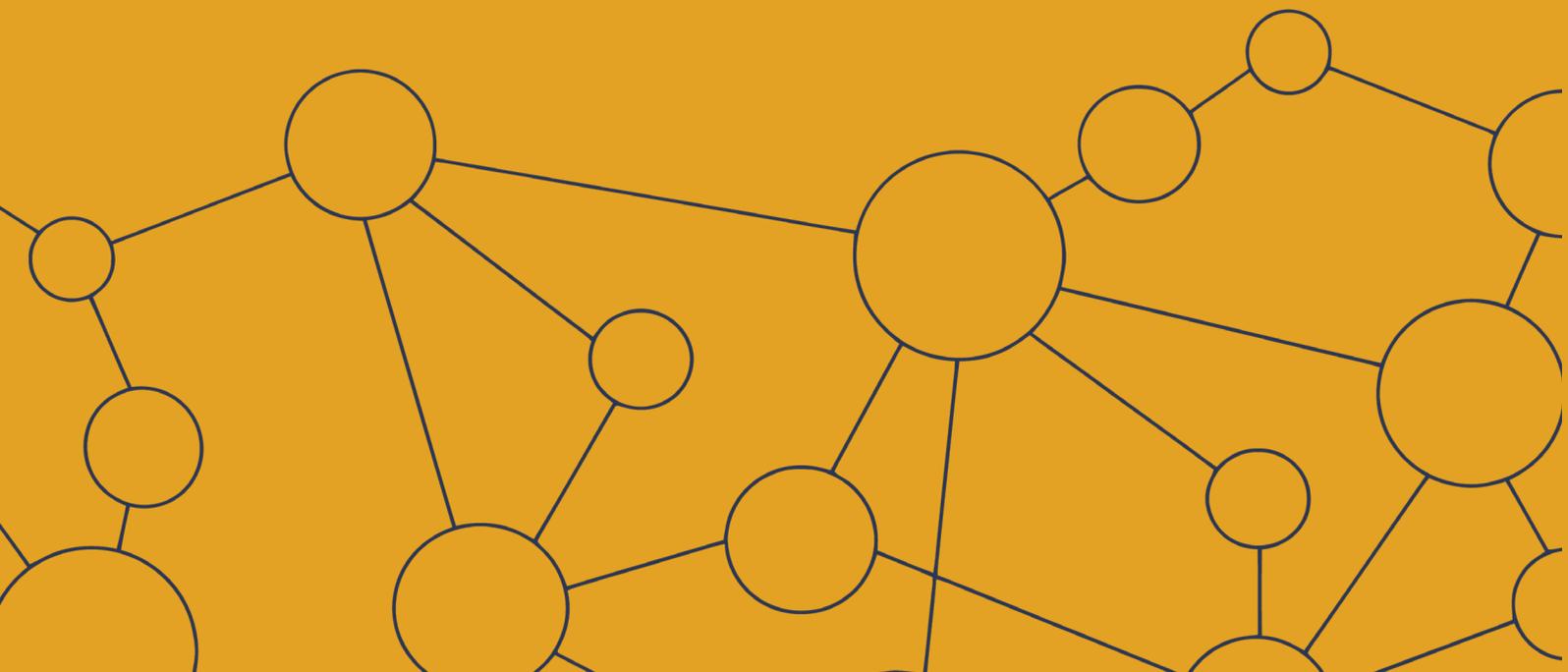


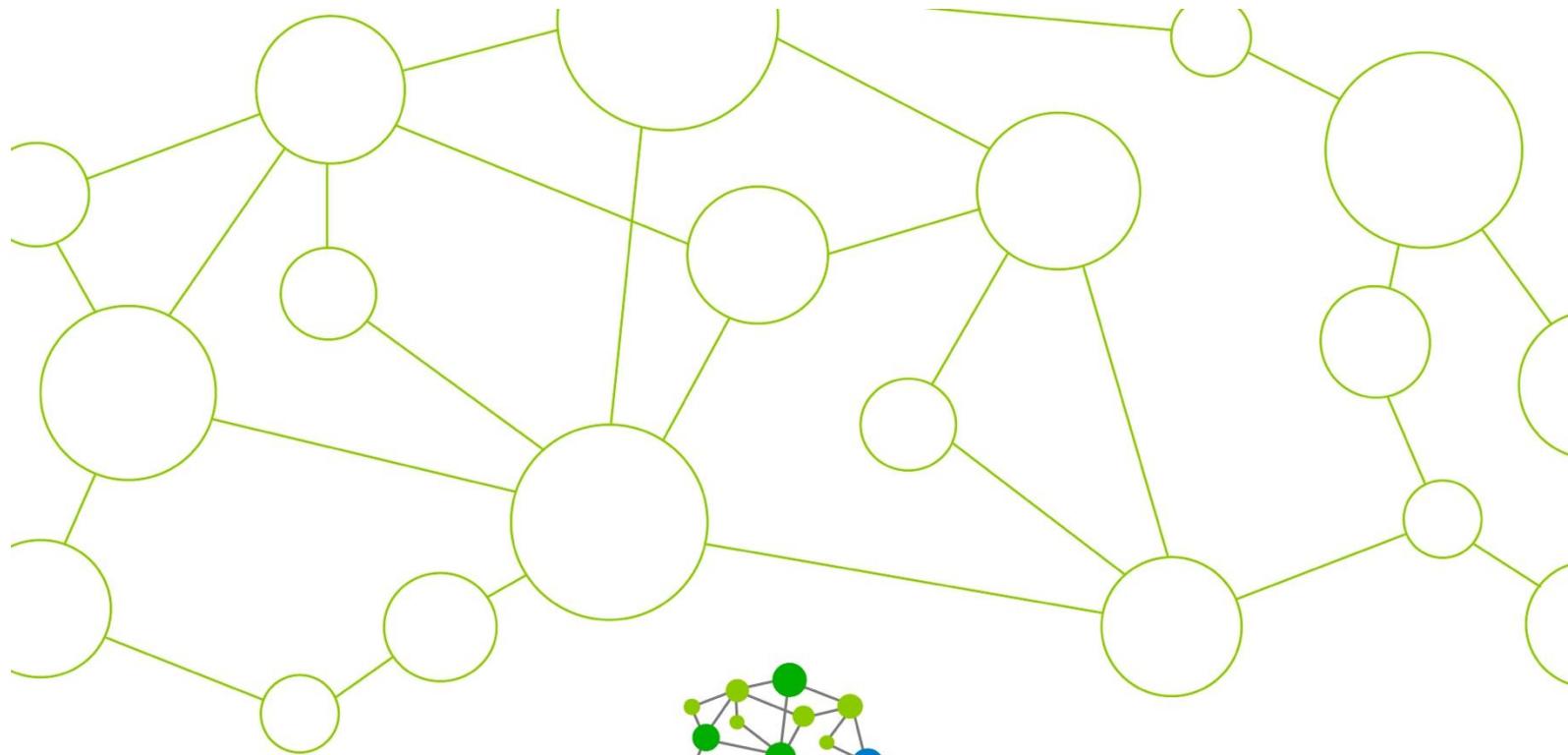


ROSE WOOD
4.0 Sustainable Wood
for Europe

SOUTH-WESTERN HUB ROADMAP

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South-Western Hub Roadmap

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1. Introduction

Modern information and communication technologies (ITC) continue to develop rapidly in all sectors of the economy and society. The forestry sector (compared to agriculture or manufacturing sectors) is however lagging behind in terms of adaptation and spreading of modern ICT solutions. A major challenge is the large variety of ecosystems, forest owner types, supply chain actors and stakeholders, and regional disparities of technological progress. **Forest industry 4.0 solutions** (including new measurement sensors, high resolution digital maps, forest planning tools, risk monitoring, realtime data exchange and control, logistical optimisation, etc.) are a major field of innovation and future market, which will enable continuous information exchange at all stages in the supply chain, tracking timber flows from forest harvesting to processed wood products and markets. Furthermore, **Decision Support Systems (DSS), educational tools and marketing platforms for forest owners** are more and more emerging to connect knowledge and practice, and the actors within a region. This will leverage huge benefits for resource efficiency, sustainable use and climate change mitigation. These solutions can however only be exploited to their full potential, if they are more adapted and adopted, disseminated and deployed in the various regional contexts. The need for **broader sharing of ITC-driven solutions and best practices** is imminent and increasing, to maintain and enhance the competitiveness of Europe's forest industry by transforming it to a forest industry 4.0.

Digitalisation is one of the most powerful drivers of change in all aspects of society. In forestry, it has the potential to enhance the information flows and the relationships between actors (owners, managers, authorities, workers, communities and society) at all steps of the value chain. It has the potential to improve decision-making, empower forest managers and workers to achieve greater sustainability and fulfilment of multi-functionality standards as well as improving efficiency and transparency. However, the adoption of digital solutions is generally slow and very uneven across Europe. Through its Roadmaps, ROSEWOOD4.0 identifies and supports the adoption of close to market solutions and the replication of success cases by stakeholders of the value-chain.

Throughout Europe, the challenges for a sustainable wood mobilisation are diverse and often a lack of specific knowledge leads to non-ideal solutions. However, international and interregional knowledge transfer offers the potential to improve this situation. Against this background, the ROSEWOOD4.0 project has initiated five regional Hubs throughout Europe bringing together 21 partners from 18 countries to steer the interregional knowledge transfer on sustainable wood mobilisation:

- Northern Europe: Finland, Sweden, Norway, Baltic countries, Denmark
- Central-West Europe: Germany, Belgium, France, Switzerland, Austria
- Central-East Europe: Czech Republic, Hungary, Poland, Romania, Slovakia, Ukraine
- Southern-West Europe: Spain, Italy, Portugal and South of France
- Southern-East Europe: Bulgaria, Croatia, Greece, Slovenia

These 5 communities within ROSEWOOD4.0 will facilitate wood mobilisation through mutual learning across European regions. ROSEWOOD4.0 builds on the insights and experience gained in recent research and innovation efforts and will implement specific activities to reinforce digitalisation of the forestry domain with a sharp focus in the most relevant innovation opportunities in the following areas which are highly impacting the sustainable wood mobilisation: (a) Engaging forest owners and overcoming land tenure fragmentation, improved forest planning and risk management, adapted silvicultural measures for increased multifunctionality and biodiversity conservation; (b) Design and maintenance of infrastructures, optimized forest operations and logistics for improved economic and environmental performance; (c) Organisation and transparency of regional wood markets; new business models and market arrangements; (d) Access to finance and business support, including through EAFRD measures and PES (payment for environmental services) type mechanisms; legal and fiscal regimes; (e) Education, training and skills development.

By creating adapted materials and extensively sharing technological and non-technological innovations, best practice cases and RDI results, **ROSEWOOD4.0 multi-stakeholders approach** closes knowledge gaps and creates new opportunities for economic partnerships within the whole wood mobilisation value-chain. ROSEWOOD4.0 focuses on tailored (user- and region-specific) **transfer of know-how and information** that enables and supports **stakeholders of the wood value-chain to exploit innovations and best-practices** and facilitates the capture of innovative ideas enhancing the development of the field. ROSEWOOD4.0 aims also to provide practitioners with development skills (educational and entrepreneurial) and facilitate organisational innovations leading to **novel exploitation actions** leveraging the uptake of new ideas and Best Practices in daily business.

The roadmaps presented here address stakeholders throughout Europe for facilitating the transfer of knowledge and collaboration between partnership regions. The roadmaps represent the collection, the analysis and strategic direction of the results from the five Hub regions including their validation. The main objective of the roadmaps on Hub level is to strengthen the regions through transfer of the gathered knowledge, experiences and circumstances. With the accurate description and assessment of well-functioning best practices and innovations as inputs, there is an active support in strengthening the local wood value-chain development thanks to newly developed digital tools. Further, the roadmaps enhance cooperations by increasing interactions between stakeholders and regions for creating opportunities to initiate further and new developments. Relying on networks, it supports the self-initiative and empowers the forestry to push new actions. For this purpose, the roadmaps highlight best practices and innovations (BPI) that have the potential to serve as tools for prosperous and sustainable wood mobilisation among European regions. ROSEWOOD4.0 has initiated a web-portal for presenting the best practices and innovations to the wider public and stakeholders. This way, new solutions can be incorporated and the transfer of best practices monitored. The roadmaps give readers insights into regional perspectives of wood mobilization, capitalizing on information and cooperation possibilities between European regions. By steering the knowledge transfer between the regions, the roadmaps aim to provide a European perspective on digitization issues in the forestry domain. In times of structural changes, a changing climate and new technologies, the ROSEWOOD4.0 Hubs can rely on a broad knowledge base from various countries for identifying suitable approaches for their regions. For this purpose, the roadmaps shall pave the road towards more collaboration between the regions, transfer of best practices and innovations meeting the needs of the regions. All this will further develop the ROSEWOOD4.0 network and strengthen the individual regions onto their path towards a sustainable wood mobilization and the transition to a bio-based economy in Europe.

2. Interregional Roadmap for the South-Western Hub

2.1 Description of the South-Western Hub region

The South-Western Hub's (SWE) aim is to find specific digital solutions and innovations that help increase the wood mobilisation rate in the region, and ease the management for a higher efficiency. Its focus is on sustainable wood resource management and the question how to serve both, the demands of the industry and the protection of the region's sensitive biodiversity, especially regarding the effects of climate change. Europe is full of solutions, sharing them through interregional cooperation is mutually beneficial.

The SWE Hub is formed by four partners from four different regions: Instituto Superior de Agronomia (ISA) from Lisbon (Portugal), Centre National de la Propriété Forestière (CNPF) from Aquitaine (France), Associazione Italiana Energie Agroforestali (AIEL) from Veneto (Italy) and Fundación Centro de Servicios y Promoción Forestal y de su Industria de Castilla y León (Cesefor) from Castilla and León (Spain). These are four regions with a high wood mobilization so they can act as leaders inside their countries:

Despite a strong potential in terms of wood volume, the region faces many challenges concerning the mobilization of wood due to very fragmented forest property and the threat of serious forest fires, pests and forest diseases.

Another common characteristic in the South-Western region is the complex orography with diverse climates that favour the rich flora, a wide variety of forest species different to manage with different needs for transportation and logistics, therefore, specific digital solutions are needed.

Challenges to wood mobilisation furthermore lie in the development of tools for the establishment of joint management models and the conception of more efficient utilization systems for low-value products, allowing their profitable use.

The forestry sector in *Castilla y León, Spain*, is one of the most important in the national context in terms of magnitudes, both in terms of production area, production and production potential, as well as the variety and type of products.

The regional wooded forest area amounts to 2,982,000 hectares, according to the most recent National Forest Inventory, to which must be added 1,825,000 hectares of treeless forest land, making a total of 4,808,000 hectares of forest area. In contrast, cropland totals 3,509,000 hectares, which in recent decades has been gradually decreasing as less productive land is abandoned.

Sub-sector	Primary production (€ million)	Industrial production (€ million)	Total (€ million)	% of total forest production
Pine sawnwood	55	121	176	26.07 %
Poplar wood	26	28	54	8.00 %
Board	40	212	252	37.33 %
Biomass	15	26	41	6.07 %
Total Wood products	136	387	523	77.48 %
Non Wood products	35	117	152	22.52 %
Total	171	504	675	100%

Table 1: Forest production in Castilla and León.

Forests	Economic significance
<ul style="list-style-type: none"> • 55 % forest area of Spain's surface territory • 36 % forest area with woods of the national total • 56 % of broadleaved trees, 37 % conifers, and 7 % mixed • Types of formations: 15 % of dehesas, 14 % holm oak forests, and 11 % Pinus halepensis forests • In terms of stocking, the two species that contribute the most cubic meters are still Pinus pinaster and Pinus sylvestris • In the last 10-12 years the timber volume has increased by 43 % • 28 % of forests are public forests • 72 % of forests are privately owned forests 	<ul style="list-style-type: none"> • Roundwood exports have increased from a deficit of over two and a half million cubic meters in 2000 to a peak surplus of just under one million cubic meters in 2020. • For both imports and exports, the highest economic value comes from paper and paperboard. In imports it accounts for 59 % of the total and in exports for 55 %

Production volume	Energy
<ul style="list-style-type: none"> • In 2018, 19.7 million m³cc were harvested, 12 % more than the previous year. • Softwood harvests exceeded 10.6 million and hardwood harvests exceeded 9 million • Eucalyptus and radiata pine are the main productive species • 97% of hardwood harvests were on private property and 89 % of harvests on public property were of coniferous species. • 1.32 million tons of firewood. 	<ul style="list-style-type: none"> • Bioenergy continues to be the sector with the highest wood consumption, 38 %, followed by pulp with 21 % and board with 20 % (considering roundwood plus equivalent roundwood that is burned from industrial wastes or by-products)
Employment	Sustainability
<ul style="list-style-type: none"> • 0.30 % of contracts in the primary forestry sector compared to the total number of contracts • 2.43 contracts in the primary forestry sector per 1,000 ha. of forest land. • 8,966 forestry businesses: • 3,865 forestry companies • 5,101 self-employed in the forest sector • 67,312 contracts/employment: engineers, qualified workers, laborers 	<ul style="list-style-type: none"> • 18.5 % of the total forest area is managed • Average increase of just over 140,000 ha/year for the last 12 years, representing 1.7 million hectares • 43 % of the public forest area is managed. • The area certified by PEFC in 2018 represents 12 % of the forested area and that certified by FSC 1.6 %. • The protected area represents 41 % of the total forest area, 40 % of the forested area and 41 % of the unlogged area. • 80 % of the Natura 2000 Network is forested and the percentage of forested area in Protected Natural Spaces is 87 %

Table 2: Spanish Forests in Numbers.¹

Forest covers one third of metropolitan **France**, with approximately 16.5 million hectares of forested lands. The diversity of landscapes and climates over the country creates a very diverse forest, most of which is dominated by broadleaved trees. Coniferous trees represent a third of the national forest and are particularly represented in plantation forests. A big part of the national forest (75 %) is privately-owned.

The New Aquitaine region, resulting from the fusion of Aquitaine, Limousin and Poitou-Charentes in 2016, is one of the first forest regions in France and hosts the largest man-made woodland of western Europe, the Landes of Gascony. In New Aquitaine, the forest has the originality of being owned by more than 90 % of private owners (250,000 owners of more than 1 hectares), representing 21 % of the surface area of the national private forest. The forest area in New Aquitaine is about 2.8 million hectares (17 % of the national

¹ Ministry for the Ecological Transition and the Demographic challenge (2018); Asemfo: National Association of Forestry Companies (2018).

Foreign trade of roundwood. Source: Ministry of Economy, DataComex, 2021.

forest). Forests cover 34 % of the region's surface area. The area of private forest managed according to a sustainable management document represents 30 % of the area with such a document at the national level.

The forest in New Aquitaine is very diverse in terms of species and stands. Hardwood trees (Oak, Chestnut...) occupy nearly 62% of the forest area (1.73 million hectares). Coniferous trees (Pines, Spruces, Douglas fir...) occupy 38% of the regional forest area, or 1.08 million hectares. The standing volume of the New Aquitaine production forest amounts to 383 million m³ (excluding poplar plantations). From forestry and logging to finished products and retail, the wood-forest sector plays an essential role in the local economy and job market: 28,300 establishments employ 56,300 people; 31,000 of whom work in the four main segments: forestry and logging, sawmill and wood processing, paper and board industry and carpentry work.

Forests	Economic significance
<ul style="list-style-type: none"> • 16.5 millions ha of forest land • +0.7 % of increase per year, +40000 ha/yr • 75 % privately owned forests • 25 % public forests • 166 m³/ha • 65 % broadleaved trees 	<ul style="list-style-type: none"> • EU 6st paper pulp importer • EU 5th firewood exporter • EU 3rd largest stock of standing timber • Mostly exporter rather than importer • Forest sector accounts for 12.7 % of industrial job market, at national level
Production volume, 2018	Energy
<ul style="list-style-type: none"> • 37.5 million m³ harvested per year • Approximately 25 million m³/year of firewood • Main production is lumber 	<ul style="list-style-type: none"> • Firewood consumption is 344000 GWh/yr • EU 1st consumer of wood for energy • Wood is 47 % of renewable energies in France
Employment	Sustainability
<ul style="list-style-type: none"> • 425,000 employees • 2/3 of the workers are in timber transformation, paper industry • 1.7 % of employment in France 	<ul style="list-style-type: none"> • 1.7 % of the forest is protected area • 35 % of forests certified PEFC, 8.2 million ha

Table 3: French forests in numbers.

Veneto is an Italian region located in the north-eastern part of the country, with a total area of 18,398.9 km², and a population of more than 4.8 million inhabitants.

The north–south extension of Veneto is 210 km from the Austrian border to the mouth of the River Po. By area, 29 % of its surface is mountainous (Carnic Alps, eastern Dolomites and Venetian Prealps).

The climate changes significantly from one area to another: while it is continental on the plains, it is milder along the Adriatic coast; around Lake Garda and in the hilly areas. The whole forest area covers more than 400,000 hectares, and managed forests cover an area of about 270,000 hectares. Private ownership is about 60 % of the regional forest area, and public ownership (70 %) consists mainly of high forests. In Veneto, the forest area is steadily increasing due to the abandonment of the traditional agricultural activities, forest

management is the fundamental tool to guarantee multi-functional ecosystems. The regional policy is focused on the concept of sustainable forest management: to guarantee natural ecosystem conservation and to supply multiple services.

Forests	Economic significance
<ul style="list-style-type: none"> • 10,982 ha total of forest land • +0.2 % increase every year for a total of 77,000 ha/yr • 41.8 % coppices • 34.4 % high forests • 66.2 % privately owned forests • 33.5 % public forests • Over a billion of m³ of woody biomass • 144.9 m³/ha 	<ul style="list-style-type: none"> • EU 1st firewood importer • EU 4th pellet importer • Net importer of timber products and pulp and paper • Export value of 5 billion euros • Total revenue of the second processing sector is 13 billion euros
Production volume, 2018	Energy
<ul style="list-style-type: none"> • Harvesting levels between 18 % and 34 % • Approximately 8 million m³/year • 60 % of production is firewood 	<ul style="list-style-type: none"> • Energy production: 4 TWh (source TERNA) for 1.4 % out of all renewables • Heat production 86 TWh (elab. RSE),for a total of 24 % of domestic heating requirements
Employment	Sustainability
<ul style="list-style-type: none"> • 1 forest worker/2000 employees • Average dimension of a forest enterprise is 2 employees • 6471 forest enterprises in total 	<ul style="list-style-type: none"> • Approximately 3000 CoC in Italy for timber products • Approximately 4000 certified (FSC and PEFC) enterprises

Table 4: Italian Forests in Numbers.²

Forests in **Portugal** cover 3.2 mill. hectares of the country (36 %) with cork and holm oaks, managed as multifunctional systems, covering 1/3 of the forest area.³ Portugal is the European country with the highest share of privately owned forests (97 %). Despite small-forest owners playing a significant role in the management of the country's forests, the majority of certified forests (81 %) are managed by two large pulp and paper industries.

² Rapporto sullo stato delle foreste e del settore forestale in Italia (RaF) 2017-2018 (2019), accessible online: <https://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/19231> (17.06.21).

³ ICNF, 2019. IFN6 – 6^o Inventário Florestal Nacional, 2015 Relatório Final. Instituto da Conservação da Natureza e das Florestas, Lisboa, 284 pp.

The small-sized fragmented properties originated a slow increase in sustainable forest management certification. By 2019, forest areas certified under FSC® and PEFC™ covered 473200 mill. hectares and 288300 hectares, respectively.⁴ However, certified maritime pine area is estimated in 4.5 % and 2.3 % by FSC and PEFC respectively, making it possible to have the same area certified under the 2 different schemes.⁵

National forests have a limited number of tree species with considerable representativeness. According to the last NFI Eucalypt (26.2 %), maritime pine (22.1 %) and cork oak (22.3 %) dominated stands are the most representative tree species, followed by holm oaks (10.8 %), stone pine (6.0 %), other oaks (2.5 %) and chestnut (1.5 %).³ Pine and Eucalypt forests, the traditional wood production species, cover around 77 % of the forests North of the Tagus river and 25 % of the forests to the South, where multifunctional agro-silvopastoral systems (holm and cork oaks) represent close to 55 % of the forest area. Typically, eucalypt and pine forests to the North are small-sized (~ 0.5 hectares) and characterized by fragmented ownership. Pine forests are mainly composed of maritime pine with stone pine share (managed for fruit production) increasing to the South. The southern part of Portugal is characterized by large holdings where wood harvesting and extraction (resulting from thinning and pruning) from oak and stone pine stands only takes place on a small scale being used as fuelwood by local populations and for charcoal. Forest areas managed by private non-industrial owners lack professional forest management throughout the country.

The National Forest Inventory is carried out every 10 years and is in its current 6th cycle (reference year 2015) with the aim of producing national and international statistics and assisting policy-making strategies. Forest management must be in line with the regional forest management plans (PROF) developed for 7 different regions in Portugal: 2 in the north, 3 in the center and 2 in the south.

The major disturbances affecting Portuguese forests are pests and diseases and recurrent wildfires. The inland forests of pine and eucalypt in central Portugal were severely damaged after the wildfires in June and October 2017 that took place while the second revision of the PROFs was in course. These fires triggered the development of several instruments for the recovery of burnt areas such as the Landscape Transformation Program that considers a mid-term transition from the existing landscape toward resilient forests focusing on the economic valuation of all ecosystem services. The funded program aims to operationalize changes on Integrated Landscape Managed Areas (AIGPs) covering areas from the North of Portugal to the Tagus river Portugal.⁶

In 2016, total harvests rose up to 11985000 m³ (underbark) with 9144 000 m³ of hardwoods harvested wood.⁷ Portugal is among the top European producers of pulp and paper having produced 2.8 mill. tons of pulp and virgin fibers and 2 mill. tons of paper, cardboard and tissue in 2019.⁸ In 2018, the forest sector contribution to GVA was 2471 mill. € (1225 M€ maritime pine, 895 mill. € eucalypt and 351 mill. € cork oak).⁹

Forest area is the predominant land use in the Centre Coastal PROF region (48.3 %) followed by shrubs and pastures covering 23.6 % of the area. In 1991, the population was close to 1,400,000 but by the end of the

⁴ CELPA, 2019. Boletim Estatístico 2019 – Indústria Papeleira Portuguesa, Associação da Indústria Papeleira, Lisboa, 112 pp.

⁵ Calado N., Porta M., Carneiro S., Teixeira P. (2020). Política de apoio ao investimento para o Pinheiro-bravo no horizonte 2021-2027 e 2028-2034. Centro Pinus,84 pp.

⁶ <https://www.dgterritorio.gov.pt/paisagem/ptp/prgp> (18.06.2021).

⁷ INE 2018. Estatísticas Agrícolas 2017, Instituto Nacional de Estatística, Lisboa 2018

⁸ CELPA, 2019. Boletim Estatístico 2019 – Indústria Papeleira Portuguesa, Associação da Indústria Papeleira, Lisboa, 112 pp.

⁹ Calado N., Porta M., Carneiro S., Teixeira P. (2020). Política de apoio ao investimento para o Pinheiro-bravo no horizonte 2021-2027 e 2028-2034. Centro Pinus,84 pp.

decade migration to coastal and urban areas led to the aging and abandonment of inland areas. Over the last 2 decades, agricultural land has been converted to forests, particularly in fertile areas. However, small-scale agriculture abandonment has mostly contributed to the shrubs and pastures increase. Private and communal ownership represents 90 % of the ownership structure and public forest areas cover 9.7 % of the region with an average property size between 1 and 2 hectares.

Before the 2017 wildfires, maritime pine covered 324100 hectares, (34.1 % of forest space), eucalypt 254450 hectares (26.8 % of forest space). Maritime pine and eucalypt forest stands are mostly pure (81 % and 87 % respectively). Timber, sawn-wood and pulp are the most important forest products in the region. Forest productivity ranges between 3-11 and 7-16 m³ ha⁻¹ yr⁻¹ for maritime pine and eucalypt, respectively; with the latest reaching higher productivity in some areas. Despite the importance of the forest sector, GDP evidenced fluctuations over the last 2 decades. Total forest value was estimated in 125 x 10⁶ €, with the biggest contribution from wood production (70 %), followed by protection functions namely along the coastline (9.4 %), biodiversity (6.9 %), desertification combat (4.4 %), pastures (3.0 %), game management (3.0 %), wild mushrooms aromatic and medicinal plants (2.0 %). The contribution of other products/functions (e.g. resin, honey, water regime) is marginal.

Forests	Economic significance
<ul style="list-style-type: none"> • Forest land, 2015: 36 % of Portugal • Total volume in forest, 2015: 172.6 mill. m³ (38.5 % maritime pine, 25.1 % eucalypt) • Protected land (Natura 2000), 2015: 599800 ha • GVA of the Portuguese forest sector, 2016: 0.5 % • Over the past 100 years, Portuguese forest area increased by 2.584 mill. ha 	<ul style="list-style-type: none"> • Europe's 3rd largest exporter of pulp and 2nd top producer of paper and uncoated paperboard. ¹⁰ • Export value, INE 2017: € 4 896.5 million € • 37.8 % paper and cardboard, 13.3 % pulp, 12.2 % wood, 14.4 % furniture, 20.1 % cork • Forest sector contribution to GDP: 2471 M€ (1225 M€ maritime pine, 895 M€ eucalypt, 351 M€ cork oak) ¹¹
Production volumes ¹²	Energy
<ul style="list-style-type: none"> • 2017: Paper and cardboard (2095200 tons) • 2017: Pulp (2752900 tons) • 2017: Sawn wood (848016 m³), wood panels (1129000 m³), Pellets (709218 tons) 	<ul style="list-style-type: none"> • 2017: 4th EU country with the highest share of Renewable Energy Production (39.7 %), (22 % wind, 11 % hydroelectric power, biomass ~5 %) • 2018: Primary energy consumption: renewables represent 24 % with biomass taking the lead (49 %) followed by hydroelectric (22 %) and wind (21 %)

¹⁰ CELPA 2019. CELPA, 2019. Boletim Estatístico 2019 – Indústria Papeleira Portuguesa, Associação da Indústria Papeleira, Lisboa, 112 pp.

¹¹ Calado N., Porta M., Carneiro S., Teixeira P. (2020). Política de apoio ao investimento para o Pinheiro-bravo no horizonte 2021-2027 e 2028-2034. Centro Pinus, 84 pp.

¹² <http://www2.icnf.pt/portal/florestas/fileiras/econ#relatorio-sintese>.

Employment ¹²	Sustainability
<ul style="list-style-type: none"> 2016: 68700 employees in forestry (94300 if trading activities are included) 	<ul style="list-style-type: none"> In order to promote the economic valuation of forest under sustainable management targets according to the criteria and indicators approved at the 3rd ministerial conference (1998), the Portuguese government, at national and regional level, recommends forest owners to implement Sustainable Forest Management Plans in their areas which must be developed in accordance with the specifications in the Regional Management Plans defined. Additionally, certification ensures meeting a set of criteria and Indicators for Sustainable Forest Management. In 2019, certification systems currently in use in Portugal were the PEFC (288300 ha) and FSC (473200 ha). Over the past decade FSC has been increasing its area (250000 ha in 2010).

Table 5: Portuguese Forests in numbers.

2.1.1 Political Targets for Wood Mobilisation and Forestry

In *Castilla y León, Spain*, the Forest resources mobilization program is based on the following principles of action:

- Diversification and complementarity of production and forest functions;
- Business internationalization and opening up to the global market. Integration of the region into the commercial forestry development pole of Southwest Europe (SUDOE region) and, more specifically, into its Atlantic Arc. Commitment to quality and sustainability as a production strategy, seeking final productions with greater added value and ecological orientation;
- Importance of traceability links between stakeholders in the sector and integration into value chains;
- Clarity, simplicity and strength in regulatory frameworks; and
- Sectoral transparency and improvement of commercial information.
- Forest-based sector Technology Platform (FTP) 2040.
- Mature forests protection combined with forest management.
- Ministry MITECO strategy of long-term Decarbonization (ELP 2050)

In addition, the national Ministry of Agriculture, Fisheries and Food developed **PASSFOR** (Plan for Socioeconomic Activation of the Forest Sector). The objective of the plan is to profit from the forest sector ability to promote socioeconomic activity. Despite its relevance, it is not fully implemented due to lack of vision and knowledge at the political and administrative levels. It is necessary to continue evaluating and reviewing the development of projects, strategies and policies, establishing clear purposes and agreements.

The wood resource and industry is very important in the *New Aquitaine region, France*. Softwood lumber accounts for 50 % of the harvest, pulpwood and energy wood for 39 % and 11 % respectively. New Aquitaine is France's leading surplus region in terms of external trade, with nearly 250 million euros released in 2016. Primary transformation (sawmill industries, wood-based boards and pulp) produced 11 million tons of goods in 2014. Secondary transformation produced more than 20 million tons of wood and paperboard products in

2014, 70 % of which goes to the paper industry. As with pulp, the furniture industry's resources come from both domestic production and imports. Wood waste is used to supply the wood-energy sector, which has seen rapid growth over the period: the production of wood pellets reached a peak of 1 million tons in 2014.

With this in mind, the two main political axes for wood mobilization are:

- 1) strengthening the competitiveness of the sector, and
- 2) stimulating silviculture and sustainable forest management.

Indeed, strengthening the competitiveness of the forestry sector is essential to enhance the value of local wood resources and create jobs in rural areas. This involves supporting companies in their positioning on new markets, stepping up research and innovation, and finally encouraging partnerships between stakeholders. Concerning sustainable forest management, the diversity of forest areas and species implies a diversity of silvicultural practices. Hardwood forests generally have little wood mobilization, while softwood forests are managed more intensively. The stimulation of silviculture in New Aquitaine's forests must include sustainable practices to tackle the challenges due to the multiple functions of the forest. Boosting sustainable management requires complementary actions, such as reinforcing present efforts and certification of sustainability, grouping forests, and updating the silvicultural techniques and education for forest owners.

These political targets of sustainability together with competitiveness are encouraged by the 2020 recovery plan ("France Relance") presented by the French ministry for agriculture and food. Thanks to this plan, financial support will be given to forest owners and operators who wish to invest and adapt their forest to climate change in the year 2021 and 2022. This concerns poor, unmanaged or vulnerable forest lands, and the requirements include for example that 20 % of the forest should be diversified for surfaces above 10 hectares. Moreover, New Aquitaine contributes to mitigating climate change in additional ways. Plantation forests offer a resource and substitute for other more carbon-producing materials. and mixed hardwood forests are more likely to store carbon in the forest ecosystem. The adaptation of the forests of New Aquitaine is a major concern because they are at the interface between the temperate zone and the Mediterranean zone, with species at the edge of their range and would therefore be particularly sensitive to climate change.

The regional forest policy *in Veneto, Italy*, can be summarized in the following five main objectives:

- To improve the competitiveness in the long-term of the forest sector through the sustainable use of forests
- To maintain and increase the protection function to tackle natural hazards (wind, snow damage, flood...) due to climate change and human pressure
- To protect biodiversity, preserve landscape and enhance carbon sequestration and ecosystems health
- To increase the social and cultural value of forests
- To improve the coordination and relation between regional/local authorities and stakeholders

Starting from these objectives, four main priorities have been identified:

- structural priorities,
- conservation and preservation priorities,
- defence of the territory priorities, and
- coordination priorities.

In the Centre Coastal PROF region of *Portugal*, forest policy is implemented through the corresponding Regional Forest Management Plan (PROF) defined as a sectoral instrument for territorial management¹³ establishing specific norms for the use and exploitation of forest areas. PROFs aim to evaluate the potential dominant use of forest spaces by defining the list of species to be prioritized in afforestation and reconversion

¹³ Forestry Policy Law 33/96 of August 17 regulated by Decree Law 16/2009 of January 14.

programs and proposing the most suitable forest management models and silvicultural prescriptions. At a higher scale, the “Landscape Transformation Program” comprises a strategy for an integrated intervention in fire-prone forestry areas with the aim of potentiating the economy in rural areas creating resilient forests through cooperative and participative approaches. This program was planned to address different targets:

- Integrated Landscape Management Areas - assist in the development of a grouped management model under the responsibility of a management entity and supported by a long-term multi-fund program that provides support for initial investment, maintenance and management actions over time and remuneration of ecosystem services.
(to be implemented by local administrations, forest owners associations, etc)
- Village Condominium Program - encourage owners to change the use and occupation of the land and the management of fuels around the settlements while promoting an income-generating land occupation.
(based on a strong participatory component and involvement of the local community)
- Land Consolidation for Planning - encourage an increase in the physical size of rural properties and thus give more scale to the properties, contributing to the economic viability and sustainability of farms that are or will be established there. The program introduces management and investment factors in rural properties, with direct positive impacts on the resilience of the territories and on the dynamization of agroforestry activities.

The Centre Coastal PROF region comprises priority areas for the operationalization of the “Landscape Transformation Program” where some projects are already ongoing and more are expected until 2025.

2.1.2 Structures of Decision Making

In *Castilla y León, Spain*, decision-making is performed at two levels: national and regional (Autonomous Community of Castilla and León). On the national level, the Ministry of Agriculture, Fisheries and Food is the competent entity for the all the forestry issues, whose Directorate-General of Rural Development, innovation and forestry policy has specifically the following competencies:

- The promotion and development of the competences of the Department in matters of innovation and knowledge systems and innovation;
- To develop the functions of the Department in the area of digitization, and of the digitization agenda;
- To exercise the competences of the Department in terms of training, advice, exchange of knowledge and information for professionals, as well as the promotion of new technologies;
- The development of the competences of the Department in rural infrastructures of general interest and, in particular, the planning, coordination, implementation, modernisation and monitoring of irrigation plans, rural communication infrastructures, forest fire prevention and other types of infrastructure; as well as emergency actions and repair of catastrophic damage, produced in the field of action of the Directorate;
- The functions attributed to the General State Administration by the legislation on forests and forest harvesting, and in particular the deployment of state resources to support the autonomous communities for the coverage of fire-fighting forests.

On the regional level, the *Junta de Castilla y León (JCYL)* is the regional government. As a part of the government, the General Directorate of the Natural Environment of the Department of Development and Environment is responsible for the industrial and commercial promotion of products derived from forests. It is also competent in the planning and programming of forest policy and in the management of forests and forest uses, and it is responsible for both the administration of forests owned by the Autonomous Community and the management, in agreement with the owners, of public forests.

In addition, the Department promotes relations between the forest production sector and the industry dedicated to the first processing of forest products, and is responsible for the Registry of Forest Enterprises and Industries.

The *Junta de Castilla y León* has developed the Castilla y León Forest Plan and specifically the **Castilla y León Forest Resources Mobilization Program**. Its first objective is to increase the value of sustainable production, the productivity of the forests and the sector in the region. This would improve the main economic and employment parameters linked to the regional forestry sector.

For the *New Aquitaine region*, many French laws and regulations govern forest policy. Introduced by the Law on Management, Agriculture and Forestry in 2014, the National Forest and Wood Programme sets out the orientations of forestry policy in public and private forests for a period of ten years. The four main goals are:

- Create value in France by mobilizing the resources in a sustainable way
- Meet citizens' expectations and integrate them into territorial projects
- Combine forest mitigation and adaptation to climate change
- Develop synergies between forest and industry

Each region must develop a Regional Forest and Wood Programme within 2 years of approval of the national plan, under the aegis of the Regional Forest and Wood Commission. The law on Energy Transition for Green Growth (2015) also helps to mobilize more resources under sustainable conditions thanks to several programs and strategies, namely the Multi-year Energy Programming, National Low Carbon Strategy, and the National Biomass Mobilization Strategy.

A significant proportion of national measures are divided into regional strategies in order to adapt to specific territorial characteristics, but also to resonate with the competences of local authorities, and regional councils. The Regional Forest and Wood Programme should serve as a framework for ensuring consistency between all other regional documents. Regarding *Italy*, the Italian Constitution states that the Regional Government has direct legislative competences, thus allocating resources, fostering innovation and selecting innovative projects and initiatives on its own initiative. In addition, the implementation of a National Law for forests (TUFF – Testo Unico Forestale) that will implement new national regulations is under preparation on the national level.

In *Portugal*, the Instituto da Conservação da Natureza e das Florestas (ICNF), integrated in the Ministry of Environment and Climatic Action, is the forest authority, with much of the supervision delegated to the 5 regional offices distributed across the country. However, the Landscape Transformation Programme, comprises instruments for landscape management, and consequently forest management, that aim at combining efforts from different entities (allocated to the ministries of Agriculture and Fisheries, Environment and Climatic Action and Civil Protection).

2.1.3 Main actors in forestry in the South-Western Hub

The main actors in the public sector for *Castilla y León, Spain*, are:

- Directorate General of the Natural Environment of the Department of Development and Environment in Castilla y León
- Ministry for the Ecological Transition of Spain
- Sociedad Pública de Infraestructuras y Medio Ambiente de Castilla y León, S.A (SOMACYL).
- Regional Energy Body (EREN)

Regarding associations, the main institutions are:

- Regional Federation of Municipalities and Provinces of Castilla y León

- Mesa Intersectorial de la Madera de Castilla y León
- CEMCAL

The main nonprofit organizations (NGOs) are:

- FAFCYLE
- CESEFOR

In terms of Universities, the main actors are:

- University of Valladolid
- University of León
- Catholic University of Ávila

The main actors in the wood industry are both large and small companies: (Losán, Maderas García Varona, Maderas Pascual Vinuesa, Pallet Tama, Maderas HTM, etc.)

The public institutions serving the State in the *New Aquitaine Region, France*, are the Regional Directorate of Food, Agriculture and Forestry (DRAAF) and the Departmental Directorates of the Territories (DDT). The organizations that implement public policies related to sustainable forest management are:

- CNPF: the National Forest Ownership Center, a public institution under the supervision of the Ministry of Forests in charge of developing sustainable management of privately owned forests.
- ONF : the National Forestry Office of France, a public industrial and commercial institution created which manages nearly 11 million hectares of public forests, owned by the State and local authorities.

The main actors of the forestry sector are independent groups of forestry contractors, cooperatives and forestry experts. Sawmills also play a big part in the industry. Professionals' education and forestry development is taken care of by IGN (National Institute for Geographical and forest Information), FNB (National Wood Federation) and interprofessional associations such as FIBOIS. Different bodies carry out research on forest and innovation, the most important one being INRAE (National Research Institute for Agriculture, Food and Environment).

As for *Italy, Veneto*, the main actors are:

Universities/RTOs:

- University of Padua – TESAF
- CREA
- University of Florence
- University of Tuscia
- CNRIVALSA
- ISPRA

Other Public Bodies at National level:

- Environmental, Agrifood and Forestry Police army (Comando Unità per la tutela forestale, ambientale e agroalimentare - Carabinieri)
- Guardia di Finanza (National Finance police force)
- Italian Ministry of Agriculture – Forest Directorate
- Accademia dei Georgofili
- SISEF

- Accademia di Scienze Forestali
- Fire brigades

Other Regional actors:

- Unione dei Comuni
- Parchi regionali
- Parchi nazionali
- Cooperatives
- CIFORT
- Veneto agricoltura

Other private actors:

- Forest owners and enterprises' associations
- Forest industry actors
- Private associations (Confartigianato, Confagricoltura etc etc)
- Compagnia delle Foreste
- FederlegnoArredo
- FederForeste
- CONAIBO
- UNCEM (Unione Nazionale dei Comuni Montani)
- AIEL

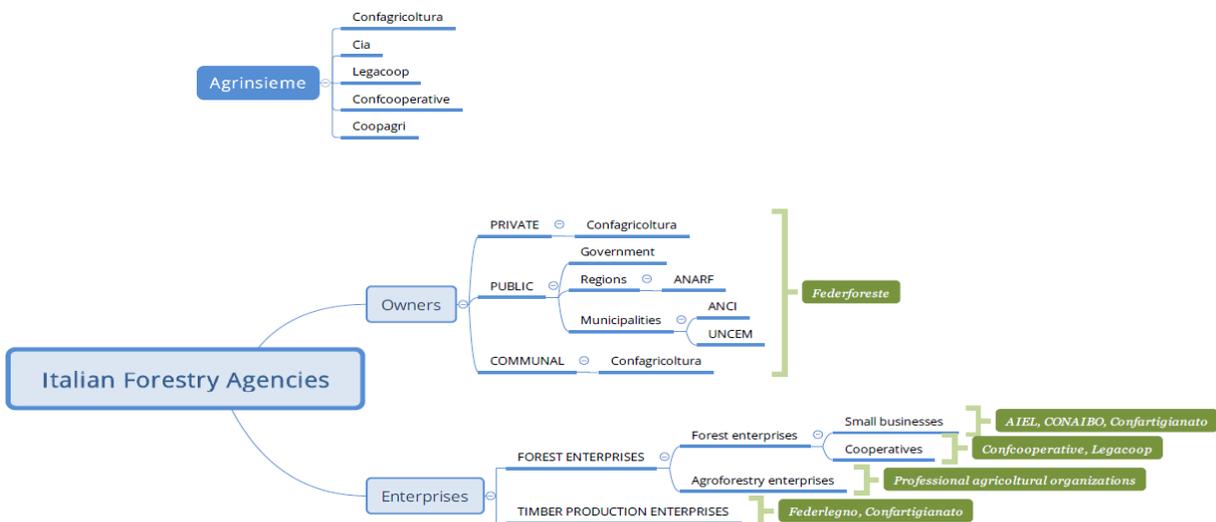


Figure 1: Main forestry actors in Italy.

The main actors in the forestry sector in *Portugal* are the following.

Forestry companies:

- ALTRI Florestal, the Navigator Company, Sonae-Arauco, Unimadeiras

Forestry Associations: services for forest owners

- Forest Owners Associations (including unions of associations e.g. UNAC, FORESTIS), Forest Intervention Zones (ZIFs), Portuguese Pulp and paper Companies Association (CELPA), Portuguese Wood and Furniture Industries Association (AIMMP)

State Forest Enterprises:

- Companhia das Lezírias, Floresta Atlântica, GESFLOPOR

Supervisor of the Forest Act, education of forestry professionals, forestry development:

- Instituto da Conservação da Natureza e das Florestas (ICNF), integrated in the Ministry of Environment and Climatic Action
- The forest guard's training is under the responsibility of several entities including universities who are also responsible for the organization of workshops promoting the use of forest simulators to assist forest managers. Adding to universities, other entities such as CELPA promote the organization of technical events to disseminate knowledge among private owners.

Forest Research Centres:

- There are several research centres linked to forestry mostly associated to Universities (e.g. CEF/ISA, CEABN). RAIZ, the research institute of The Navigator company is also responsible for forest research as well as the National Institute for Agricultural and Veterinary Research (INIAV) that is also dedicated to research in the field of forestry systems.

Educational Institutes:

- University of Lisbon, School of Agriculture (BSc; MSc, including an international Master; PhD). Other universities, institutes and schools are also responsible for education in the field of forestry or related (e.g. University of Vila Real, Escola Superior Agrária de Castelo Branco, Escola Superior Agrária de Coimbra, Universidade de Évora, Instituto Politécnico de Bragança, professional schools). The educational level in these institutions has been changing over the past years as a result of the decrease in the number of students.
- Clusters: Out of a total of 113 Operational Groups, 8 are related to forestry and can somehow be related to wood mobilization. As for Competences' Centres, the Centre of Competences for maritime pine aims primarily at increasing wood production to meet the demand. There are other 3 Competence Centres with aims that can be indirectly related to forestry/wood mobilization (out of a total of 22 Competences' Centres).

2.2 Main findings

2.2.1 SWOT-analysis

All the four regions were first analyzed in local SWOT-analysis with the advice of expert advisors and partners, merging to one joint SWOT analysis for the South-Western Hub:

<p>STRENGTHS</p> <ul style="list-style-type: none"> • Large forest areas including potentially productive ones in the future • Different forms of grouping of owners (France) • High mechanization for harvesting wood in softwood stands • Strong network of forest roads • Abundance of raw materials and large extension of forests (availability and diversity) • Certificated forest • Great value of biodiversity in the Mediterranean environment • Multifunctional raw material • Strong industrial network in certain areas • Tax incentive and forest investment (France) 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Fragmentation and disconnection of private forest ownership • Lack of interrelation between the different actors in the supply chain • Little mechanization for hardwood harvesting • Difficulty of access to raw material • Lack of demand, especially for hardwoods and quality softwoods • Lack of management in large areas of forest • Public opinion against forest production • Lack of qualified forestry labor • Poor structuring of market • Poor development of value chains at the local level • Lack of market transparency • Imported wood used for construction and furniture • Too many administrative constraints
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Tax benefits: tax credits for the purchase of plots of land (France) • Possibility of integration with the agricultural food production (agroforestry) • Availability of new collection systems more efficient and sustainable • Very specific but very high value productions (cooperage) • New market requirements: traceability of wood, wood from sustainably managed forests • Bio economy in general and the growing social demand for renewable natural products that contribute to the fight against climate change • Growing offer of technified products, good solutions, a big change in the last 20 years. • Market internationalization • Public policy for the development of wood in construction and other uses • Increase of wood demand • Development of new wood-based products • EU Directive on the use of biomass that supports new biofuels production, second generation biofuels. Opens opportunities in biorefinery. 	<p>THREATS</p> <ul style="list-style-type: none"> • New forest owners live far from the forest • Supply difficulties in small-scale, low-volume businesses • Public aid not sufficient to trigger work in poor stands • Increased susceptibility of forests to natural disasters linked to intense and particularly destructive climatic events • Increased biotic and abiotic adversities • Restrictions on wood mobilization in protected areas • Competition from new industrial countries • Reduction in the public budget for forestry

Table 6: South-Western Hub SWOT.

Based on the SWOT analysis, the following categories have been identified as critical for the South-Western Hub:

- **Forest Management:** Ownership structure and land tenure (fragmentation, urban areas...); Cooperation of owners/foresters, supply chain; Mechanization; Digitalization (digital networking); Access to terrain; Resource (wood); Sustainability concerns; Environment / Biodiversity; Forest management skills
- **Harvesting and logistics:** Mechanization; Availability of skills and personnel; Wood logistics
- **Infrastructure:** Forest roads (construction and management)
- **Markets:** Wood sale market; Development of new wood products; Market fluctuations; Wood-processing sector (construction, furniture...); Networking
- **Legal framework:** Enabling legislation for ownership

2.2.2 Best Practices and innovations identification

The South-Western Hub has identified best practices and innovations (BPI) related to wood mobilization in the involved countries. Most of them are related to **forest management**, probably the more active part within the wood mobilization value chain. **Cooperation among owners** and/or foresters, **technical developments**, **wood resources** and **sustainability** were the most common issues addressed by the best practices. Wood logistics and wood sale markets are other topics that have been researched in the Hub. On the other hand, legal framework, financing, education and training do not present relevant best practices or innovations, also weaknesses as mentioned above.

<i>Country</i>	<i>BPI Title</i>	<i>Description</i>
Spain	Cross-Forest	Cross-Forest aims to develop Digital Service Infrastructures – DSI – services, to integrate models supporting forest management and forest protection, oriented towards: (i) forest fires control through precise information on combustible materials, forestry maps and propagation models that need HPC resources to run properly and (ii) forestry evolution models on Country-Level. The foundations of those services will be forestry and GIS datasets that come from Portugal and Spain.
Spain	SISREP	Information system for the afforestation of agricultural land for Castilla y León gathering data from inspections in agricultural land afforestation. Objectives: 1. Create an information system that (1) improves data collection with mobile terminals, (2) digitally stores information in easily maintainable formats, and (3) provides advanced tools for consultation, updating and operation. 2. Use the knowledge of historical "in-situ" visits to predict the probability of success of future plantations using automatic learning techniques.
Spain	Forest LiDARioja	Updating and enhancement of forest information in La Rioja obtained from remote sensors: LiDAR and satellite data. Creating an updated cartography of the main forest species in La Rioja, collecting data such as the volume of wood, tree heights and vegetation structure for every 25x25m of land, with a very high level of resolution.
Spain	C.A.F.E	C.A.F.E. (Carbon, Aqua, Fire & Eco-resilience) is a Decision Support System for a multiple-criteria forest management. This tool determines the optimum

		silvicultural activities to manage multiple products, goods and services. It allows selecting the optimum solution while answers the four main questions of forest management: How much? Where? When? And How? In other words, the management intensity, forest working units selection, frequency and type of management (thinning/plantation).
Spain	CHAINWOOD	Blockchain for Inmutable Timber. The ChainWood operational group brings together the capabilities of the timber and forestry sector with companies and technology centers to develop software based on blockchain and IoT technology that will contribute to improving traceability, competitiveness and efficiency in the sector.
France	Je me forme pour mes bois	“I’m training for my woods” is a forest vulgarization website intended for private forest owners, teachers as well as the general public. It contains simple and attractive educational tools to learn about good management and protection practices for private forests in France. Topics cover administrative procedures, knowledge on forest management, understanding the wood market, and the content includes videos (5-10min).
France	NEOSYLVAQ	The project aims to use new technologies to make the wood sales system economical and dynamic, and to better spread information to increase wood mobilization and get forest owners involved in management. Two tools are available: a computerized wood auction sale system coupled with an online sales platform (SYLVATRADE) and a digital GIS data sharing platform for optimized management accessible to all stakeholders (NEOSYLVAQ).
France	La Forêt Bouge	The aim of this platform is to propose a simple tool with adapted services for the novice forest owners and allow the mobilization of wood from small private forests. Professionals in the forest and wood sector will also be able to access it to find information on the legislation and manage forest worksites by completing online procedures.
France	CLIMAFOR	As forest carbon issue has an increasing importance in France, Climafor is a software that allows advanced calculations on carbon rates based on production tables and coefficients. Improving through continuous updates, this software is time-saving, instantaneous and requires no training.
France	Sylv’valor	Sylv’valor is a pilot project aiming towards a better valorization of the forests of New Aquitaine. Its two main axis are better documenting and understanding of the ecosystem services provided by the forests, experience of owners, and creating experimental forests (living labs) to try out different ways of working with ecosystem services in an innovative way.
Italy	IT FOR II	Online marketing platform for local/regional wood supply chain. Municipalities and forest owners together with forest enterprises can sell their timber to the forest industry. Different sections will be available in the platform such as biofuels, roundwood, broadleaves and conifer. The platform will give the possibility to register and to place a bet in the auction.
Italy	LegnOK	LegnOK is a web platform that helps in the traceability of timber. The platform itself will provide the registered enterprise useful information about the Risk

		Assessment and will help the enterprise on how to roll a proper Risk Mitigation activity.
Italy	LogistiCIPlus	High efficiency logistic solutions for biomass sector. The efficiency of the process goes through the emission of GHGs that are continuously measured. Given this data the aim is to provide policy makers and local managers a specific and punctual analysis on the situation in order to: 1) Improve the logistics structures of the area 2) create a weighted biomass demand starting from the biomass offer.
Italy	RILEGNO	National wood waste collection and recycling platform. In Italy used and treated wood are considered waste and hardly can be reused becoming an expense for most forest industries. The RILEGNO system collects used and treated wood in order to recycle it, reuse it or refurbish it.
Italy	WoodChain	The project, coordinated by Replant srl, aims at testing the application of Blockchain technology in the frame of a PEFC certified supply chain in Piedmont Region. The solution can be applied both as part of the obligations of Due Diligence and in the PEFC Chain of Custody management
Italy	Cippato Calibrato	“Cippato calibrato” is a new type of woodchip specific for small scale boilers and stoves. The material is dessicated, sieved and dedusted in order to have a high quality and homogeneous material. The product aims to have a niche in the firewood market on a small scale bound to the forest operator that is technically able to produce that type of material.
Portugal	Areas Florestais Agrupadas	Small-size private-owned unmanaged forest areas are common in the North of the Tagus River in Portugal, making them prone to wildfires, pests and deseases. This program promotes the grouping of contiguous areas for management purposes with the overall aim to reduce the occurrence of hazard, improve and increase well-managed areas, increase investment and reduce investment risk.
Portugal	e-globulus	The project aims at technical and scientific knowledge transfer on silvicultural practices of eucalypt stands to forest owners and managers. The forest owner has to register to the platform in a process that involves only 3 steps. First, the owner adds his property delimiting it directly on Google Maps or importing a shapefile. Second, he is asked to characterize his property and forest (e.g age stand rotation, soil details, topography). Finally, he is asked to specify if he wants to establish a new stand or maintain an existing one and he is immediately provided an immediate technical prescription.
Portugal	FCTools & SIMfLOR platform	SIMfLOR is a platform that integrates several simulators developed for the main portuguese forests species. The platform aims to encourage users from research fields, managers and owners to make use of the forest growth and yield models in user-friendly way. Different stand and regional level simulators have been integrated in a common environment as well as other tools.
Portugal	Forscope	The Forscope is a prototype of an advanced planning system whose main functionalities include: (i) a digital marketplace for non-used forest-based

		biomass; (ii) support supply chains design; (iii) support the optimization of logistics processes; (iv) planning and control of operations from forest-to-mill.
Portugal	Limpa e aduba	Program integrated in the Better Eucalypt project. The forest owner applies and a forestry technician then visits him. Afterwards, he carries out weed control and shoot selection operations according to sustainability principles. The Program offers the forest owner the fertilizer as well as financial support for the fertilization service. In order to have his application approved the owner has to meet some eligibility criteria, e.g. pure even-aged eucalyptus between 2 and 6 years not past the 3rd rotation with proper stand densities (> 800 living stumps / ha), covering areas > 0.25 ha per plot but that don't sum-up more than 25 ha in total.

Table 7: Most relevant BPI from SWE Hub.

2.2.3 Needs Analysis

The following needs and problems have been detected as common in the 3 regions of the South-Western Hub:

- The general wood mobilization problem could be summarized by the diagnostic “prices are still too low”. To overcome this strong constraint, there are many practices addressed to improve the valorization of forest products, integrating them in the bioeconomy new production cycles. It is a priority to develop ways to increase the added value through the forest supply chains, including the biomass for energy.
- There is a strong need for professional agents offering forest management services (as part of a rural land management policy) addressed to owners that are more and more absent or far from the territory. Small forest owners’ aggrupation is a need to this end.
- An important degree of standardization is needed regarding the offer description. It is essential to have European common requirements of forest workers’ competences to be qualified and mutually recognized.
- As a major market problem, the crisis of quality timber sawmills has been identified as an essential challenge for wood mobilization.
- Some tax policy problems have been pointed out, such as the lack of taxation on the abandonment of land or the fiscal regimes that penalize companies offering management services to forest owners.
- Funding problems are a main constraint to forest mobilization, and the role of CO2 funds needs to be developed. This lack of financial resources also affects forest research in the fields related to forest products mobilization.
- There is a lack of intersectoral communication or joint actions, particularly in the Italian and Spanish cases. The French initiative FuturBois might be a reference to be used in the Hub.
- Lack of communication with society.
- The abandonment of the rural environment leads to the evolution of a series of vegetation that can cause disasters in case of fire and hydrogeological instability. There is a high probability of increasing the forest area in peri-urban areas.

- Despite being forest regions due to their surface area, production and productivity of some species, they have great potential for growth in new areas and owners, but with little forest culture/tradition, which must be transferred.

In *Spain*, changes in the forest sector are mandatory to be competitive in the international market; digitalisation and investment in sawmills, factories and forest management have been minimum in the last 50 years. This has led to a situation of low profitability of interventions, a lack of well-developed value chains for local species and weak markets for forest products. Also, there's a lack of advisory capacity and local cooperation, and as a result, small-holding owners are no longer interested in forest management, and workers do not have the adequate qualification plus the profession is not socially valued. These factors lead to the abandonment of the regions and aging of the population in rural areas, making the situation in the forest sector worse, and complicating the solutions in the short term. Cooperation between actors and the implementation of digital solutions is mandatory to reach a competitive level in the market.

To summarize, the main needs in Spain are the following:

- Improve advisory capacity and cooperation between forest owners and stakeholders and administration
- Effective solutions for smallholding management in order to get profitability from interventions
- Boost digitalization improvement in companies to manufacture high value products
- Professionalise the forest worker employment for a better qualification and social appreciation
- Adequate regulations and information for forest owners and stakeholders.
- Communicating with society: making forest management understood by urban society
- Industrial development of technological products for the ecological transition/bioeconomy.
- No favorable management framework in land management: not only because of smallholding, business model fails. Complication due to autonomous management, diverse decisions, areas without any type of management.
- Restrictions due to protection and conservation regulations. Large areas included in protected areas. Environmental restrictions on forest management, this discourages possible investment. In addition, each territory has a different management.
- Lack of added value to wood (good wood for packaging). In Spain little wood is destined for construction compared to other countries, due to lack of culture and promotion.
- Internal weaknesses but also structural problems (of the sector).

The needs that have been identified for *France* and more particularly for the *New Aquitaine region* concern mainly wood mobilization and better tools and resources given to the private owners. The need for a boost in using the existing trees may help to raise interest and concern of a certain category of owners into their forest, and this could be a way to reduce the fragmentation of the forest (a high number of small and scattered parcels).

Forest owners need new tools and a knowledge database to get empowered in managing their forest. Improving wood mobilization should nonetheless be done in a very conscious way, encouraging the development of the local economy, the creation of jobs and short production circuits. There is indeed a need to make the forestry sector more attractive to young workers, and also more consistent with the current expectations of the society: forest products need to be made with resilience, carbon footprint and sustainability in mind.

The need for wood mobilization reflects the necessity for a valorization of hardwood, ecosystem services and also a valorization of the multi-functionality of the forest. This includes a better measurement and recognition of the services that forest lands offer, such as recreation, contemplation, providing resources and storing carbon.

Forest companies need to be more transparent and to communicate more on their practices, as a lack of trust from the general public has been identified. Improving the communication for the general public but also between different stakeholders is of key importance. This would allow a better understanding between the rural and the urban population.

In a nutshell, the five main needs based on the French SWOT analysis are:

- improving the communication between actors
- empowerment of new private owners in the mobilization of their forest
- strengthening the local economy and short circuits
- improve the hardwood value chain and traceability
- improve the communication about forest practices to the general and urban public

Given the SWOT analysis on the *Italian* situation, several issues were identified. Starting from the beginning, on forest ownership, the fragmentation of forest parcels and the related abandonment of rural areas. These two aspects are combined and strictly related to each other.

The abandonment of rural areas caused a lack in management. With different heirs, most of them living far from their forest parcels, inheriting smaller portions of a bigger parcel, any type of management is close to impossible. The lack of management is also a direct consequence of the low profitability of timber and the lack of sawmills at a territorial level. In addition, forest owners and managers also lack an awareness that forest needs to be managed not only for timber products.

Another important issue is, in fact, the lack of properly sized sawmills, as they're getting fewer and bigger; together with logistic platforms to stack, manage and transform what comes out of the forests. Diffuse sawmills and logistic platforms would provide a helpful structure to increase quality, offer and profitability of high value timber products. At the moment, a big part of conifer roundwood extracted from Italian forests is exported to other countries to be processed and then sold back in Italy as timber, with a great loss in profitability, opportunity and sustainability.

The lack of sawmills in Italy and specifically some part of it is also related to the forest structure. In fact, in the Apennines coppice represents the great majority of the forest covered areas. This affects the products that a big share of Italy is able to produce, which is mostly firewood. In addition, the sale of firewood happens to be on a hobby level, fuelling a big share of submerged market increasing problems with work safety and soundness together with, obviously, timber legality.

The forest operators in Italy are one in two thousand workers and the average forest enterprise has approximately 2 workers. Specifically, the majority of timber in Italy is extracted and processed by few very large companies. For this reason, an action to increase and develop the skill level of all forest workers, both on a technical level and on an entrepreneurial level in order to increase the number of actors involved in the sector working also on niches of the supply chain is needed. Lastly, communication to the end user, public, citizen is necessary in order to have them aware of the real world that operates behind the world forests, as much as the different actors involved. The communication must be implemented also between policy makers and regional administrators in order to boost and implement effective initiatives, law and regulations.

Summarizing what Italy needs, the following points can be made:

- Effective solutions for smallholding fragmentation. Both technical and political.
- Small and medium sawmills on a territorial scale paired with logistic platforms.

- Increase the offer of timber related products in order to diversify the offer and increase the profitability
- Increase the skill levels for operators, forest workers and forest enterprises
- Educate the public and local administrations

Portugal is the EU country with the highest share of privately owned forests (97 %). North of the Tagus River, properties tend to be small-sized with each owner having several disjoint patches of land, which represents a major drawback for forest management. There are other weaknesses adding to the size-related one though:

- the inexistence of cadaster records leads to a considerable share of unidentified owners (UFOs) expressed by absence of management;
- the abandonment of rural areas that lead old, unprepared farmers with limited technic and economic resources for forest management;
- the extremely high costs for silvicultural operations, in particular site (re-)installation operations;
- the increasing complexity involving adaptive forest management required to build forest landscapes resilient to disturbances (fire and pests and diseases) only possible with the support of professionals;
- the lack of assistance to deal with extremely high availability of wood after the recurrent wildfire events, burnt trees left waiting to be harvested or harvested wood left on the side of the road;
- the need for diversifying production and revenues in rural areas such as support/funding schemes for creating and developing markets for new products;
- support/funding schemes to promote noble maritime pine wood uses other than for energy purposes (already represents 20% of annual wood consumption)¹⁴
- Wood to be paid based at fair prices

Thus, there is the need to:

- minimize the impacts of small-sized fragmented ownership and improve forest management
- provide technical assistance to non-industrial private owners/ managers with the aim of increasing forest areas under sustainable adaptive forest management and if possible developing funding schemes for supporting non-industrial owners financially
- rethink forest management and planning at the landscape level in an attempt to diversify forest areas and build ruptures in the vast homogeneous areas of continuous forests in order to minimize the impacts of disturbances.
- develop user-friendly support systems to assist forest owners and/or managers, loggers and industries to handle the extremely high amounts of wood left available after wildfires or to assist forest managers in assessing the profitability of forest investments over time (growth simulations under alternative scenarios of management and/or disturbances. Due to their reduced funding capacity, local owners tend to invest little, so it is important to diversify forest products and their income sources as well as developing new markets for the new products.

¹⁴ Centro pinus (2019): <https://www.centropinus.org/files/upload/pinuspress/pinus-press41.pdf>

2.3 Development targets for sustainable wood mobilisation

The main objectives for the forest sector in *Spain* are:

- Cooperation between actors

The administration and the research entities have the knowledge and the experience to advise forest owners and find solutions for their needs, but there's a lack of communication between actors and these solutions are rarely implemented. It is important to emphasize the lack of communication with society.

- Lack of updated and available data and information.

Most forest companies are outdated, their products are not competitive in the international market and the lack of knowledge and experience widens the gap. Digitalization is mandatory to adapt the factories to present and future needs.

- Investment of money and knowledge

To reach these goals it is necessary to invest in forest companies and in cutting edge projects, to bring the local sector up to the international standard and become profitable and competitive. This development must be accompanied by knowledge advice to make the most of the new technologies acquired in the companies. It is also necessary to ensure that the political will of decision-makers is at least partially directed towards improving the forestry sector, and it is urgent to facilitate administrative management

- More than half of the resources are managed by public entities/administration. A way must be found to approach it so that it does not become a hindrance, to find market harmony.

The three main development targets of *New Aquitaine, France*, are:

- A better wood mobilization

Based on the observation that much forest lands were undervalued or barely managed, the region wants to mobilize more wood. Not only is volume discussed (the National Programme for Wood and Forest aims to an increase of 20 millions m³ wood per year, between 2016 and 2026), but a big attention is also given to the quality and ethics of the mobilization. Among the key elements for the wood mobilization are the valorization of broadleaved trees, a production chain that maintains a low carbon footprint, and the preservation of the ecosystem services offered by the forest.

- Adding more value to ecosystem services

Some ecosystem services are of paramount importance in the forest of New Aquitaine, such as the recreational value (for hunting, picking mushrooms), tourism, the regulation of water, and carbon storing. The carbon balance is one of the main targets for the French forest in the upcoming years, and efforts are made already now to work on low carbon certification (Label Bas Carbone), promoting the use of wood as a building material and reducing the fossil energies. This development target is in line with ongoing projects such as Sylv'valor, setting up a procedure for valuing forest ecosystem services in addition to PEFC certification.

- Improving knowledge platforms

Another important target is a better information and knowledge exchange in the forestry sector. The aim is to encourage projects and new tools such as La Forêt Bouge, an online platform dedicated to forest owners. This is in order to make the owners more aware of the potential of their forests, and also to make it easier to buy and sell wood.

Given the SWOT analysis for *Italy* and the need of the forest sector these are the current development targets:

- On Government level:
 - The government is working on several different paths also thanks to the TUFF (Testo Unico per le Foreste e Filiere Forestali - Only Law for forests and forest's supply chains) that aims to reform the entire sector giving specific guidelines and strive to imagine forests in a twenty years' time. The TUFF is also trying to solve different problems and needs with specifics implementing decrees that are being published recently trying to ease the bureaucratic burden in the cutting authorization, aggregations and general requests related.
 - The government also provided 5 million euros to associations in forestry in order to boost the aggregation of different actors involved in the forestry sector, such as forest owners.
 - In light of the extreme climatic event involving forests, a number of different initiative blossomed on the forest disturbances niche. The government identified three main activities for the forestry sector in order to support the entire forest sector with the subsidies coming from the Next Generation EU fundings. These important aspects are:
 1. Support to the technological development of forest enterprises with the support measure of the purchase of technologically sound and advanced machinery and tools.
 2. Intervention in the support of the enhancement of the value of low profitability timber products
 3. Support for the development and implementation of logistic platform and medium/small sawmills
- On regional level:
 - The regions are trying to standardize the educational requirements for forest operators and some of them are improving their forests account's systems highly problematic on several levels.
 - The Veneto Region, being part of the Pianura Padana regions, recently started to deepen the activities in order to increase air quality levels operating on the fuelwood quality together with the high efficiency stove and boilers technologies. Also being one of the regions that suffered the most from the VAIA storm Veneto region is still trying to cope with the high amount of timber windthrown and still left on the ground. The recovery of that material needs to be pursued by the implementation of new forest infrastructures (forest roads, logistic platforms and forest sites) and proper production subsidies.
- On the level of the private sector:
 - The private sector is striving to provide a wide understanding of the market and, also thanks to the VAIA storm, to restructure the internal market of processed timber products.

The revised *Portuguese* National Forest Strategy (PNFS) is in line with the Portuguese commitments towards meeting sustainability in forests set under the United Nations Forum on Forests (UNFF) and the Ministerial Conferences on the Protection of Forests in Europe (Forest Europe) as well as the global commitments such as the Paris Agreement.

The main objectives of the PNFS are:

- minimizing the risk for biotic and abiotic disturbances;
- specification of the territory according to forest functions (wood production, multifunctional forestry);
- improving forest management and forest productivity,
- valuing forest products,
- improving the competitiveness of the forest sector and rationalization and simplifications of policy instruments.

Only by improving forest management and establishing a smart resilient landscape, risks can be reduced and forest productivity increased. On the one hand, this can only be achieved through proper cooperative management that aggregates small forest owners providing technical support and funding. On the other hand, the need for developing local markets and assisting owners and industries to optimize harvesting, storage and transporting logistics is essential. Finally, this can only be effectively implemented if the forestry sector transactions are fair and transparent and the bureaucracy is reduced. Overall, the best practices identified for Portugal, complemented and/or improved based on the concepts/tools of other Hubs' best practices and innovations, if implemented at a considerable scale in Portugal and in an integrated and coordinated manner, involving all the actors from different ministries and entities would certainly produce results.

2.4 Presentation of the Interregional Roadmap

The goal of the project ROSEWOOD4.0 is to establish an exchange of knowledge based on best practices and innovations (BPI) from other regions in Europe. Based on the findings, suitable best practices shall be transferred to other regions to turn weaknesses into opportunities or strengths.

The following BPI from other Hubs and countries from SWE were chosen as most useful for South-Western Hub forest sector:

MAIN WEAKNESSES AND NEEDS	South-Western Hub BPI	Other Hubs' BPI
Small holding of forest land dealing to lack of cooperation owners/foresters, and need of support in the legal framework	e-globulus (PT) eMoBois (FR) Areas Florestais Agrupadas (PT) AKIS focus group (ES) Forest Wise (PT)	FVS - Woodland owners community (DE) KomSilva (DE) Wald-wird-mobil.de (DE) MojGozdar (SI) Metsään.fi (FI)
Few options for financial support	CIFA (FR)	Privatwald.fnr (DE) Forestry Fund (NO)
Markets. Optimization of the wood forest resources and products	NEOSYLVAQ (FR) IT FOR II (IT)	Build in wood (RO) Basajaun (EU) Forest stock market e-drewno.pl (PI) SecureChain (GR) Online database of wood processing and furniture production (CR) Timber inventory system (PL)
Poor forest management of small-scale forest owners and associations	LaForêtBouge (FR) Safety for Rescue (IT) Melhor eucalipto (PT) STERES (FR)	Bitcomp (DE) HolzmobRegio (AT) Forest becomes mobile initiative (DE)

Sustainability, environment and biodiversity, climate change (pests, forest diseases)	C.A.F.E. (ES) CrossForest (ES) CLIMAFOR (FR) RiLegno (IT) PaperChain Project (PT)	ARBOAIR (SE) DetectIt (CR)
Lack of digitalization, , updated and available data	Harvester simulator (FR) Extrafor (FR) ChainWood (ES) WoodChain (IT) <u>LegnOK (IT)</u> SADfLOR (PT) Rustechworld (PT) FCTools & sImfLOR platform (PT) Forest LIDARioja (ES) SISREP (ES)	Biomob (EU) WoodChainManager (SI) Woodlogistic data platform (AT) WaspWoodlogistics (DE) ForOps (FI) TimFlow wood tracking system (RO) Electronic Timber Tracking (UA) Joint wood terminals (FI) Forwarder2020 (CH) Kollegenschutz 4.0 (CH)
Weak infrastructure		FelixForst (AT) Joint wood terminals (FI) Forestry Road Scanner (CH) The Forestry Extension Institute (NO)
Need for educational strategies to explain forest ecosystem services to the public	LaForêtBouge (FR) Je me forme pour mes bois (FR) Together for the Forests (ES)	Waldaktie (Forest Shares) (DE) ThinkTree (NO)

Table 8: BPI matched with Main Weaknesses and Needs for the SWE Hub.

Despite the fact that the Hub seemed to have a local solution for the identified weaknesses and needs, in some cases the results weren't as good as expected or the implementation failed at some point. That is the reason why these points remain weaknesses and need other solutions to be addressed effectively.

At Hub level, the best practices and innovations from other Hubs were analyzed to see if these could help solving the weaknesses detected in SWE. To facilitate the pairing each SWE country analyzed the BPI from other Hubs by domain and selected the ones that seemed most promising to tackle the national weaknesses. Similar best practices can be found in different countries but limited information is available to determine their applicability and the requirements for adaptation in SWE Hub countries, thus a more detailed analysis is required to determine their suitability.

In the case of *Spain*, many of the best practices identified are useful, but those related to communication and those that help to promote management by private owners of small plots of land stand out. Therefore, those with the best implementation in Spain are **LaForêtBouge (FR)**, **Metsään.fi (FI)**, **CLIMAFOR (FR)**, **ThinkTree (NO)**, **Areas Florestais Agrupadas (PT)**, among others, since all the best practices identified are of great interest and can boost Spanish forestry development.

The best practices and innovations that would be of interest for *France* are mostly concerning cooperation between actors, improvement of communication and also development of new technologies for remote sensing and data analysis. Thus, BPI exposed here could be of interest. From the Central West Hub, **Bitcomp**

(Germany) and **HolzmobRegio** (Austria) are in keeping with this need to develop tools for owners, and take climate change into account. This gives France new insights on how to improve existing platforms. From the Northern Hub, **Arboair** (Sweden) could help in tackling the bark beetle problem that was identified in many spruce stands all over the country. Such initiative could also be interesting to develop solutions for other forest pests and diseases affecting France. **ThinkTree** (Norway) is also a good example of what could be done in the New Aquitaine region to communicate better on the purpose of forest management and help reducing the lack of trust from the general public into foresters and owners. From the South West Hub, initiatives to strengthen the local cooperation would make sense as well for the New Aquitaine region: **Together for Forest** (Spain) and **IT FOR II** (Italy) work on developing local markets and value chains, and to increase collaboration between different stakeholders.

To tackle the need for France to invest in bio-economy, promote wood as a construction material and also as a key raw material, and develop alternative forest products, the practice from the Central-East Hub **Build-in-Wood** (Romania) is relevant. It is also a way to promote carbon storage and sustainability. Initiatives such as **ReGaP** (Germany and Poland) and **Re-Leaf** are also worth exploring, to think of recycling wood waste and also creating alternative and ecological production trajectories.

As for *Italy* most of the best practices of interest are related to the fragmentation of forest lands and the abandonment of rural areas. For this reason, best practices useful for forest owners on a economic level are of high interest. Best practices such as **Forest becomes mobile initiative (DE)** and **FVS - Woodland owners' community (DE)** can support undecisive and unaware forest owners to manage or make them profitable. This might also help the rural area abandonment and the fragmentation of forest plots. Increasing interests and in forest, making them profitable, increase the management levels. Another important issue on the Italian forest sector is related to the low level of forest infrastructure that is a relevant hindering factor. **Biomob (EU)** and **FelixForst (AT)** can be of interests and very helpful for forest enterprises and forest workers. In the end **Waldaktie (Forest Shares) (DE)** would help the end user to have a a better understanding of forest ecosystems and forestry in general.

BPI that could be useful once adapted for the *Portuguese* conditions relate to: i) minimizing forest area fragmentation and improving forest management (*domains: ownership, cooperation*); ii) optimizing logging and transport operations (*Domain harvest*); iii) valuing and/or diversifying forest income while supporting the development of new products and markets (*Domain: Products, markets, trade*); and iv) developing funding schemes (and/or reducing operation costs) (*Domain: Financing, funding schemes*). Despite some BPI have been developed to tackle some of these weaknesses in Portugal and/or within the South-Western Hub by Portugal itself, similar BPI from other Hubs could be useful. Thus, **LaForetBouge (FR)** and **ForetData (FR) platforms from SWE** and the **Wald-wird-mobil.de (DE) (from CWE** under the domain "Ownership, cooperation" could serve as inspiration for developing or improving/completing existing Portuguese BPI (e.g. Forscope, e-globulus). Under the domain "Harvesting, logistics, transport, safety", several digital platforms or tools, similar to Forscope, all aiming to connect actors along the forestry wood chain could serve to improve or further develop the Portuguese tool, namely, **Woodlogistic** data platform (AT, CWE hub), **WaspWoodlogistics** (DE, CWE hub), **ForOps** (FI, NE hub), and **MojGozdar** (SI, SEE hub). An interaction with the developers and users of these systems could help promote an effective implementation at regional or national scale. Still under this domain, **TimFlow** wood tracking system (Ro, CEE hub), which aims to monitor wood traceability and improve transparency, could be a useful tool to help valuing wood (similar to Rustechworld). Another interesting initiative that could affect the logistics of burnt wood harvested is the **Joint wood terminals** (FI, NE hub) that create intermediate storage for wood from several small-scale units.

To promote the development of products, markets and trade in rural areas that could lead to an increase in revenues from forest management, the **Forest stock market e-drewno.pl** system (PL, CEE hub) could be a solution toward the engagement of managers and sawmills in wood sale auctions. Under the same domain, “products, markets and trade” the **SecureChain** (Gr, SEE hub) initiative that gathers small and medium enterprises with the aim of securing future-proof bioenergy chains could serve as an example to energize rural areas and local markets. The major issue is the lack of funding, for which initiatives such as the **privatwald.fnr Webportal** (DE, CWE hub), under the domain “Financing, funding schemes”, responsible for assisting forest owners in applying for funding could be extremely useful.

2.5 Implementation of the Interregional Roadmap

During the development of Rosewood 4.0 project, SWE Hub partners have been working closely with expert advisors of the four countries (Spain, France, Italy, Portugal) in different workshops and meetings to identify the strong and the weak points of the respective regional forest sectors. First ideas arose to implement strategies for addressing weaknesses and needs.

As SWE hub manager, CeseFor will host the hybrid implementation workshops, both online and in-person, with the collaboration of the Institute for Business Competitiveness of the regional government of Castilla y León that has already shown interest in the implementation strategy of the South-West-Europe Hub. The same way, the rest of the hub partners will invite and enhance the implementation with the equivalent regional entities.

The objectives of the implementation workshops will be:

- To present the main business ideas with good possibilities of being implemented in different territories and with greater impact, based on the research carried out in the framework of the Rosewood 4.0 project.
- To induce innovation in the wood utilization sector, with the overall objective of improving its sustainable mobilization (e.g. by finding new sources or applying new technologies). The approach of the workshops can be described as a collective brainstorming of a preferably diverse group of stakeholders, with the expected outcome being the collection of grassroots ideas for new businesses. In general, the workshops will initiate an active process of idea creation, collection, follow-up and implementation.
 - To stimulate discussion on the way forward to increase international technology transfer and participation in European R&D programs by the business sector of Castilla y León.

Participants invited to the workshops will be:

- Representatives of private companies operating in the forestry sector in the Southwest Europe region.

The partners of the South-Western Hub: CeseFor (Castilla y León), University of Lisbon (Portugal), CRPF Aquitaine (France), AIEL (Italy), their experts and all the entrepreneurs who, having received the information about the workshops, would like to participate.

- All other Rosewood 4.0 project partners and representatives of the wood value chain. The workshops will also be open to internal or external collaborators of the companies, consultancies, and representatives of the research sector.

The conferences may have different focuses:

- To promote the knowledge of the most recent technological innovations in the wood handling sector, for the benefit of the companies in the hub.

- To propose collaboration and the possibility of establishing lines of business between different companies and between several countries.
- Information on European R&D&I funding programs. Work programs, rules of participation, search for partners, presentation of the European Enterprise Network (Enterprise Europe Network).
- Elaboration and dissemination of partner search profiles, international technology offers and demands, through the Enterprise Europe Network.

2.6 Conclusions and Outlook

After the research and collaboration work carried out in the Rosewood 4.0 project, expectations are high regarding the result of the implementation of the BPI of different hubs, and the medium-term development of the forestry sector in Southwest Europe. The involvement of Business Competitiveness Entities will result in a higher success rate.

With the work done so far it has been observed that the technological development of the hub is not at a low level but there is a gap between the technologies created by companies, universities and administrations, and the implementation in small companies and private owners, which are very disconnected from the new possibilities and the current market. Different BPI in other countries have obtained better results; with an adequate knowledge transfer, similar results can be achieved in Southwest Europe. The support and collaboration between countries will be essential to succeed in effectively transferring knowledge.



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