Forest-based Sector
Technology Platform

FTP Topic Prioritization Process 2025-2027

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Forests & Forestry

1. Defense of cork oak forests

Subsector: **F&F**

FTP Remarks: Text have been taken from TPP2021 topic 8

Scope: practical challenge/bottleneck to address

Lack of management of these ecosystems. Cork is a renewable bio-resource with unique properties both in terms of physical characteristics as a material as well as its growth as a forest-based non-wood product – its exploitation does not imply the cutting of trees but makes use of its capacity to naturally regenerate instead. This fact results in an average lifespan of over 100 years which, coupled with the 9-year gap between debarking, makes long-term stability mandatory for economic feasibility and appropriate forest management.
Despite efforts, however, an increasing dieback of cork oak trees is being reported which constitutes a huge throwback for the increasing demand for cork by the industry. Innovation in the form of irrigation is currently under development to meet these new demands.
For all these transformative changes, data to monitor the new and old methodologies are required. A data-driven improved forest management is necessary to contribute to its sustainability by controlling fungal spread as well as an ample variety of abiotic stressors. These will contribute to both protect the tree health and ensure higher survivability at all stages of growth but also to better characterize and predict the cork quality as early as possible – and by extension, to predict prices and allow for a more stable income for forest operators.

Scope: strategy to address the above-mentioned challenge

Upstream and downstream enhancement of cork oak sector. A combination of IT, such as digital twins, IoT, big data analytics and AI can support an advance monitoring system intended as continuous, providing alerts when deemed necessary based on bioindicators to be developed – measurable characteristics to monitor tree health. In addition, the data collected is to be analyzed and opportunities for improved precision on cork quality predictions are to be explored. Finally, the combination of these techniques can be used to better trace the produced cork (respective quality and origin) throughout the supply chain, ensuring higher transparency of certified raw materials and corresponding products.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

1) New measurable bioindicators for disease detection in cork woodlands as well as existing abiotic conditions' monitoring (temperature, air and soil humidity, etc.) combined to form a complete system with continuous data generation;

2) Connection of data to decision-making – when or if to apply pesticides or biocides to control fungal growth, etc.;
3) Better methods and with high technological decision evaluation to determine cork quality as early as possible within the supply chain to better establishes price and stabilize investments;
4) Increased knowledge on the effects of novel forest management approaches such as irrigation to decrease debarking time, etc.
5) Indirect contribution in scientific know-how regarding the fluxes of greenhouses gases such as CO2 and CH4 from different types of managed cork woodlands and forests, providing valuable data on natural sources of GHG and impact of forest management.

Metric for quantification of impacts can be:
- Reduction in serious fungal infections detected (prevention due to the successful implementation of the project);
- Statistically significant reduction in tree mortality;
- Estimated quality similar to verified quality with a 10% error margin;
- Increased traceability – reduced non-compliances of forest certified material;
- Improved biodiversity indicators (using well-known indices);
- Creation of a few, yet long-term, qualified jobs in often depopulated areas of Portugal and Spain (main producers of cork in Europe);
- Higher long-term CO2 fixation through increased survival of trees with long life cycles (up to 200 years);

Competences and technologies likely to be applied

This project would require the expertise in IT system such as big data and AI for data analysis but also high-level expertise for the field use of sensors in continuous monitoring mode, which would likely require modifications to accommodate the needs of the project. In that sense, the project would apply existing high-tech sensors as well as prototype modifications of said sensors in combinations to be assessed. These novel modified sensors would start a low TRL level but eventually aimed to function in pilot and field environments.
Due to the multidisciplinary nature of the project, the consortium should be a well balanced mixed of universities, research institutes and companies who manage cork oak woodlands and forests.

Budget: **4M€**

Duration: **3-6 years**

Related theme (EC Work Programmes 2023-2024)

6-4-Biodiversity friendly practices in agriculture, forestry and aquaculture

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
E Analysing and foresighting markets and material flows of forest-based products

3. More added value from non-wood ecosystem services

A Improving business opportunities for non-wood forest products

2. Visualising consequences of various forest management and use of forest ecosystem services

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Deficiencies in communication due to different system boundaries, resulting in locked positions. Still much research and communication is conducted in silos.

Scope: strategy to address the above-mentioned challenge

1. **Define terminology and clarify the importance of temporal and spatial system boundaries.**
2. **Data management and access (data bases and other information available)**
3. **Create platform for analysis and visualisation (flows of carbon, materials and products (including energy output), structures for biodiversity, energy input, emissions, '...) aimed for use by various stakeholders.**
4. **Consultation and alignment among stakeholders and member states (continuously through the project).**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Facilitates the inter-disciplinary discussion, improves possibility of informed decisions.**
- **Platform for analysis and visualization established among stakeholders.**
- **Improved transparency.**
- **The results facilitate transition to biobased circular economy.**

Competences and technologies likely to be applied

- **Data base owners and experts**
- **Systems analysts**
- **Domain experts (forestry, soil, water, biodiversity, industry,...)**
- **Tech industry and entrepreneurs (SMEs)**
- **Socioeconomic and policy experts**

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-9-Innovative governance, environmental observation and digital solutions in support of the Green Deal

FTP SIRA 2030 Challenges:

1. Sustainable forest management, biodiversity and resilience to climate change
   A Capitalizing on the interdependencies between forest management and functional diversity
   B Strengthening forest ecosystem resilience and fostering Climate Smart Forestry
   C Enhancing the vital role of forests in regional and continental water supply
   D Mitigating wildfires risks in forest landscapes
   E Improving the partnership with citizens

2. Increased, sustainable wood production and mobilization
   A Improving seeds, seedlings and plants to increase productivity and resilience
   B Using the digital revolution for precision forestry
   C Empowering small-scale forest owners
   D Harnessing novel technologies and automation in forest operations
   E Analysing and foresighting markets and material flows of forest-based products

3. More added value from non-wood ecosystem services
   A Improving business opportunities for non-wood forest products
   B Enhancing value creation with other ecosystem services
   C Providing forest-based benefits for urban and peri-urban societies
   D Identifying the benefits of forest expansion as a consequence of land-use change
   E Innovation in forest governance to promote forest-based benefits for society

3. Forest management for multiple use (and conflicting goals)

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Variation in forest ownership, climate, forest type, forest management system, use of forest ecosystem services and forest products, demographics entails that there is no single solution applicable in all EU member states. This variation is needed to spread risks and exploit the potential of sustainably managed forests. The current development in the EU is towards conformity in methods and management that is not justified by the variation in biotic and abiotic factors.
Also, biodiversity protection while still making sure that humans have biobased products and food need to coexist. methodologies for doing this need to be increased

Scope: strategy to address the above-mentioned challenge

Describe and demonstrate the variation in European forests and forestry. Consequences for scenarios defining different goals, forest types and forest management regimes are calculated. Demonstrations and excursions with decision makers and other stakeholders are conducted and documented.
Also, continued research into biodiversity and the mechanisms around it, what can be done to improve it, if there are ways that eg. synthetic biology and other measures can be used to promote and restore it

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Common knowledge about and acceptance of the variation in European forests and forestry.
Also, biodiversity restoration is possible through specific regiments, allowing for agriculture and forestry to continue. There are active actions that can be taken to promote and increase/speed up biodiversity. understanding of actions must also increase.

Competences and technologies likely to be applied

Social scientists (incl policy and economy), forestry researchers.

Also, natural biodiversity mechanisms, utilisation of biology, synthetic biology and chemistry in promotion and speeding up the processes needed, where applicable and possible/feasible.

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-4-Biodiversity friendly practices in agriculture, forestry and aquaculture

FTP SIRA 2030 Challenges:

1. Sustainable forest management, biodiversity and resilience to climate change
   A Capitalizing on the interdependencies between forest management and functional diversity
   B Strengthening forest ecosystem resilience and fostering Climate Smart Forestry

2. Increased, sustainable wood production and mobilization
   C Empowering small-scale forest owners

4. Improving seeds, seedlings and plants to increase productivity and resilience

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

High-quality seeds and plants of native and introduced species with better growth possibilities under future climate conditions and also higher resistance to pests and diseases are more imperative than ever. Improved forest regeneration material will also enable more suitable wood qualities. (See also SRIA 2030, 2A)

Scope: strategy to address the above-mentioned challenge

Research is needed on new methods and strategies for tree breeding, propagation material provision, plant cultivation, establishment of new forests and regeneration of existing forests. This includes designing measures to protect endangered high-interest genetic resources so they can adapt to climate change, as well as measures for assisted migration.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Strategies for assisted migration established and applied in regions of Europe.**
- **Non-native species analysed and included in programs for adaptive forest management in X member countries.**
- **Facility established for screening of seedlings for resistance aginst some relevant pathogens/pests.**

Competences and technologies likely to be applied

Forest tree breeders, pathologists, forest genetics, ...

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-4-Biodiversity friendly practices in agriculture, forestry and aquaculture

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization

A Improving seeds, seedlings and plants to increase productivity and resilience

5. Using the digital revolution for precision forestry

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Precision forestry is an indisputable means for sustainable forestry. The conditions for rapidly moving best practice is better than ever, given the rapid development in technology and applications. New measurement technologies, remote sensing, land-based smart sensors, detailed production data from machinery, mobile devices, industrial scanning records and standardized interfaces bring opportunities for the collection of detailed and dynamic information. This wealth of comprehensive data will enable new levels of precision forestry. Ways in which advanced prediction models can be applied, including the use of AI and IoT data, need to be explored and developed. These predictive models can be used for characterization, visualization, harvest planning and retrospective traceability of mobilized wood material, as well as for forest monitoring. See also SIRA 2B

Also, Novel technologies and automation, such as machine learning and robotics, not only offer huge potential to improve the productivity of forest operations (planting, tendering, thinning, harvesting, logging), but also to provide social (attractiveness of rural jobs, gender balance in forest employment), safety and environmental benefits. Used to its full potential, automation can create new job opportunities in rural areas. See SIRA 2D.

Scope: strategy to address the above-mentioned challenge

- **Develop planning and monitoring tools for multi-purpose forest landscapes.**
- **Optimize supply-chain management including harvesting, transport and pre-processing, linked to planning tools.**
- **Develop traceability systems covering the entire chain from raw materials to wood-based products.**
- **Exploit further potentials of using data from various sources (machines, geodata etc) to increase quality and efficiency in retention and general nature conservation in forestry operations.**
- **Design applications for improved decision-making processes in forest management and optimized wood logistics, to develop new business models and for strengthening forest protection. To bring this about, participatory approaches that include forest owners, forest contractors and logistics operators, industry, technology providers, society and end users need to be tested.**

Also, Research is needed to adapt advances in automation for use in complex and extremely variable forest environments, and to improve decision-making support for operators. The potential of semi-autonomous, fully autonomous, and remotely-operated machinery to enable

forest operations to work in greater harmony with the forest environment, while at the same time integrating human supervision, needs to be analysed.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Increased precision in silviculture (choice of tree species for each (micro) site, identifying planting spots etc), harvesting, transport and pre-processing. The precision concerns the operation per se, plus overall efficiency, quality and transparency.

Competences and technologies likely to be applied

- **Researchers and technology expertise in forestry, AI, IoT, databases.**
- **Forest industry**
- **Robotics, forest machine engineering, forestry, soil science**

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-9-Innovative governance, environmental observation and digital solutions in support of the Green Deal

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
   B Using the digital revolution for precision forestry

6. Enhancing value creation with other ecosystem services

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Besides woody biomass and non-wood products, other forest ecosystem services also benefit society, and can contribute to inclusive regional growth. However they are difficult to value. To meet the growing demand of services, new approaches should be developed to deliver these in a more market-oriented way. It should be possible for forest owners to be remunerated for combined utilities from the forest besdides wood and hunting/fishing. Research is needed to improve integrative forest management approaches that can support the provision of these services (e.g. recreation, health, biodiversity, well-being, carbon sequestration, clean air) and, at the same time, provide biomass and other products. Such balanced approaches should be as unperturbed as possible by changing climate conditions. See SIRA 3B.

Scope: strategy to address the above-mentioned challenge

Concepts, including the upscaling phase, need to be developed to evaluate the economic value and interest of these ecosystem services. Effective business cases then need to be developed, demonstrating how services can be provided in an economically viable way. This is likely to require cross-sectoral co-operation (e.g. tourism, health & wellness sectors) and the involvement of those who would use the services.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **New value chains and business models established, based on co-operation between forest owners and users of ecosystem services.**
- **An economic valuation method developed for non-wood forest ecosystem services at national and European levels that includes the effects on employment.**
- **Digital infrastructure for the business models.**
- **The efficiency analyzed of various financial incentive systems and instruments for enhanced provision of other ecosystem services, including payment for ecosystem services (PES) and PES-like schemes.**

Competences and technologies likely to be applied

Researchers, trans-disciplinary in forestry, economy, ecology, soil, …

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-9-Innovative governance, environmental observation and digital solutions in support of the Green Deal

FTP SIRA 2030 Challenges:

3. More added value from non-wood ecosystem services
   B Enhancing value creation with other ecosystem services

7. Enhancing the valorization of tops and branches

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Europe is currently facing an energy crisis. The availability and mobilization of sustainable biomass is key to reinforcing the competitiveness of forest-based industries and to determining how large a contribution bioenergy can make to the 2040 energy mix. Today, however, pre-commercial cleaning and thinning operations are costly for forest managers. As a result, many European forests are growing too densely, giving poorer harvests, and increasing the fire risk, particularly in southern Europe. Lowering the cost of these forest operations and increasing the value of the biomass could change the financial equation, making it economical to use residues from cleaning and thinning operations. This may require new and cheaper collection and transport solutions, which would improve the efficiency of local energy production and innovative infrastructure investments. New strategies are also needed to maximize the mobilization of low-quality sawmill residues and biomass harvested due to natural disasters, such as roundwood damaged by bark beetles, storm breaks or rot. See SRIA 10B.

Scope: strategy to address the above-mentioned challenge

- **Development of rational harvesting and mobilization methods.**
- **Business models integrated with timber and pulpwood harvesting and industrial.**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

What is now refered to as 'forest residues' will be upgraded to a side product among others.

Competences and technologies likely to be applied

- **Forest machine technology**
- **Process engineers**
- **Forest owners**

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

5-3-Sustainable, secure and competitive energy supply

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources
   C Improving raw material efficiency and production value in wood-based manufacturing

10. Renewable energy for society
   B Enhancing the valorization of forest residues

8. Harnessing novel technologies and automation in forest operations

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Novel technologies and automation, such as machine learning and robotics, not only offer huge potential to improve the productivity of forest operations (planting, tendering, thinning, harvesting, logging), but also to provide social (attractiveness of rural jobs, gender balance in forest employment), safety and environmental benefits. Used to its full potential, automation can create new job opportunities in rural areas. See SIRA 2D.

Scope: strategy to address the above-mentioned challenge

Research is needed to adapt advances in automation for use in complex and extremely variable forest environments, and to improve decision-making support for operators. The potential of semi-autonomous, fully autonomous, and remotely-operated machinery to enable forest operations to work in greater harmony with the forest environment, while at the same time integrating human supervision, needs to be analysed.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Autonomous machine systems for forest operations demonstrated.**
- **Remotely-controlled machines in operation.**

Competences and technologies likely to be applied

AI, robotics, forest machine engineering, forestry, soil science

Budget: **2-10 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-4-Biodiversity friendly practices in agriculture, forestry and aquaculture

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
   D Harnessing novel technologies and automation in forest operations

9. Integrating autonomous and/or electrified harvesting and transportation systems

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

The marginal cost of transport and logistics from the forest to the end market is a prohibitive factor in supplying many sustainable forest-based solutions. Being an early adopter of digital technologies and autonomous transportation solutions could significantly reduce transport-related emissions and costs whilst significantly increasing speed and flexibility. The objective is a completely seamless integration throughout the value chain, from sourcing of raw materials (including harvesting), to measuring, processing, sorting and logistics. See SRIA 6F.

Scope: strategy to address the above-mentioned challenge

- **Develop autonomous and/or electrified harvesting systems that increase precision and productivity**
- **Develop semi- and fully-autonomous transport systems to improve efficiency and reduce environmental impact**
- **Develop methods for the assessment of total logistics efficiency to reduce emissions.**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Autonomous and/or electrified harvesting systems demonstrated.**
- **Electrified and/or autonomous transport systems demonstrated.**

Competences and technologies likely to be applied

- **Automotive researchers**
- **Manufacturing industry**
- **Road and vehicle authorities**

Budget: **10-50 MEUR**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

6-4-Biodiversity friendly practices in agriculture, forestry and aquaculture

FTP SIRA 2030 Challenges:

6. Diversification of production technologies and logistics
   F Integrating autonomous and/or electrified harvesting and transportation systems

10. Supporting development and deployment of remote sensing based systems in forestry

Subsector: **F&F**

FTP Remarks:

Scope: practical challenge/bottleneck to address

A lot of the current forestry practices rely on manual field inspections (inventories, wind, fire, snowfall damage assessment, volume estimation, animal population accounting and many more), while other processes are slowed down due to hard-to-locate, hard-to-access areas or simply vast distances (reaction to wildfire events or response to illegal felling notification). Theses processes are slow, labor intensive, costly and usually have significant accuracy limitations due to often opting for small sample instead of whole object measurements. Also, these inspection creates significant CO2 emissions, as the specialists usually drive to the site and traditional aviation is consuming very high amounts of fuel (for example a helicopter uses around 60 l of fuel per hour).

Scope: strategy to address the above-mentioned challenge

Remote sensing applications (based on satellite, traditional aviation, drone data) are slowly being applied more widely. While satellites and traditional aviation have been applied in forestry for decades, they provide low resolution data. While it is optimal for more broad decision making, it is not sufficient to vastly reduce or eliminate work that is being carried out by on-site crews.
Meanwhile, with rapidly developing drone technology new opportunities open up - new generation drones are able to carry multiple sensors (including LiDAR) at the same time, fly extended duration (4-8 hours or more) and cover long distances (hundreds of kilometers). These technologies allow to gather high-resolution multisensory data on relatively large scale and at a low cost (especially in comparison with traditional aviation). The commercial drone industry is forecasted to grow 11% per year with industry focused solutions expected to drive this growth. However, our analysis shows lack industry specific drone solutions for forestry. At the same time, drone uses in forestry are becoming a more popular research topic, however, its results are not yet widely adopted.
It has to be noted that drone use result in vast amounts of data gathered. Manual review or analysis of this data is not efficient or reliable. Hence it is widely accepted in the drone community that in many cases drone solution development needs to go hand-in-hand in automated analytic solutions, often based on artificial intelligence and machine learning.

We propose the following strategy to address the challenge: support the development of building blocks of reusable, multifunctional remote sensing system solutions for forestry. These key building blocks include: UAV systems (incl. sensors), data analysis software, supporting private and public forest owners to deploy such systems. The key of this strategy is

to ensure the applicability and scalability of these forestry focused solutions, as well as ensure integration between different technologies (satellites, traditional aviation and drones).

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

The main impact would be a beginning of conceptual shift in forestry processes to move from manual, small sample, lower accuracy data gathering to large-scale high-resolutions multisensory data gathering and automated analytics. We expect the main impacts to be:

- **Improved accuracy due to measuring larger samples or whole objects as well as eliminating human error risk;**
- **Improved efficiency of the processes (impact would depend on the use case);**
- **Better forest management due to more accurate data;**
- **Cost savings due to saved time, fuel, etc.;**
- **Decreased CO2 emissions due to less driving and use of traditional aviation.**

Competences and technologies likely to be applied

- **Drone systems (aviation, robotics, mechatronics)**
- **Sensors (physics, IT)**
- **Analytical software (Artificial intelligence, machine learning, other programming skills)**
- **Flight operations (legal aspects, pilot training, flight safety, etc).**

Budget: **20 million EUR**

Duration: **5 years**

Related theme (EC Work Programmes 2023-2024)

6-9-Innovative governance, environmental observation and digital solutions in support of the Green Deal

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
   B Using the digital revolution for precision forestry
   D Harnessing novel technologies and automation in forest operations

Woodworking Industries

11. Establishment of product approval systems for reused timber construction products and components – towards a zero waste society

Subsector: **WW**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Currently, there are no European approval systems on reused construction products.
Approval systems are currently only available for new products. These are stemming from harmonized product standards, ETA approvals and various national approvals.

Essential product characteristics are initially defined in the CE-marking and in the DoP.
The questions are:

- **how do these characteristics change in a reuse situation after an initial service time (of different durations and conditions)?**
- **How should these characteristics be verified in a non-destructive manner? Test methods to be developed?**
- **How should this be organizationally set up, e.g., building dismantling teams and notified bodies cooperation as well as new legislation needs.**

Addressing this topic could increase reuse of wooden materials, to remove waste from landfill/energy use and ensure longer sequestration of carbon in wood

Scope: strategy to address the above-mentioned challenge

Development of non-destructive testing methods for load bearing building products related to all essential characteristics. This will enable drafting of the declaration of performance on these recycled building parts, which can be load bearing.
Some actions are:

- **Dismantling methods for minimal destruction of parts.**
- **Testing of non-destructive methods – how do these match to characteristics such as: strength, stiffness, reaction to fire, fire resistance, release of formaldehyde, and other substances, assessment of glued connections, assessment of non-perfect geometry (distortions, cracks, holes), etc.**

- **Cooperation between dismantling teams, notified bodies and authorities.**
- **Demonstration of building parts recycling.**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **New regulatory setting for reused construction parts and their essential characteristics.**
- **New markets for reused wooden building components with predictable performance.**
- **Without this project, reused products will not be able to be used in buildings where a certain performance is required.**

Competences and technologies likely to be applied

- **Non-destructive testing technologies – old and new technologies to assess the essential characteristics of timber building products.**
- **Knowledge on the established product approval systems is required. This topic is also linked to the new draft of the construction product regulation, where recycling of building components is a common theme. The new knowledge developed should be applied into CEN standards at a later step.**
- **Recycling and waste sorting, quality assessment through scanners, product development, business model development**
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Budget: **5-10 million EUR**

Duration: **3-4 years**

Related theme (EC Work Programmes 2023-2024)

4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

4. Towards a zero-waste, circular society
   A Optimizing material recovery through efficient collection, sorting and separation
   B Adapting reuse and recycling technologies to complex products
   C Defining methods for cost assessment and optimization of recycling
   D Boosting the circularity of forest fibres and wood products

6. Diversification of production technologies and logistis
   D Extracting and producing natural compounds with high added value

8. Renewable building materials for healthier living
   C Harmonization and standardization research and more intelligent, digital design tools

12. Optimized use of under utilized wood raw material sources

Subsector: **WW**

FTP Remarks:

Scope: practical challenge/bottleneck to address

The global demand for wood for building purposes is increasing faster than the forest industry can increase its production of construction products. At the same time at least 80% of the raw material presently taken out of the European forests are used for biofuel or short cycled products like pulp, greatly reducing the positive climate mitigation effect possible from use of forest- based products. If a greater share of the forest raw material would be used for building purposes it would lead to higher carbon storage effects as well as increase the possibilities to exchange non - renewable materials with renewable and improve the socio- economic situation in rural areas of Europe.
The reasons for the present situation vary depending on the wood species and region. A few technical hinders need to be eliminated such as need for defect elimination and re-engineering, logistics, limited experience in industrial processing of the matrials, limited number of building products suitable for the raw material and lack of methods to CE-mark. However, the main obstacles are linked to traditions and historical economic factors where the need for firewood for heating, historically high value of printing paper and earlier abundance of low- cost quality sawn goods from Northern Europe have undermined the profitability of producing building products from such raw materials. The resulting effect is that the infrastructure needed to utilize the resources available is missing even though the market situation has fundamentally changed.

Scope: strategy to address the above-mentioned challenge

Greatly increased supply of forest- based building can be achieved by removing the technical hinders to utilize more of the raw material available and by providing information needed to build the infrastructure required. The challenge needs to be addressed in a holistic approach where the value chain from forest to finished product is covered. The main parts of the strategy are 1) Develop and / or transfer to Europe technology needed to process a larger proportion of the forest material into building products, including under- utilized wood species as well as small diameter softwood presently used for fuel or pulp. 2) Develop and or introduce to Europe building products optimized for said raw materials. 3) Introduce methods to CE-mark products made from said raw materials. 4) Provide a database of available raw material sources throughout Europe covering species, wood properties, volumes, logistic requirements and legal or environmental issues reducing availability. 5) Pilot production of optimized building products from selected raw material sources. 6) Provide National and European policy makers with information needed to adapt present regulation to the new products.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

The project will facilitate the use of presently not economically feasible forest- based resources to produce building components. European forest and building industry will have gained a considerable increase in raw material available and greatly increased the use of renewable forest- based building components. The use of presently under- utilized raw material resources will greatly improve the possibilities to replace non- renewable materials. The aims will primarily be reached by implementation of existing technology into systems of systematic value chain optimization, but will also require development of new scanning and grading techniques, material models, new products optimized for the new raw materials, and building designs utilizing the new building products. New products and production methods will be developed in the project and combined with introduction of products and production processes presently in use outside Europe. Since the project to a large extent will be based on new applications of existing technology, IPR will mainly have impact on the later stages of the project where new building products are introduced to the market.

Competences and technologies likely to be applied

- **Forestry to determine available forest resources.**
- **Scanning of logs and sawn goods to determine quality and optimize sawing patterns and defect elimination.**
- **Gluing expertise in environmentally friendly finger jointing, lamination and board production.**
- **Structural enginering to optimise building elements based on new raw material resources.**
- **Experience in standardization and approval policies.**
- **Production planning and logistics.**

Budget:

€ 30 Million including € 25 M R&D and € 5 M industrial investments in pilot production facilities.

Duration:

Very broad scope where results will be delivered at different times. Database of products 1.5 years. Scanning and re- engineering processes introduced in 2 years. CE-marking system after 3 years. Possibly ten years until new regulation has been introduced.

Related theme (EC Work Programmes 2023-2024)

4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources
   B Optimizing the use of raw materials by exact control of natural variations

C Improving raw material efficiency and production value in wood-based manufacturing

8. Renewable building materials for healthier living
   A Developing new building systems, including modular and pre-fabricated systems
   B Improving wood-based products, including engineered wood and composites
   C Harmonization and standardization research and more intelligent, digital design tools

Related theme (EC Work Programmes 2023-2024)

Circular Bioeconomy Europe Joint Undertaking or 4.1 Climate neutral, Curcular and Digitalised Production

FTP SIRA 2030 Challenges:

8. Renewable building materials for healthier living
   D Exploring the experience of living with wood ad its health benefit

13. Initiate a programme to make holistic evaluation of fire retardants and fire protective coatings

Subsector: **WW**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Improving the reaction to fire properties of exposed wood surfaces is of great importance for the wood industry in order to utilize the architectural benefits of the material without reducing the fire safety of buildings. However, today we lack a complete system of test methods and requirements to approve chemicals and coatings, third party control of production facilities, and methods for acceptance of the finished treated wood products delivered to the market. The knowledge of long- term durability of the fire retardant treatments for wood is also minute or missing. In addition, and more serious is the total lack of means for on- site control if a wood surface treated with fire retardants still has the properties required after being weather exposed. A final issue is the environmental impact of fire retardants during production, from leakage in service or after end of service.

The missing system for approval has the effect that it is difficult for a customer to compare products from different suppliers. The unknown long- term durability in combination with the lack of test methods to evaluate the properties of wood on site have the effect that we risk that a facade treated with retardants fails in case of fire. A large fire on a wooden facade would be a major blow to wood construction.

We need a complete holistic evaluation of treatments with both fire retardants and coatings, develop a complete system for approval of products for treatment, quality control of treatments, test methods to determine properties of treated material at delivery, long- term properties of treated material, methods for maintenance and service, test methods to determine properties of wooden surfaces in situ and finally evaluate the environmental effects of using fire protective treatments.

Scope: strategy to address the above-mentioned challenge

The topic of fire protective treatments covers a very broad area and will require expertise in many different areas, requiring a research programme rather than a research project.

The proposed project aims to gather the main stake holders within industry, insurance, authorities and academia to prepare a list of issues to cover and activities needed, with priority, estimated budget and time required to reach the targets.

The project is suggested to be based on a series of 3 seminars with separate Working Groups covering the main workload between the seminars.

- the first seminar aims to let stake holders present their views and needs and during which working groups are set up to cover different areas and draw action plans.
- the second seminar aims to jointly discuss the results from the WGs, identify areas not covered and needs to further develop WG proposals.
- the final seminar shall finalize the content of a proposed research programme divided into separate but linked Work Packages that can be carried out independently.

The material should be compiled into a strategy document by an editorial board with selected experts in different fields.

Examples of activities that may be suggested for the WGs are:
- mapping of existing systems on the market,
- practical experiences of treated wood such as degrade and known fires
- long term weather exposure tests of different systems available,
- compare outdoor weather exposure to short term analysis and accelerated ageing tests,
- determine if treatments are chemically bound to wood or not,
- theoretical analysis of possible durability,
- small- and large- scale reaction to fire tests on new and weather exposed material, and
- development of systems combining fire protection with decay resistance and longer service intervals for facade cladding.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

A successful implementation of the project will have two main principal effects.
1) it will reduce or eliminate the risk of not functioning products reaching the market and reduce the risk of existing wooden surfaces losing their protective properties due to weathering, and hence improve the fire safety of wood- clad buildings.
2) it will greatly improve the credibility of fire protected wooden surfaces and thus improving the market potential of exposed wood surfaces and exterior cladding stake holders.

Competences and technologies likely to be applied

The proposed activities cover a very broad area and will require expertise in many different areas. At this stage it is difficult to compile a complete list of competences and technologies needed. Examples are: Organic and inorganic chemistry. Non- destructive and destructive chemical analysis. Wood physics, moisture migration and leakage of substances from the wood. Reaction to fire and fire testing expertise. Expertise in quality control systems. Environment and health.

Budget:

5 Million Euro

Duration: **24 months**

Related theme (EC Work Programmes 2023-2024)

4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

8. Renewable building materials for healthier living
   B Improving wood-based products, including engineered wood and composites

14. Prefabrication of modular building systems for use in refurbishments and high-rise buildings

Subsector: **WW**

Scope: practical challenge/bottleneck to address

The building industry is responsible for a large use of material, energy use and CO_2 emissions, on a world basis about 40% in each category can be attributed to the building industry.

When reaching requirements on Near Zero Emission for new buildings during the use phase it will be necessary to also study the CO_2 emissions and resource efficiency also in the production phase for buildings produced today. The building costs in Europe is in general also very high which means that a large portion of the living cost can be contributed to the accommodation costs. The use of biobased buildings built in off-site production facilities, often in rural areas, have shown to be resource efficient, result in low energy and CO_2 emissions both during production and use. Increasing the use of Bio-based off-site buildings/building elements therefore will contribute to several important aims on the European market.

More than 220 million building units, representing 85% of the EU's building stock, were built before 2001. 85-95% of the buildings that exist today will still be standing in 2050[1]. Many of these buildings are not energy efficient and is in many cases not optimal for their use today, space being too large/small or need to change use residential/commercial/offices. The possibility of building an industrial capacity for renovation/re-building and extend these buildings using bio-based, industrially manufactured products in a green renovation wave in Europe. Forming strategies for the society, governmental agency, and industry to develop solutions for working in common with these issues would be beneficial.

Scope: strategy to address the above-mentioned challenge

Building Information System (BIM) that can handle the whole process. The main problem in the building industry is that there are many actors/companies involved in the process and that makes the ownership and compatibility of the information transfer important. This would include a system that can be used through the whole value chain. It should show the architect and customer what difference different choices makes in the following categories directly:

- **Life cycle analysis**
- **Circularity**
- **Cost**
- **Production time**
- **Life cycle costs**

[1] https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF

Other areas of importance for a building system would be the possibility for mass customization – effective systems to use platform system but still allow for freedom for the architect. Other areas relate to automation in the factories and level of pre-fabrication of elements by sub-contractors.
There the challenges of the area of refurbishment and vertical/horizontal extensions are somewhat different.

- **City planning – what is allowed to do and the process for city planning**
- **Juridical issues – same/different owner of extension**
- **Risk management – is there documentation of the existing building that is OK or is there a lot of risks of not knowing what type of structure is used.**
- **Social issues – people living in/around the refurbished building, how to get them positive to the change**
- **How to take the existing building into account when deciding values for:**
  - **Life cycle analysis**
  - **Circularity**
  - **Costs**
  - **Land area use**
- **Technical issues regarding fire, sound, accessibility etc**
- **Logistics in small buildings sites in cities**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Impact measures can be:

- **Production time in industry – reduced by 20%**
- **Time on building site – reduced by 40%**
- **Building cost – reduced by 15%**
- **Life cycle analysis – reduced CO_2 emissions in production phase by 50% compared to average building stock produced 2020 and fulfil requirement for NNE during use.**
- **Higher circularity – The degree of possible circular use of building components for the buildings increased by 50%**
- **Number of jobs moved from building site to production plant -**

Competences and technologies likely to be applied

A project with the aims as written above need a broad assemblage of competences bridging several different sectors.

Industry
Architects, building consultants, IT-specialists, pre-fabrication plants, property owners, contractors

Governmental
Policy makers, municipalities, regions, city planners and organisations for the society

Research
Research Institutes and universities

Budget:

10 M€.

Duration:

4 years

Related theme (EC Work Programmes 2023-24)

4-2-Increased Autonomy in Key Strategic Value Chains for Resilient Industry

FTP SIRA 2030 Challenges:

8. Renewable building materials for healthier living
   A Developing new building systems, including modular and prefabricated systems

15. Wood durability research & innovation

Subsector: **WW**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Study how to secure the durability of wood and wood-based products (choice of raw material, design, environmentally preferable treatment against fire, insects, mould and decaying fungi.

Up to date there are no efficient, technically and economically, treatments for wood that are efficient in the four areas mentioned above. Hence the impregnation industry in Europe treating about 6 million cubic meters annually have to use chemicals listed in REACH, Biocide directive. The use is given allowance yearly and we cannot predict when there will be a prohibition on certain chemicals. The annual use of treatment chemicals in Europe is about 60 000 tonnes whereof about 8 000 tonnes of biocides
If prohibition would take effect before alternatives is on the market there is a high risk for increased use of rainforest timber that have a good durability naturally. Acetylation is used in some products but are yet to be seen as a high cost treatment in today's market perspective.

Initiatives as The New Bauhaus, building with wood and other initiatives where wood will be used as construction material indoors and outdoors requires predictive material properties to fulfil quality and security for the products. That includes wood durability against fire, insects, mould and decay fungi. Especially this is to be very important in southern Europe and in more northern parts if the temperature increases, leading to insects as termites moving north. In northern Europe it is predicted to be more rain and moist in the future leading to increased need of protection against mould and fungi.

Last but not least the industry for wood treatment is often located in rural areas and as such very important for regional employment.

Scope: strategy to address the above-mentioned challenge

State of the art today is more or less the treatments available on the market, chemicals and processes, where acetylation, furfuryl alcohol based processes are the most advanced. In recent years some products are out of the market, e.g. Zink in white paints making them more prone to be attacked of mould and leading to consumers to buy "mould-treatment agents" and using them

together with hosing and thus spreading it nature and ground water. Brome is not used as protection to fire leading to quality questions about building with wood.

A successful project will have the effect to move research and innovation into new grounds where there are new alternatives to protect wood in a healthy and environmentally friendly way. The new products are biobased and not listed in the biocide directive list. Parallel to the development of treatment agents there is development of the processes used. Development of new ones and modification of existing processes to be able to use new and more efficient treatments. Also, the treated wood products are safe to use and can be circulated in an efficient way or used as fuel without requiring certain burners because there is poisonous content.

Certain care has to be taken to moisture since wood is a hygroscopic material and almost always the attacks on wood is related to high moisture contents. Also the moisture is affecting how well treatments are performing and how long they last before macerating from the treated product. This is very important for fire protection agents.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

A successful project has several areas of impact:

- **Quality of wood products is defined and very precise to predict service life thus making wood an easier choice in future constructions and products all over the world.**
- **Maceration is predictable and if success at least as long a products service life.**
- **CO_2 emissions decreases due to longer service life of wood products, new areas for wood products and new possibilities to circulate treated wood products.**
- **Reducing or eliminating treatments containing chemicals listed in the Biocide directive.**
- **Export of technology to a worldwide market, essentially larger than the EU market. E.g. Large parts of Africa is still using almostonly CCA treatment.**
- **We can also see protection against the pine wood nematode (Bursaphelenchus xylophilus) as an effect of a successful project. Today all timber for export must pass a heat treatment according to KDHT/ISPM 15 (International Standards for Phytosanitary Measures No. 15) that can be very costly in certain areas.**

Competences and technologies likely to be applied

A project with the aims as written above need a broad assemblage of competences bridging several industries.

Industry: Sawmills, treatment companies, chemical industries, wood construction companies.

Organisations: There are also some organisations that can be involved: CEI-Bois, CEPI, CEFIC, IRG.

Research: Research Institutes and Universities

Budget:

5-10 million Euro

Related theme (EC Work Programmes 2023-24)

CBE JU or 4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

6. Diversification of production technologies and logistics
   D. Extracting or producing natural compounds with high added value

8. Renewable building materials for healthier living
   B Improving wood-based products, including engineered wood and composites

Pulp & Paper Industries

16. Circularity improvement of recovered materials by turning wastes into resources

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Recycling/de-inking processes produce material losses that depend on the selectivity of the separation of "contaminants" such as plastic films and particles, fillers, inks... Waste flows are thus sometimes very large: for example, they can represent between 20 and 50% of the flow of recovered paper entering deinking plants. For plants producing packaging, plastic wastes are not at all neglictable and the new regulatory policies linked to the "plastic ban" encourage the use of paper/plastic film laminates, which end up in the recovered flows and increase the amount of plastic in rejects. To date, apart from a few specific recovery ways, the treatment of the resulting waste/sludge remains a major cost for the paper manufacturer and some of the traditional valorization such as land spreading or even cement works are becoming increasingly difficult. Recycling such wastes in other fields could be imagined but such implementation has to face heterogeneity and stability rejects composition, odors, water content and lack of control in line with the targeted applications. At the same time, many sectors are looking for alternative raw materials encouraging a real circular economy.

Scope: strategy to address the above-mentioned challenge

- **Improve the circularity of papers and boards by reducing the amount of non-valorised wastes/rejects: Turning wastes into resources.**
- **Change the business model and transform cost into revenue for recycling plants.**
- **Generate stable and controlled recovered raw material for other industries.**
- **Show how regional aspects, such as industrial implantation can influence the implementation of new value chains.**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Technological : New treatment/sorting lines to separate and control the different components and composition of the waste.**

- **Economic : Give added value to materials considered as waste and cost.**
- **Circularity : Propose new raw materials from recovered flows to other industries and move away from the notion of waste.**

Competences and technologies likely to be applied

- **Sorting**
- **Material science and physics**
- **Process monitoring & engineering**
- **Digital tools and AI**
- **Policy and legislation at national and European levels**

Budget: **EUR 5-8 Million**

Duration: **at least 36 months**

Related theme (EC Work Programmes 2023-2024)

6-7-Clean Environment and zero pollution

FTP SIRA 2030 Challenges:

4. Towards a zero-waste, circular society

B Adapting reuse and recycling technologies to complex products

C Defining methods for cost assessment and optimization of recycling

17. Reduction of energy consumption in papermill

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Energy efficiency is a first order parameter regarding competitiveness and GHG emissions. Among energy intensive industries, paper and board producers are facing a dilemma in line with the energy cost. Indeed, the increase of the energy price and availability push some industrial sites to temporarily shut down their production. Improving the energy efficiency of the paper mills implies a holistic approach even if intensive section such as drying processes should be particularly reconsidered for matching final energy performances. For this last point, dry water is one of the heat sources as more than 75% of the net energy supplied to the drying section ends up in the moisture and to a great extent are lost due to a lack of performance of current energy recovery systems (heat exchangers) which often have an efficiency less than 10-15%.

Scope: strategy to address the above-mentioned challenge

- **Development of highly efficient technological breakthroughs focusing on the most energy intensive parts of specific processes (refining, drying…).**
- **Provide new and improved tools to support decision makers and stakeholders in the design of more efficient production lines data driven by AI based optimisation (composition, refining, paper, board, …).**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Technological:**
  - **New concepts dealing with the reduction of energy use by at least 30% as compared to current state of the art.**
- **Economic:**
  - **Enable the techno-economic feasibility of novel technologies and processes, validated and demonstrated at TRL6-7.**
  - **Transfer the results to other value chains.**
- **Environmental:**
  - **Contribute to achieving EU climate neutrality goal and becoming independent from fossil energy.**

Competences and technologies likely to be applied

- **Digitalisation.**
- **Process engineering & simulation.**
- **Material engineering.**
- **Paper and lignocellulosic science.**

Budget: **EUR 8-10 Million**

Duration: **36 to 48 months**

Related theme (EC Work Programmes 2023-2024)

5-4-Efficient, sustainable and inclusive energy use

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources

A Reducing energy consumption in biorefineries, including pulp and paper mills

9. New fibre-based products and 80 per cent lower CO2 emissions

A Providing sustainable, fibre-based, high-value consumer products

18. Improvement of cellulosic-material properties for food contact applications

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Directive (EU) 2019/904 on single-use plastics products was adopted in June 2019 with the aim to prevent and reduce the impact of certain plastic products on the environment. The Directive should be transposed into national law and applied as of 3 July 2021. For example, in France, AGEC law of February 10, 2020 set a new regulatory framework for plastic packaging. The end of single-use plastic packaging is planned for 2040. In addition, the law states that only recyclable packaging can be marketed from 2030. R&D efforts are needed to develop sustainable alternatives to plastics that meet the specific health, social and economic needs of the food sector. Cellulose-based packaging are an alternative solution that needs to show barrier properties in line with final market applications/standards.

From a health point of view, the suitability of packaging for food contact must be respected. The European regulation (EC 1935/2004 and EC 2023/2006) incorporates a key principle common to all countries which is the inertness of the material which means that there must be no transfer of substances to the food in a quantity likely to present a danger to human health, to cause an unacceptable change in the composition of foodstuffs or to cause an alteration in the organoleptic characteristics of these.

Also, Sustainable solutions for oil/grease and water barrier in cellulosic packaging applications (paper, molded pulp), alternative to single use plastics, allowing product recyclability or biodegrability/compostability. Most of the few so-called biobased available solutions are not as effective as their fossil-based counterparts (eg PFAs coatings or polyethylene laminates).

Scope: strategy to address the above-mentioned challenge

- **Develop biobased, recyclable and biodegradable alternatives to plastic food-packaging for a large set of application (takeaway, collective catering, frozen food) in order to find solutions for implementing the transposition of SUPD in the different countries.**
- **Obtain barrier properties: mechanical & water, water-vapour, grease and oxygen, contaminant in line with final market applications/standards.**
- **Develop solutions for food contact that comply with European and national regulations and the needed requirements**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

- **Technological:**
  - **Develop alternative biosourced, biodegradable and recyclable food-packaging solutions**
  - **Deliver solutions with improved environmental and production-efficiency performances compared to the state of the art**
  - **Improved health and safety profile when compared with fossil-based state of the art.**
- **Circularity:**
  - **Obtain alternative solutions with higher circularity through advanced/new functionalities compared to the state of the art.**
  - **Guarantee that alternative food-packaging solutions do not disturb existing recycling lines.**
- **Economic: Deliver economically viable solutions to substitute plastic in food packaging**
- **Health: Guarantee the safety of the food-packaging alternatives regarding the migration of harmful contaminants**

Competences and technologies likely to be applied

- **Food contact materials analysis**
- **Material science, chemistry & physics**
- **Coatings and surface treatments and related formulations/processes**
- **End-of-life waste management sector**

Also, expertise on pilot paper coating (aqueous), paper extrusion/lamination and thermoformed pulp products area available at our Research Institute. Partnertship with emerging startups or big chemical supplyers will be mostly welcome.

Budget: **EUR 5-8 Million**

Duration: **At least 36 months**

Related theme (EC Work Programmes 2023-2024)

6-7-Clean Environment and zero pollution

FTP SIRA 2030 Challenges:

9. New fibre-based products and 80 per cent lower CO2 emissions

A Providing sustainable, fibre-based, high-value consumer products

C Developing building blocks for biobased materials and chemicals in the circular society

D Adding value through digitalization and functionalization

19. Thick, durable and flexible fibre-based wrapping and packaging solutions

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Several industrially manufactured products such as sawn timber and engineered wood products are wrapped in thick plastic covers for transport. They serve as protection towards mechanical wear and the weather conditions during storage and transport. They are burst resistant, suitably stretchy to enable easy use and they have a good surface for printing. However, they are made of plastic, and thus remain a source of microplastics and relatively high carbon footprint. Also, they are almost always single use, but on the other hand, recyclable with plastics. New European regulation is expected to increase the required share of reusable packaging solutions also in this category. Similarly, protective, durable and reinforced plastic tarpaulins are use as weather guards for various households, leisure, retail and industry needs.

The industry would like to find ways to package its products using the most sustainable option without compromising the functionality of the packaging material. Recycled plastics offer some improvement in terms of carbon footprint, but the potential microplastics problem remains.

Scope: strategy to address the above-mentioned challenge

New sustainable, fibre-based composite materials should be developed which can compete with thick, durable and flexible plastics. There are some novel fibre-based stretchy materials available, but they have rather low grammage and can better replace lighter and thinner plastics, such as those used in plastic bags. The raw materials and manufacturing technology for these sustainable thick packaging films or reinforced longer life-time protective products should be sustainable and resource efficient. The end product should have improved carbon footprint compared to existing products made from (recycled) fossil-based plastics and demonstrate its recyclability in existing recycling systems (plastic or cardboard) and lack of shedding microplastics.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

The project should produce new knowledge on the potential of different raw materials in this type of use, new material recipes and innovative production concepts and manufacturing methods (with IPR) as well as laboratory- or small pilot-scale proof-of-concept demonstrations.

Competences and technologies likely to be applied

Mechanical and chemical fibre treatment technologies, production and modification of biobased plastics, different types of manufacturing technologies including composite technologies

Budget: **EUR 3-5 Million**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

4-2-Increased Autonomy in Key Strategic Value Chains for Resilient Industry

FTP SIRA 2030 Challenges:

9. New fibre-based products and 80 per cent lower CO2 emissions

A Providing sustainable, fibre-based, high-value consumer products
B Developing more sustainable and competitive processes for paper-making and other biobased products
C Developing building blocks for biobased materials and chemicals in the circular society
D Adding value through digitalization and functionalization

20. Highly efficient water removal from wet paper web in paper machines

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Pulp and paper production requires significant amounts of energy, a large share of which is generated in-house by the production plants. Per year, the European pulp and paper industry consumes ca. 1,250 TJ of fuels and 95 TWh of electricity (Cepi, 2018 statistics). About 20% of the total energy consumed in the papermaking process is used for drying.

Paper manufacturing starts with a mixture of pulp fibres and water with a solids content of about 1%. Gravity and vacuum driven drainage raises the dryness to around 20%, after which mechanical pressing of the paper web removes enough water to bring the dryness level to 40-50%. That is, after the pressing, there is about as much water in the web as there is pulp fibre material. This water needs to be removed by drying which requires large quantities of energy. Reducing the drying energy is therefore an important part of making pulp and paper production more energy more efficient.

There are several avenues through which drying energy can be reduced by more efficient water removal:

It has been estimated that the practical dryness limit reachable by water removal by pressing of the paper web is ca. 65%, which is far above currently achieved levels. Developing a next generation of pressing technology that approaches this performance limit could reduce the drying energy requirement by 40%. A key aspect will be to ensure single-direction water flow in the press nip, in order that re-wetting of the paper web by previously drained water does not occur. This is considered the main reason why current dryness levels are well below the estimated maximum level.

More efficient processes for water removal by drying are needed. Significantly more drying energy is required than the minimum amount given by thermodynamic considerations, and technological approaches should be developed that close this gap.

The pulp fibres are mechanically treated (refined) to improve their bonding ability and the strength properties of the paper product. The refining causes the fibres to swell and hold water, which has a negative impact on the water removal. Alternative and novel approaches that decouple strength and fibre water retention would therefore reduce drying energy and would provide additional energy savings by eliminating/reducing the need for mechanical refining (25-100 kWh/t product).

It is during the drying that the bonds providing the paper strength develops. However, historically drying processes have primarily been considered from an energy efficiency perspective. Efforts to

develop new approaches for paper strength that are effective at reduced fibre swelling should therefore include research into the mechanisms behind bond creation in paper during drying.

More efficient water removal can also be addressed by novel/modified pulping processes that yield fibres more amenable to dewatering and drying, or which do not require the same degree of swelling to provide strength.

Scope: strategy to address the above-mentioned challenge

Water removal in papermaking has only seen incremental improvements over the last twenty to thirty years. A successful project would move the research front forward in key areas that will allow real breakthroughs in water removal and drying efficiency:

Elimination of rewetting during water removal by pressing will require new design principles for press nips and felts based on increased fundamental understanding of water transport in compressed pulp mats, and the interaction effects between the pulp mat and the press felt that contacts it during re-wetting.

Advances in the understanding of fibre property development during mechanical treatment of pulp, and how specific effects in the fibre material relate to operational and geometrical parameters in the process equipment. Current understanding is at gray-box level. Deeper understanding could lead to improved versions of existing technology, or completely new equipment design principles, that limit mechanical treatment to the desired effects, and avoid unnecessary fibre swelling.

A better understanding of how bonds form between pulp fibres during drying, in order that novel approaches to develop paper strength by additives can be conceived that do not rely on highly swollen fibres.

An understanding of how the pulping process can be adapted to provide fibre material with a structure and physical/chemical properties that make it easier to dewater (directly or under the action of subsequent unit operations) while otherwise resulting in the same paper properties and unchanged pulp yield.

5. How would you like to quantify the impact of a successful project? (e.g. jobs created, reduction of production costs, reduction of CO2 emissions…)

- **A reduction of drying energy of 20% in papermaking through novel pressing technology. Implemented across all European paper production this amounts to 19 TWh/year of electricity and 250 TJ of fuel. In 2018, 60% of the fuel was based on biomass. Consequently, the fuel saving would make biomass available for energy generation in other parts of society, and/or, if fossil fuels are eliminated, the fraction of biobased fuel used by the industry for drying would increase.**
- **A further reduction in drying energy of 10% from improved technologies for mechanical treatment of the pulp that give equal paper strength properties with less**

fibre swelling, and/or approaches for developing paper strength with less refining. As part of this, the energy used for the refining could be reduced by 10% (10 kWh/t product). The total production of paper and board in Europe is ca. 100 Mton per year (2019), and the associated energy savings are hence substantial.

- **In 2019 the pulp and paper industry in Europe directly employed 180,000 people, and the turnover was 90 BEUR. The industry operates on an international competitive market and more than 22% of the production is exported. Energy is one of the major cost components for the pulp and paper industry, and energy reductions will contribute to maintaining a large and competitive pulp and paper sector in Europe.**

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

The project would touch upon most aspects of the papermaking process and will require competences from essentially all disciplines of pulp and papermaking (pulp chemistry, paper chemistry, papermaking process chemistry, process mechanics, physics). Success will also require expertise in advanced measurement and characterization methods, including those available at large scale research infrastructures such as ESRF, DESY, MAX IV and ESS. The project should also include system level energy and sustainability analyses, and competence in these areas is required.

The project will work at multiple TRL levels. Some hypotheses are likely to start at a low TRL level (1-3), but it is expected that the project will demonstrate concepts up to TRL 5 (in pilot environments). To ensure a breadth of perspectives and competences, the project consortium should include different type of organizations: universities, research institutes, and pulp and paper companies.

Budget: **EUR 20 Million**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

P4P and 4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources

A Reducing energy consumption in biorefineries, including pulp & paper mills

21. Integrated drying and heat recovery processes for large energy savings in papermaking

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

The papermaking process generally consists of dispersing recycled and/or virgin cellulose fibres in water, forming the paper web and removing the water by pressing and thermal drying. On average 70% of the energy required for paper making is used for thermal drying with steam.

Water is an essential element in the production of paper as the cellulose fibres are mutually bound by hydrogen bonds. By dispersing pulp or paper recycling in water hydrogen bonds between the fibres are broken. By subsequent dewatering and drying of the formed paper web, the hydrogen bonds are formed again thus creating strength and stiffness. This reversible process also allows for the excellent recyclability of paper and board.

Although the water cycles are fairly closed, the main GHG challenge of the presence of water is the large amount of energy required for the thermal removal of it. This means that the paper industry searches for solutions that can significantly reduce the amount of heat needed for drying the paper.

One of the options is to recovery the latent heat from the drying process. Innovative heat recovery technologies, like mechanical vapor recompression and other kinds of heat pumps, may realise a significant reduction of energy required for steam production. However, effective use of these techniques inherently requires a starting vapor at high temperature and low air content. Though drying technologies in papermaking processes are highly efficient in achieving almost 100% energy transfer for water evaporation, the processes are not designed for resulting in a vapor of which heat can efficiently be recovered: low dewpoints and high air content. The challenge is the development of innovative drying technologies that allow efficient heat recovery. Technological solutions may be in the areas of energy efficient drying, including airless drying, superheated steam, vapor-air separation technologies or any other drying technology that facilitates efficient recovery of latent heat from drying exhaust.

In a large EU project 'Joule II' performed in the nighties of the 20th century a technology was developed based on superheated steam. Experiments on a small pilot showed in more than 50% energy savings. Though, as this new technology appeared to require a complete rebuilt of the major part of a paper machine, and thus extreme high costs for 'stranded assets', the development was not continued. Other technical challenges to be solved include the purity of the steam for reuse, sealing issues of the process equipment, and accessibility of the equipment because of high temperatures.

Current CO2 emission reduction ambitions and high CO2 prices lead to a higher interest for complete rebuilds to reach the Green Deal targets.

Scope: strategy to address the above-mentioned challenge

The project will work at multiple TRL levels. Most new concepts are likely to start at a low TRL level (1-4), but it is expected that some concepts may include demonstration to TRL 5-7 (in pilot environments). To ensure a breadth of perspectives and competences, the project consortium should include different type of organizations: universities, research institutes, pulp and paper companies, and especially machine suppliers that are able to develop the concepts further towards actual deployment in industry.

The challenge of reducing the amount of process heat is valid in many industry sectors. In the paper industry more than 70% of the energy need is related to heat for drying purposes. But also in the agri-food and other biomass processing industries, and also in specialty chemicals processes, the water removal by evaporation is an energy intensive process step.

Tackling this challenge requires a multi-disciplinary approach with experts on papermaking processes and paper physics on the one hand, and experts in heat, thermodynamics and heat recovery technologies on the other hand.

Many sectors face the challenge of reducing the amount of heat needed for drying. Superheated Steam concepts are under development for other sectors as well. It may be efficient to combine knowledge and expertise.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Reducing the amount of heat needed for drying is the most important challenge in papermaking as to allow a significant reduction in emission of CO2 emissions. This cannot be accomplished with some minor changes. A breakthrough is needed to completely change the current drying part of the papermaking process.

A successful project would move the research front forward in key areas that will allow real breakthroughs leading to a reduction of drying energy of more than 50% in When this activity is not started in 2023-2024, the rolling out of results for industry over Europe, the EU green deal targets for 2030 and 2050 will not be reached.

A reduction of drying energy of 50% in papermaking through novel pressing technology. through novel integrated drying and heat recovery technology implemented across all European paper production this amounts to 48 TWh/year of electricity and 600 TJ of fuel. In 2018, 60% of the fuel was based on biomass. Consequently, the fuel saving would make biomass available for energy generation in other parts of society, and/or, if fossil fuels are eliminated, the fraction of biobased fuel used by the industry for drying would increase. This would lead to a significant reduction of GHG emissions.

In 2019 the pulp and paper industry in Europe directly employed 180,000 people, and the turnover was 90 BEUR. The industry operates on an international competitive market and more than 22% of the production is exported. Energy is one of the major cost components for the pulp and paper industry, and energy reductions will contribute to maintaining a large and competitive pulp and paper sector in Europe.

The huge energy reduction addresses the European Green Deal targets of 2030 and 2050.

Totally eliminating water from paper making in the end would be the holy grail for reduction of CO2 emission reduction. However, the inherent sustainable biobased and circular character of paper is due to water and its induced hydrogen bonding between cellulose. This means that closing the energy loop in the process as much as possible is the best way to keep all other highly sustainable aspects of paper products.

Budget: **EUR 20 Million**

Duration: **?**

Related theme (EC Work Programmes 2023-2024)

P4P and 4-1-Climate neutral, Circular and Digitised Production (RIA and Demo actions)

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources

A Reducing energy consumption in biorefineries, including pulp & paper mills

22. Water removal without evaporation for large energy savings in papermaking

Subsector: **P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Water is an essential element in the production of paper as the cellulose fibres are mutually bound by hydrogen bonds. Paper manufacturing starts with a mixture of pulp fibres and water with a solids content of about 1%. Gravity and vacuum driven drainage raises the dryness to around 20%, after which mechanical pressing of the paper web removes enough water to bring the dryness level to 40-50%. The huge amount of remaining water needs to be removed by evaporation, using thermal drying which requires large quantities of energy.

On average 70% of the energy required for paper making is used for thermal drying with steam.

Although the water cycles are fairly closed, the main GHG challenge of the presence of water is the large amount of energy required for the thermal removal of it. This means that the paper industry searches for solutions that can significantly reduce the amount of heat needed for drying the paper.

One of the options is to remove water without evaporation, aa it is the high enthalpy of water that causes the high energy consumption. When the last 50% of water can be removed without having to evaporate, this may significantly reduce the energy consumption. We are searching for innovative technologies that can isolate water from a wet paper web without evaporation (e.g. electric field, electro-osmosis) or by eliminating water from the papermaking process

- Papermaking without water would mean a complete plant redesign. Strength and stiffness of paper comes from hydrogen bonds between the cellulose fibres. Dry formation processes are not new to the sector, they are already applied for the production of nonwovens. Due to lack of hydrogen-bonds these products are typically very soft, flexible and easily tearable, which are properties that are not appreciated for most paper and board applications. The challenge is to induce proper bonding between dry-laid cellulose fibres to create strong and stiff papers.

- Concepts avoiding water evaporation may include technologies applying electric fields, electro-osmosis or supercritical CO2, but does not preclude other technologies that can achieve a more than 60% reduction in energy consumption for water removal.

In both cases, the challenge is how to induce hydrogen-bonds without the presence and evaporation of large amounts of water.

Type of activity: development and testing of innovative technologies and concepts

Scope: strategy to address the above-mentioned challenge

The project will mainly start at a low TRL levels (1-4). To ensure a breadth of perspectives and competences, and ensure a potential fast scale-up, the project consortium should include different type of organizations: universities, research institutes, pulp and paper companies, and especially machine suppliers that are able to develop the concepts further towards actual deployment in industry.

The challenge of reducing the amount of process heat is valid in many industry sectors. In the paper industry more than 70% of the energy need is related to heat for drying purposes. But also in the agri-food and other biomass processing industries, and also in specialty chemicals processes, the water removal by evaporation is an energy intensive process step.

Tackling this challenge requires a multi-disciplinary approach with experts on papermaking processes and paper physics on the one hand, and experts in heat, thermodynamics and heat recovery technologies on the other hand.

Many sectors face the challenge of reducing the amount of heat needed for drying. Supercritical CO2 based concepts are being developed to assist energy efficient drying and colouring in the textile and food industry. Insights achieved in these sectors may assist the development for the paper industry. It will be efficient to combine knowledge and expertise.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Reducing the amount of heat needed for drying is the most important challenge in papermaking as to allow a significant reduction in emission of CO2 emissions. This cannot be accomplished with some minor changes. A breakthrough is needed to completely change the current drying part of the papermaking process.

A successful project would move the research front forward in key areas that will allow real breakthroughs leading to a reduction of drying energy of more than 60% in When this activity is not started in 2023-2024, the rolling out of results for industry over Europe, the EU green deal targets for 2030 and 2050 will not be reached.

A reduction of drying energy of 60% in papermaking through novel pressing technology. through novel integrated drying and heat recovery technology implemented across all European paper production this amounts to 57 TWh/year of electricity and 700 TJ of fuel. In 2018, 60% of the fuel was based on biomass. Consequently, the fuel saving would make biomass available for energy generation in other parts of society, and/or, if fossil fuels are

eliminated, the fraction of biobased fuel used by the industry for drying would increase. This would lead to a significant reduction of GHG emissions.

In 2019 the pulp and paper industry in Europe directly employed 180,000 people, and the turnover was 90 BEUR. The industry operates on an international competitive market and more than 22% of the production is exported. Energy is one of the major cost components for the pulp and paper industry, and energy reductions will contribute to maintaining a large and competitive pulp and paper sector in Europe.

The huge energy reduction addresses the European Green Deal targets of 2030 and 2050.

Totally eliminating water from paper making in the end would be the holy grail for reduction of CO2 emission reduction. However, the inherent sustainable biobased and circular character of paper is due to water and its induced hydrogen bonding between cellulose. This means that reducing the energy demand may be the smartest and fastest way to keep all other highly sustainable aspects of paper products.

Budget: **EUR 20 Million**

Duration: **?**

Related theme (EC Work Programmes 2023-2024)

P4P and 4-1-Climate neutral, Circular and Digitised Production (RIA and Demo actions)

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources

A Reducing energy consumption in biorefineries, including pulp & paper mills

Cross-sub-sectoral

23. Optimal value for wood

Subsector: **WW, P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Production of different products such as sawn timber, engineered wood products and pulp and paper products from wood have different requirements and preferences regarding the raw material properties. Guiding the logs to the most suitable process for high material efficiency using most sustainable logistic chains should also lead to optimised value from the logs. Currently, the models and data needed for optimising the use of wood towards any one of these targets is very limited; possibly one of the most developed methods is real-time LCA. Digital tools and methods connecting the relevant data sources and models for conducting multi-criteria optimisation need development.

Scope: strategy to address the above-mentioned challenge

Optimisation of different wood species' value chains from forest to construction and manufacturing raw materials calls for development of methodologies and tools, and evaluation of cases to demonstrate the trade-offs between the targets.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Platforms for sharing data and models, multi-scale models for capturing the critical phenomena at different levels from wood properties to overall value chain sustainability, knowledge on requirements for data and data sharing needs for optimisation

Competences and technologies likely to be applied

Big data, data analytics, wood science, economic analysis, life-cycle analysis

Budget: **4-5 M**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
E Analysing and foresighting markets and material flows of forest-based products

5. Efficient use of natural resources
B Optimizing the use of raw materials by exact control of natural variations
C Improving raw material efficiency and production value in wood-based manufacturing

6. Diversification of production technologies and logistics
C Adopting additive manufacturing technologies and new production methods

24. Energy management of future forest industry facilities

Subsector: **WW, P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Future forest industry production processes targeting higher main product yields and producing efficiently different new products from side-streams will have very different energy demands and energy generation potential compared to current state-of-the-art sawmills or pulp mills. Moreover, renewable electricity production, energy storages and hydrogen economy will further influence how future plants manage their energy balances. Understanding the technological implications that these shifts in energy demands and production bring to the production of forest industry products is needed.

Scope: strategy to address the above-mentioned challenge

Practical modelling based analysis of all relevant processes and future energy and production technologies (e.g. electrified kilns and boilers, heat pumps, energy storages), integrated into energy generation (e.g. PV, wind, forest industry processes primary heat and waste heat) and energy consumption in forest industry processes. Systematic review of technology readiness and development needs to create roadmaps for forest industry process development. Gathering knowledge from other industrial sectors

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Practical engineering knowledge of future energy systems at equipment and process levels; understanding on integration of energy and electrification possibilities into forest industry processes

Competences and technologies likely to be applied

Energy technologies, forest industry process technologies, process simulation and modelling

Budget: **2-3 M**

Duration: **3 years**

Related theme (EC Work Programmes 2023-2024)

5-3-Sustainable, secure and competitive energy supply

FTP SIRA 2030 Challenges:

5. Efficient use of natural resources

A Reducing energy consumption in biorefineries, including pulp and paper mills

D Improving water balance and process water treatment

25. Innovative fibre-based materials in construction sector applications

Subsector: **WW, P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

Construction sector is a large user of materials, especially those that have high fossil carbon footprint. Its products have a long life time and therefore the ability to store carbon for even over hundred years. Cement production is a known climate polluter but other products such as mineral wools, plastic films, construction chemicals may cause high greenhouse gas emissions during production and lifetime.

Scope: strategy to address the above-mentioned challenge

Wood-based fibres are one of the most widely available and versatile intermediate product which could be used more widely in the construction sector. Its use in the construction sector would store its carbon into long life-time products. Smart combinations of cellulosic fibres with other materials such as wood, lignin, extractives and bioplastics could produce the functionalities needed in the applications such as surface durability, mechanical strength and moisture protection.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

The project should produce new knowledge on the potential of cellulose and cellulosic fibres in construction sector applications, e.g. new material recipes and innovative production concepts and manufacturing methods (with IPR) as well as laboratory- or small pilot-scale proof-of-concept demonstrations. Wood or other wood-based fractions such as lignin, hemicelluloses and extractives can be used as well to bring other types of functionalities to the product.

Competences and technologies likely to be applied

Materials chemistry, composites, manufacturing technologies, polymer chemistry, fibre processing

Budget: **3-5 M**

Duration: **4 years**

Related theme (EC Work Programmes 2023-2024)

4-2-Increased Autonomy in Key Strategic Value Chains for Resilient Industry

FTP SIRA 2030 Challenges:

6. Diversification of production technologies and logistics
C Adopting additive manufacturing technologies and new production methods

8. Renewable building materials for healthier living
B Improving wood-based products, including engineered wood and composites

9. New fibre-based products and 80 per cent lower CO2 emissions
C Developing building blocks for biobased materials and chemicals in the circular society

26. Digital transformation based on the implementation of Forestry 4.0, Sawmill 4.0 and Pulp & Paper 4.0 into research-innovation activities, support for open science and more efficient knowledge transfer to practice

Subsector: **F&F, WW, P&P**

FTP Remarks:

Scope: practical challenge/bottleneck to address

- **Smart forest inventory based on 3D high-resolution scanning (mobile terrestrial laser scanning, airbased lidar scanning).**
- **3D CT log scanning, enhanced grading, sorting and sawmill processing.**
- **Digital gapless traceability, wood flow management and customisation.**

Also, Data are mostly available, however not for the whole value chain. Increased value, quality and sustainability can be achieved through traceability throgh the whole chain, increased data sharing and by means of technology for efficient and secure data management. Simultaneously, the same data and technology can also be used for improved production control through the value chain

Scope: strategy to address the above-mentioned challenge

Personnel completion of research teams and infraštruktúram upgrade of laboratories of the Center of Excellence of the Forestry and Timber Complex (CoE LignoSilva).

Alternative 1: Through large-scale projects.
Horizon Europe Widening Participation and Spreading Excellence actions that contribute to building research and innovation capacity for countries lagging: Teaming, Twinning.
Position of National Forest Centre - CoE LignoSilva: coordinator.

Alternative 2: Through small and medium-scale projects of Horizon Europe, The European Regional Development Fund (ERDF) and national research and innovation funds.
Position of National Forest Centre - CoE LignoSilva: partner of the projects or coordinator.

Also,
1. Identify relevant and necessary standards
2. Technology and system setup for information carriers
3. Demonstration in relevant value chains including all actors concerned

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

Maintaining the competitiveness of FBS requires the deployment of new digital and IT technologies. Mobile scanning technologies for acquiring data about forest resources, wood flow optimisation tools, and wood traceability need to be developed, tested and demonstrated for forestry companies. Further valorisation of wood requires the implementation of advanced technologies such as 3D CT scanning in grading, sorting and sawmill processing. Then, there is a need to non-destructively test how internal defects affect the quality of the resulting products. CoE laboratories of 3D scanning and non-destructive wood testing will play a unique role in the digital transformation of FBS.

Also, Working technology and system for traceability and production control, approved by relevant market actors. This will in result in improved quality, improved efficiency, higher value, customized products, reduced waste, improved circularity.

Competences and technologies likely to be applied

The NFC already has adequate infrastructure to fulfil the stated goals. CoE LignoSilva directly manages the research base: 1) Straze at Zvolen (5.6 ha with experimental forest stand 1.6 hectares) with an experimental pilot line for 3D CT detection of wood defects Future upgrade of CoE assumes completing the laboratory of non-destructive methods at the area Straze. Based on 3D CT scans and knowledge of detected internal errors, enhanced research and development of test methods are expected to determine the physical and mechanical properties of wood and wood materials.
NFC and CoE operates mobile terrestrial laser scanner and technology with airborne lidar scanner and aerial multispectral metric camera. Better alignment of data from lidar and terrestrial laser and 3D CT scanning allows achievement of the desired level of complex processing of assortments corresponding structurally to harvested timber quality and the demand of customers. Demonstrated will be software solutions and the implementation of advanced techniques of image processing (including image recognition) allowing to trace trees to logs and logs to respective boards through a "digital fingerprint" and vice versa

Also, Researchers (logistics, ICT including AI, forestry,...), Tech industry and entrepreneurs (SMEs) and Industry

Budget:

12 million EUR for the period 2024-2029, including the completion of the research infrastructure.

Duration: **2024-2029 (5 years)**

Related theme (EC Work Programmes 2023-2024)

4-1-Climate neutral, Circular and Digitised Production

FTP SIRA 2030 Challenges:

2. Increased, sustainable wood production and mobilization
B Using the digital revolution for precision forestry
D Harnessing novel technologies and automation in forest operations

7. Purposeful, safe jobs and links between rural and urban regions
D Adapting job offers in an era of Artificial Intelligence (AI)

8. Renewable building materials for healthier living
C Harmonization and standardization research and more intelligent, digital design tools

9. New fibre-based products and 80 per cent lower CO2 emissions
D Adding value through digitalization and functionalization

Honorary mentions

Impact of clear cuts and regular forest management on biodiversity, carbon cycles, quality of wood production, bioeconomy, forest resilience

Nutrient recovery and reuse to keep to planetary boundaries

Nutrient usage has exceeded the planetary boundaries. there is a need to make sure that nutrients are recovered and recycled/reused as efficiently as possible to enable agriculture/forestry and maintain biodiversity
Identification of where nutrient flows can be found that are not utilised for growth of biomass (excl. eutrophication) and harness them.
nutrients do not make their way into waterways through leaching or waste waters of processes, they are recycled and reused, some are even captured from streams where they have no function (or are even detrimental to processes)
Competences and technologies likely to be applied: synthetic biology, membrane technology, biology, chemistry
Budget: 10 M
Duration: 5-10 years
Related theme (EC Work Programmes 2023-2024)
6-7-Clean Environment and zero pollution

Forest-based biochemicals and products

More effort and investment are needed to develop novel high-performance biobased chemicals and materials that fully meet the current state-of-the-art of fossil-based materials. More funding are needed to run effective demo/pilot scale test for novel biobased materials.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?
Novel (patented) products after 3-10 years after research and innovation cooperation projects.

Competences and technologies likely to be applied
chemistry, polymer technology, process engineering, biorefining, forest industry, chemical industry

Budget: 600-1000 kEUR/project PI
Duration: 3-4 years

Emission free processing of biomass

Scope: practical challenge/bottleneck to address

There is a clear need to make sure that components of wood(other biomass) can be separated without converting part of the material into CO2 through combustion.
Scope: strategy to address the above-mentioned challenge
new chemistries need to be investigated that will allow for this. There will be additional challenges of chemical recovery and recirculation or other modes that will not harm the environment

Impact: progress beyond "state of the art" of a successful implementation of the strategy?
the yield of components extracted and utilised for material production (not energy) rises significantly (double digits)

Competences and technologies likely to be applied
understanding of the chemistry needed to break specific bonds selectively (chemistry and structure of biomass, solvent chemistry) . Once this is clear the technology development will need to follow.
Understanding of the needed properties of future products and material availability (smart utilisation of resources - best suited materials for use/sustainability)

Budget: most likely this kind of project will need significant budget, 10 M
Duration: > 5 years

Sustainable use of natural resources considering biodiversity and carbon balance for new, renewable, recyclable (circular) and competitive, value-added industrial-scale bio-based application replacing fossil/non-renewable ones

1) Finding ways to measure biodiversity and carbon balance in different kind of forests
2) combining this knowledge to the use of natural resources (including both wood-based and biogenic CO2 as raw materials) for sustainable products, thus considering the whole value chain, not forests and products separately
3) for circular and competitive, value-added industrial-scale products replacing fossil/non-renewable ones.

Scope: strategy to address the above-mentioned challenge

Scientific data-based evaluation of biodiversity, carbon balance and the options balancing the three pillars of sustainability.
Utilizing world leading computing and digitalization technologies, natural sciences, sophisticated measurement and evaluation techniques.
With the help of novel manufacturing technologies including biotechnology and electrification, using wood-based raw materials and/or biogenic CO2 as a raw materials, replace fossil based materials.

Impact: progress beyond "state of the art" of a successful implementation of the strategy?

New knowledge and ways to measure biodiversity, different forests' and forest lands' GHG emissions and sinks.
Novel manufacturing technologies (e.g. biotechnology and synthetic biology, new kind of chemistry, electrification) for applications / products (and IPR) replacing fossil ones.

Competences and technologies likely to be applied

New knowledge and ways to measure biodiversity, different forests' and forest lands' GHG emissions and sinks.
Novel manufacturing technologies utilizing e.g. biotechnology, synthetic biology, new chemistry.
Computing and digitalization technologies, natural sciences, measurement and evaluation techniques.
Wood and CO2 chemistry, engineering, electrification technologies.