



Forest bioeconomy NRA

Recommendations for the Finnish forest-based bioeconomy R&D

By the Finnish National Support Group to the Forest-based Sector Technology Platform

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Task-force assignment

The Strategic Research Agenda (SRA) of the Forest-based Sector Technology Platform (FTP) provides a European-level approach to R&D bottlenecks within the forest-based sector. It is also the basis for R&D efforts in Finland, however, as a pan-European agenda it naturally also contains issues not relevant in the Finnish context. The FTP SRA is also already a few years old.

With these two premises in mind the Finnish National Support Group to the FTP decided to make an internal exercise to highlight topical R&D needs from a Finnish perspective and these are the recommendations identified.

Bioeconomy and Cleantech are in the heart of the Finnish government's spearhead programmes. At the same time Finland faces significant challenges regarding its economic performance as country, which also impacts the Finnish public R&D funding capabilities negatively. The scarce capabilities must be focused efficiently.

Meanwhile, the Finnish forest industry is in the midst of a significant industrial transformation, which can be seen, for instance, as clear focusing by companies and, but also as development of new products. This undertaking also needs support by focused R&D.

All this in mind, our task was to identify important research themes that would create new business opportunities, jobs and well-being in general. The themes identified should also reinforce the competitiveness of current players, identify new value-added products and to affect positively to export opportunities.

National Research Agenda (NRA), Forest-based Bioeconomy

1. The forest-based sector in a biobased society^(*)

1.1. Barriers and policy instruments in forest-based bioeconomy

2. Responsible management of forest resources^(*)

2.1. Enhanced biomass production and new inventory systems (Forest Big Data)

2.2. Forests and well-being

3. Creating industrial leadership^(*)

3.1. Novel fractionation and modification technologies

3.2. BioIT

3.3. Distributed bioeconomy

3.4. Circular economy based on renewables

3.5. Bioenergy, biofuels and bioenergy carriers

3.6. Business models and service concepts for bioeconomy

4. Fulfilling consumer needs^(*)

4.1. Building with wood (including interior solutions)

4.2. From wood to textiles (including demo-platforms)

4.3. From wood and forests to food and feed

4.4. Biochemicals and biomaterials

4.5. New biobased products

^(*) The first level headings are identical with the FTP Strategic Research & Innovation Agenda 2020



1. The forest-based sector in a biobased society

1.1. Barriers and policy instruments in forest-based bioeconomy

Why important:

New products and value chains of bioeconomy need legislation support in order to enter the market and initiate business activities. On the other hand, knowledge and know-how is necessary to prevent the legislation and regulation from hindering the development of bioeconomy.

Required research and innovation activities:

- Scenario approach: Operational environment as a challenge – Resource smartness as the target
- How regulation and legislation support the development of bioeconomy
 - Carbon sink vs growing forest vs necessary harvesting
 - Using recycled materials
- Creating a chain of traceability for all bio-based and recycled materials
- Refining knowledge to support decision making
 - National level, EU



2. Responsible management of forest resources

2.1. Enhanced biomass production and new inventory systems (Forest Big Data)

Why important:

- Secured wood supply, forest operations and logistics
- Distributed biomass production systems and machinery, novel SME business concepts
- Advanced silviculture practice
- New tree varieties: accelerated breeding, exploitation of natural biodiversity

Required research and innovation activities:

- Develop new inventory techniques for determining quantity, quality, dimensions and specific properties of forest resources
- Develop intelligent forest operations systems and new solutions for human-machine-terrain interactions,
- Harvesting, new automatized machineries, transportation of wood
- Develop innovative processing concepts to be carried out during transport , processing on wheels development of the value-chain, agromachinery industry to be combined
- Develop new (or adapt existing) ICT solutions for new, smart and integrated transport and logistics systems from local and regional to global scale
- Traceability, capitalization of sustainability
- Accelerated breeding of e.g. short rotation boreal varieties

2.2. Forests and well-being

Why important:

Multi-purpose management of forests creates new business opportunities and jobs especially for rural areas.

Required research and innovation activities:

- Nature tourism, nature experiences for well-being, new service concepts
- Superfood from Finnish forests: harvesting techniques for non-wood forest products e.g. berries and mushrooms.



3. Creating industrial leadership

3.1. Novel fractionation and modification technologies

Why important: Opens new ecosystems for wood-based product concepts.

- Renewal of current SME sector by new business concepts, cross-fertilization with innovative SME machinery companies from agro sector - potential input to governmental agenda
- Proactive generation of missing players to the value-chain

Required research and innovation activities:

- Develop and demonstrate novel separation technologies
- Concepts for the separation of valuable components from pulping spent liquors
- Demonstrate concepts based on thermal processing of biomass (gasification, flash pyrolysis, hydrothermal liquefaction, etc.)
- Bark biorefinery and valorization of waste waters
- Debarking technologies and machinery for thin wood and unconventional wood species
- Demonstrate biomass deconstruction technologies enabling sugar platform concepts
- Omnivore process concepts - processing with agro and forest raw materials

3.2. BioIT (New)

Why important: Digitalization is changing the business environment of bioeconomy.

IT as an enabling technology combined with raw material and processes knowledge with completely new way offers competitive edge for forerunners.

Required research and innovation activities:

- Efficient use of big data on bio-resources for business
- Particularly forest owners, SME's in machine technology and wood processing and their service providers can develop new business on internet platforms
- Window to biomass resources:
 - Precise sourcing of raw materials, right material to right end use
- Monitoring and service concepts of harvesting and transport fleet
- Shared economy including reuse, recycle and remanufacturing of bio-materials

3.3. Distributed bioeconomy – research themes

(New)

Why important:

Creates new business opportunities, new enterprises or symbiosis with existing mills and new jobs.

Required research and innovation activities:

- New business and service concepts
- Logistic systems
- Forest operations
- Technologies
 - Pre-processing in harvesting and storage
 - Distributed small-scale bioenergy
 - Processing during transport
- Small-scale processes
- Industrial symbiosis and utilization of side-streams
- Omnivore mills

3.4. Circular economy based on renewables (New)

Why important:

Circular economy is promoting transformation of Europe into a more competitive resource-efficient economy. European Commission is striving towards circular economy, but the role of renewables are not taken sufficiently into account.

Required research and innovation activities:

- Increased recycling of bio-based products
- Recyclability as baseline in product design
- Utilization of agro-food side streams in the production of bio-based chemicals
- Recovery of valuable fertilizer components from side and waste streams
- Legislation to support the use of recycled materials in product manufacturing
- Creation of a traceability chain for recycled materials and all bio-based materials
- Recycled materials as raw materials for new products e.g. in composites

3.5. Bioenergy, biofuels and bioenergy carriers

Why important:

Strengthen the existing business and its renewal as well as totally new concepts.

Required research and innovation activities:

- Focus in bioenergy, biofuels and energy carriers
- Improve efficiency and power-to-heat ratio
- Combine biogas production with waste water treatment, where technically and economically appropriate.
- Develop concepts to use solar and wind power generation at existing mills, new mill concepts to be connected
- Feasible use of low energy content streams: steam and water
- Cooperation with smart grid development

3.6. Business models and service concepts for bioeconomy

Why important:

New business ecosystems by enriching co-operation of SMEs and big companies as well as creating strong smart green rural ecosystems.

Required research and innovation activities:

- Develop foresight methodologies to predict market changes and consumer behavior
- Create business models that target evolving consumer needs and behaviors
- Develop service concepts to be integrated into existing FBS value chains (supporting current products)
- Business development element to be included in all technology projects: new business concepts, consumer perceptions and design
- Effective combination of high volume business to high value, low volume business, new business models and value sharing
- Understanding consumer business and its potential in creating opportunities to traditional B2B business



4. Fulfilling consumer needs

4.1. Building with wood and design

Why important:

Strengthens the competence of wood products industry and secures the raw material supply for biorefiners.

Required research and innovation activities:

- Identification of barriers to sustainable construction and revision the building regulations
- Innovative construction solutions
 - Low-energy housing
- Wood-based interior systems and environmental construction product solutions
 - Design
 - Durability with sustainable measures
- Utilization of digitalization in production and housing solutions

4.2. From wood to textiles (including demo-platforms)

Why important:

Radical renewal of wood value chain addresses the needs of ecological consumers and brings added value to wood based materials.

Required research and innovation activities:

- Demonstration for dissolution-regeneration concepts
 - Continuation from FIBIC initiatives
- New technologies for textile processing
 - NFC to fibre etc.

4.3. From wood/ forests to food and feed (New)

Why important:

Utilization of forest for multiple purposes creates new business potential and boosts food industry turnover.

Required research and innovation activities:

- Functional food components:
 - Dietary fibre, antioxidants, hydrocolloids
- Functional feed components
- Non-wood forest products e.g. berries and mushrooms and their chemical components (pharmaceuticals and cosmetics) and their production technologies

4.4. Biochemicals and biomaterials 1/2

Why important:

Wood and fibre-based packaging materials are in the core of existing business and to major extent export business. Biochemicals offer considerable new business potential.

Required research and innovation activities:

- Enhance the material efficiency of wood- and fibre-based packaging materials, incl. lightweight CLIC programme
- Improve the performance of wood- and fibre-based packaging materials (mechanical incl. moldability, resistance to moisture and microbial contamination, other barrier properties, etc.)
- Improve recyclability of packaging materials through materials research. Introduce new materials which are easier to recycle and increase the share of renewables in packaging raw material base (e.g. new types of bio-based barrier materials), circular economy in packaging
- Develop high-end, advanced applications (films, membranes, electronic components etc.)

4.4. Biochemicals and biomaterials 2/2

Why important:

Hygienic products are a growing business area: Tissue products, towels, nappies

Required research and innovation activities:

- Develop methods to improve softness and strength of tissue products
- Wood-based materials to replace current fossil-based materials (absorbents, moisture barriers, etc.)
- Develop improved, fibre-based nonwoven materials
- Diagnostic products combining IT & fibre products, e.g. self-diagnostic applications

4.5. New bio-based products

Why important:

Focusing on upgrading the intermediate products – moving to higher level in the value chain.

- New value-chains and ecosystems

Required research and innovation activities:

- Develop new products from lignin, processing liquors (hydroxy acids)
- Develop technology to fractionate bark and debarking waste waters
- Extractives and bark components as bioactives, fine-chemicals, biocides; bark biorefinery concept
- Develop technologies for production of cost-efficient drop-in fuels for road, aviation and maritime transport
- Develop new sugar-based high-value products



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