Forest-based Sector
Technology Platform

Recommendations
for the Work Programme 2018-2020
of Horizon 2020

Industrial Technologies
Nanotechnologies, Advanced Materials, Biotechnology, Advanced Manufacturing and Processing

October 2016
INDUSTRIAL TECHNOLOGIES
Nanotechnologies, Advanced Materials, Biotechnology, Advanced Manufacturing and Processing (NMBP)

The scope of Industrial Technologies and NMBP covers several challenges and opportunities for the forest-based industries, which is reflected in the number of suggested priority topics for 2018-2020. However, we wish to emphasise the significant importance of the following topics:

- Nanocellulose – new products & composite uses
- Advanced biobased construction products
- Wood preservation methods

Nanocellulose – new products and composite uses

Nanocellulose, also called micro-fibrillated cellulose (MFC) forms the basis for a new material group with diversified and exceptional properties of tensile strength, viscosity etc. Applications of MFC-based materials span from innovative lightweight bio-composites for the automotive and transport industry to filler and emulsifier in concrete, paper, soil and food products.

In recent years, the production capacity for MFC in Europe has increased from laboratory scale to industrial tonnes per day. It is now timely to launch a concerted, cross-sectoral European R&D&I programme focusing more on products development and standardisation together with automotive-, construction-, food- and space-sectors.

New industrial value-chains and ecosystems will emerge but the transition needs support. Public support to innovation is particularly critical for cross-sector actions together with manufacturing industry, designers, researchers and customers.

MFC is a renewable biobased material that will contribute to developing a circular economy. However, on challenge is developing systems for reuse, recycling and end-of-life use (cradle to cradle), paving the way to a renewable circular economy.

New MFC-based materials and their functionalities have to be characterised using new methods and measuring techniques, which have yet to be developed.
Advanced biobased construction products

One of the most sensible investments the EU can do on the path to fulfil EU’s commitments under the COP21 Paris Agreement is to encourage the use of wood in the construction sector.

Meanwhile, the percentage of new wooden (multi-storey) buildings are around 9% in the EU (with significant differences between Member States) compared to e.g. 30-40% in North America and Japan. Despite this, the technical competence of European wood construction industries is world leading, so now when the Chinese are developing a national timber construction standard, they have chosen to cooperate with the European woodworking industry.

FTP believes that advanced biobased construction has been poorly addressed in Horizon 2020 Work Programmes so far and recommends that the NMBP Work Programme 2018-2020 together with the Societal Challenge 2 launch several demonstration and innovation actions in 2018-2020 that will support environmentally friendly and advanced biobased construction.

Wood preservation methods

The wood preservation industry is going through a very challenging period as many of the biocides and preservatives used in the sector have disappeared from the market over the last years and for some the future is very bleak. Therefore, a lot of research is ongoing on the future of the wood preservation industry.

The market and uses for treated durable wood is much larger than commonly believed. For instance, the French railway buys several million wooden railway sleepers each year. The sleepers are expected to last for 60+ years while being in contact with the ground. Due to the EU bans on several impregnation chemicals, it is becoming difficult for European industry to guarantee durability.

EU actions on new biobased treatments to enhance the long-term durability of wood-based products would give the industry a chance to find environmentally friendly solutions.

Table of proposed Call Topics for NMBP in 2018, 2019 and 2020

<table>
<thead>
<tr>
<th>Proposed Call Topic title</th>
<th>Description and potential impact 5-10 years</th>
<th>Possible participation from other WPs</th>
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<tbody>
<tr>
<td>(a) The Factories of the Future (FoF) contractual Public-Private Partnership Industry 4.0 and resource efficiency in manufacturing</td>
<td>o Manufacturing and processing technologies that significantly increase agility and production flexibility. o Apply new product design approaches, models and simulation tools and the necessary new production technologies for more functionality from less material and energy input, e.g. lightweight wood construction or reduced paper grammage.</td>
<td>o Circular economy o Cross-sector cooperations, e.g. textiles, ICT, automotive industries</td>
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</table>
### (b) The Sustainable Process Industries (SPIRE) contractual Public-Private Partnership

- Next generation wastewater treatment
- Resource efficiency in pulp & paper production
- Next generation bleaching concepts
- First of its kind bark biorefinery
- Clever use of the CO2 from lime kilns and flugasses in the pulp & paper process

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<th>Impact</th>
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<tr>
<td>Hundreds of large, highly-integrated pulp mills are in operation globally. Any efficiency gain will have significant impact.</td>
<td>Partly BBI JU</td>
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<tr>
<td>Recycling and end-of-life use (cradle to cradle), paving the way to a circular economy.</td>
<td>Circular Economy</td>
</tr>
<tr>
<td>Making use of the bark represents around +10% of biomass from a tree.</td>
<td></td>
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### (c) The Energy-efficient Buildings (EeB) contractual Public-Private Partnership

**Advanced biobased construction products**

- Biobased construction products in the EU has doubled its market share from 2010 level due to a more widespread use of energy-saving modular housing structures & functional furniture.
- Wood-based construction is perceived as a cornerstone of the biobased economy, generally credited as low carbon footprint construction.

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<td>Societal Challenge 2: Bioeconomy</td>
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<td>Wood-based construction is perceived as a cornerstone of the biobased economy, generally credited as low carbon footprint construction.</td>
<td>Circular Economy</td>
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**Biobased indoor products and furniture**

- E.g. creating new functional bio-based and composite products for home and urban furniture.

### (d) Industrial biotechnology

**Biotech strategies to increase wood durability – wood impregnation**

- It is becoming ever more critical to come up with viable alternatives to chromated copper arsenate (CCA) and other banned or questioned chemicals for wood preservation. Billion-Euro market at stake! Environmental concerns.

**New molecular genetic tools to determine wood and fibre properties**

- While recognising that this should only happen with public acceptance, molecular genetics and plant biotechnology is the key to increasing the yield and specific qualities of woody biomass. Progress will in the end lead to more efficient processes and products.

### (e) Nanotechnologies and advanced materials pilot lines for industrial value chains (pilot lines)

**Nanotechnologies and advanced materials for healthcare**

**Nanotechnologies and advanced materials for energy applications**

**Generic domain for nanotechnologies and advanced materials, including modelling**

**Nanocellulose – new products & composite uses**

- Nanocellulose is a new tool in the green manufacturers toolbox.
- New renewable materials and their functionalities are characterised using suitable new methods and measuring techniques
- Standardisation and certification
- Nanocellulose will be developed to generate functional surface structures that for example can change colour, block UV radiation to preserve the wood underneath.

### Intelligents surfaces

- Circular economy
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<td>Functionalisation of fibre surfaces</td>
<td>New functional surface treatments such as layered curtain coating, including nanocellulose, chemical grafting and surface activation enables bulk material reduction and enhanced product durability and functionality.</td>
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<tr>
<td>Wood-polymer composites products and markets – light weight</td>
<td>E.g. EU Building norms allowing paper and corrugated materials and wood-polymer composites to become established construction materials.</td>
</tr>
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</table>
| Packaging materials in the circular economy – design for recyclability| - Biobased food packaging eliminates plastic waste.  
- New functional surface treatments such as layered curtain coating, including nanocellulose, chemical grafting and surface activation enables bulk material reduction and enhanced product durability and functionality. |
|                                                                      | - Circular Economy  
- Raw Materials                                                                                                                                  |
Annexes

Stakeholders’ priorities for 2018-2020 indexed according the FTP Strategic Research & Innovation Agenda 2020

The research and innovation activities are organised according the Research Areas of the FTP SRA.

Annex to NMBP priorities

2.3 Enhanced biomass production
D. Develop new tree breeding strategies that include quantitative and molecular genetic tools aiming at sustainable and high yield of biomass, improved wood quality and resistance to stress.
F. Study molecular, biochemical and physiological processes, determining wood and fibre properties and matrix architecture, as well as pest and disease resistance, water efficiency and nutrient biology

2.4 Secured wood supply, forest operations and logistics – Wood mobilization
E. Develop intelligent forest operation systems and new solutions for human–machine–terrain interactions
A. Develop new inventory techniques for determining quantity, quality, dimensions and specific properties of forest resources.

2.5 Raw Material reuse and recycling systems – Wood mobilization
A. Generate a better knowledge of useful or harmful chemical compounds in different tree parts and wood biomass fractions for cascading purposes
D. Develop value-added applications of extracted wood polymers, nanofibrils, lignin, xylan, pulp fibres and paper, for example, for carbon fibres or ultra-lightweight composites in the fields of construction, interior design and packaging.
K. Develop new process technologies like separation, fractionation or extraction with improved selectivity for various components in recycling stock which enables a utilisation in value-added applications inside and outside the production chain.
J. Develop innovative sorting systems using new sensors for detection and robotics technologies for paper, wood waste and forest residues to separate according to different types of fibres, inks and fillers, contaminants and soil residues and resulting in higher sorting accuracy and velocity

3.1 Resource efficiency in manufacturing
E. Develop production technologies with significantly optimised energy efficiency and energy management in defibration of wood, drying of sawn timber, production of panels, paper and board or in transportation.
B. Apply new product design approaches, models and simulation tools and the necessary new production technologies for more functionality from less material and energy input, e.g. lightweight wood construction or reduced paper grammage.
G. Devise functional surface treatments such as layered curtain coating, including nanofibrillated cellulose, chemical grafting (chromatogeny) and surface activation (plasma) to enable bulk material reduction, enhance durability or extend life.
F. Develop enhanced separation and fractionation technologies for material components to enable their optimal use in layered or composite structures

3.3 Sustainable water stewardship
E. Improve separation and cleaning technologies (using physical chemistry and/or industrial bio-technology) for a further closure of water cycles and to reduce the amount of effluent.
F. Develop innovative technologies for the value-added use of separated and extracted components from wastewater treatment.
3.5 New business models and service concepts
H. Create business models based on conversion of traditional mills to new markets.
B. Develop foresight methodologies to predict market changes and consumer behaviour and create business models that target evolving consumer needs and behaviours.

4.1 Advanced wood-based construction
A. Identify barriers to sustainable and environmentally-friendly construction and develop further urban building solutions.
D. Develop cost-effective integrated pre-fabricated timber building systems including hybrid and composite materials
K. Develop advanced wooden structure joints to improve performance and broaden the applicability of wooden structures to substitute for carbon-intensive materials.
F. Develop design concepts taking into account changing building services during the building’s lifetime
G. Improve building physics, indoor air quality and the behaviour of wooden constructions
I. Develop advanced scientifically-justified lightweight wood and fibre-based products, engineered wood products and composite materials with superior performance, low emissions, produced with novel, high quality environmentally-friendly biobased adhesives
M. Develop construction systems and biobased treatments to enhance the long-term durability of high performance wood-based products.

4.2 Indoor environment and functional furniture
F. Develop and establish design criteria to ensure the full recyclability of packaging materials, in particular barrier layers and embedded electronics.
B. Improve the performance of packages and wood- or fibre-based packaging materials, not limited to mechanical properties but including resistance to moisture and microbial contamination, in particular prevention of microbial activity in food packages with the help of shielding gases or active substances
A. Enhance the material efficiency of packaging with, for example, new lightweight construction approaches.
G. Develop concepts and upscaling to production scale for the manufacture of 100% biobased packaging
C. Integrate sensor and information systems in packaging materials – printing applications using functional inks and tags carrying anti-counterfeiting information

4.3 New biobased products
A. Develop new products from wood fibre (nano/microfibrillated cellulose (MFC), nanocrystalline cellulose (NCC), fibre/polymer blends, novel derivatives, some even with improved thermoplastic properties, etc.)
C. Develop new products from lignin (e.g. chemicals, in composites and as carbon fibre) and hydroxy acids (chemicals and polymers).
G. Develop weatherproof panels, fibre-based insulation materials and wood-polymer composites suitable for exterior use
B. Invent new textile fibre qualities based on cellulose for replacement of cotton fibres in textiles

4.5 Hygienic, diagnostic and healthcare products
G. Explore the applicability of wood- and fibre-based material in medical applications
E. Develop and establish design criteria to enable recyclability of relevant product categories and methods for the safe disposal of non-recyclable materials.
C. Develop production concepts of layered tissue products with multi-layer properties

4.6 Integration of new solutions in printed products
D. Develop smart and intelligent features for applications based on printed electronics or printed biosensors, e.g. in packaging.
B. Develop high-precision paper substrates and surfaces that enable the printing of electronics and safeguard their functionality and durability
E. Develop design concepts for ensuring recyclability of hybrid products and technologies for the separation and reuse of used material components.
About FTP

FTP is the European Technology Platform for the forest-based sector. The long-term strategy of FTP's stakeholders is established in the FTP Vision 2030 to be implemented through the Strategic Research and Innovation Agenda for 2020 (SRA). Since 2005, FTP has been organising European cooperation across the whole forest-based sector value chain. The FTP network consists of stakeholders organised in 25 National Support Groups; four shareholder Confederations/Associations: CEI-Bois, CEPF, CEPI and EUSTAFOR; and three Research Umbrella Organisations: EFI, EFPRO and InnovaWood. FTP is active in 25 countries.

The EU forest-based sector in figures

- 35% of the EU land area is covered by forests sustainably managed by 16 million forest owners
- The forest-based industries contribute 8% of EU's total manufacturing added value
- The sector supports 3-4 million industrial jobs in the areas of wood processing, transport, machinery, construction, instrumentation, ICT, chemicals and energy
- The woodworking industries employ some 2.4 million workers in 365 000 SMEs
- € 81 billion was the total turnover of the European paper industries in 2010
- 70% of Europe's Freshwater repository comes from forest land

Forest-based Sector
Technology Platform
The European hub for research and innovation in the forest bioeconomy

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