WIDESPREAD-2014-1 TEAMING

# LignoSilva
# Centre of Excellence Forest-based Industry

## Implementation of intelligent technologies into wood assortment and wood processing

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**SCAR SWG AKIS 4 - 4th Meeting, Bratislava, 27-28th March 2017**

NÁRODNÉ LESNÍCKE CENTRUM
NATIONAL FOREST CENTRE

**National Forest Centre**

**We are a semi-budgetary forestry agency established by the Ministry of Agriculture on 1st January 2006**

Staff: 235 employers (70 researchers)

BUDGET: 8.0 mil. EURO/ year (45 % governmental budget, 55 % NFC activity)

| Forest Research Institute | Institute for Forest Consulting and Education | Institute for Forest Resources and Information | Forest Management Planning Institute |
|---|---|---|---|
| (1898) | (1978) | (2006) | (1952) |

# Focus of presentation

- CE LignoSilva objectives
- CE LignoSilva framework
- CE LignoSilva policy context
- FBS Innovation environment - problems

- Demontration case - Implementation of intelligent technologies into wood assortment and wood processing

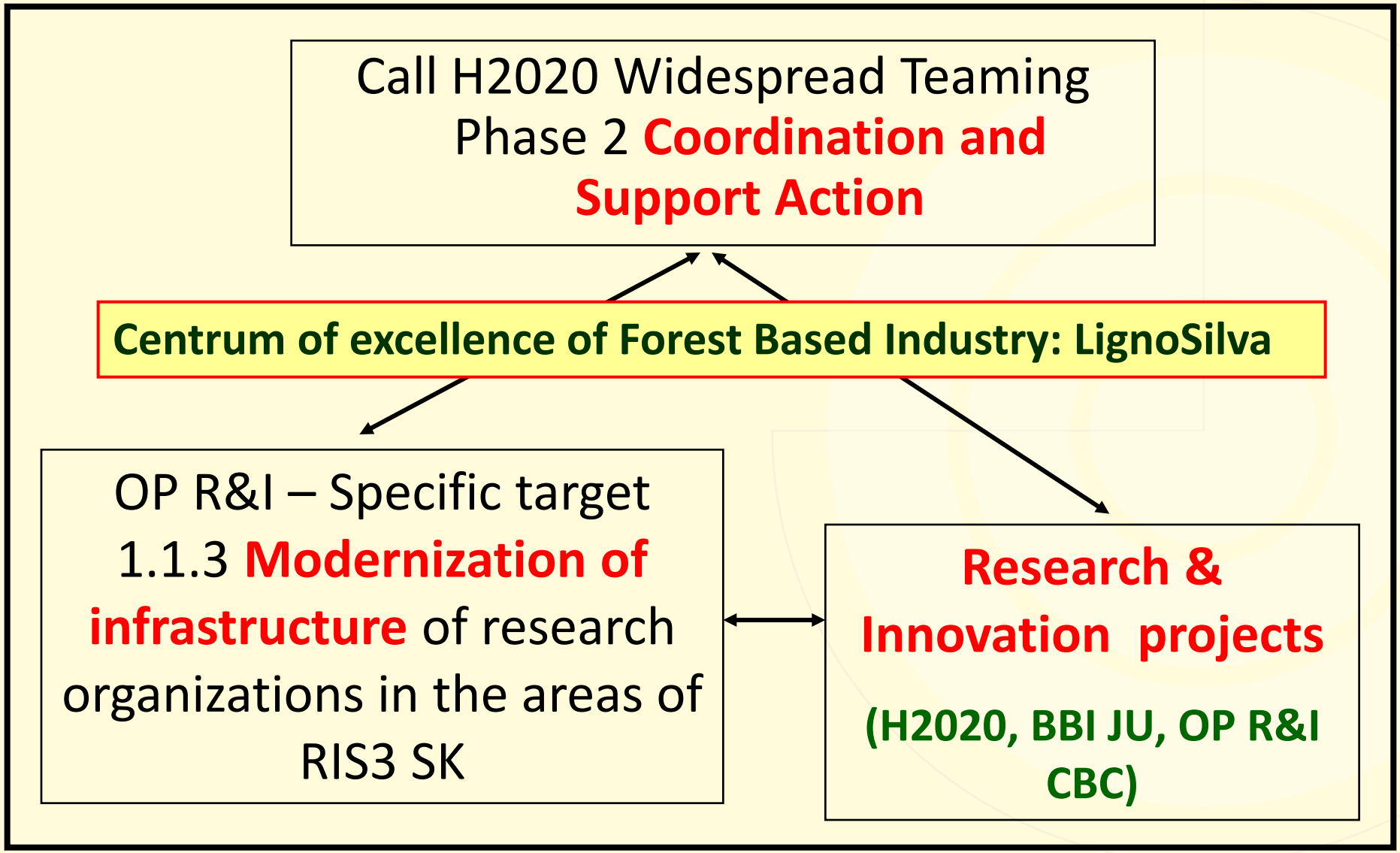
# CE LignoSilva objectives

**LignoSilva** will represent a **Centre of excellence** that integrates research, development and innovation potential of the forest based industry that rationally links the chain of wood production, processing and utilization.

The CE covers five interconnected priority areas (PA):

1. Forest resources and sustainable wood production
2. Biomass and bioenergy
3. Paper-pulp technologies
4. Recycling and cascading system of wood and wood products use
5. Regional development in the context of bioeconomy

# CE LignoSilva framework



# Policy context

- **Europe 2020 Strategy** / Roadmap to a Resource Efficient Europe {COM(2011) 571 final}
- **A new EU Forest Strategy** for forests and the forest-based sector {COM(2013) 659 final}
- **EC (2013): A BLUEPRINT FOR THE EU FOREST-BASED INDUSTRIES**
- **Smart Specialisation Strategy for the Slovak Republic** (the RIS3 SK) n. 665/2013. The document identifies key areas of specialisation from the point of view of available **scientific and research capacities**: (i) agriculture and environment including chemical technologies, (ii) sustainable energy
- **National programme and Action plan to use wood potentia**l (NPUWP) approved by the Government of the SR (August 2013 and February 2014)
- **EFI (2014): Future of the European Forest-Based Sector – Structural Changes Toward Bioeconomy**

# FBS innovation environment - weakness

- Fragmentation of research program and infrastructure
- Insufficient level of cooperation with partners from business sectors
- Insufficient level of cooperation with top research institutions from abroad
- Insufficient cross-sectorial research
- Non-effective system for know-how and technology transfer
- Need to improve all features of innovation system, including screening; benchmarking; SMEs Market Uptake, networking, integration and mutual sharing of research and infrastructure capacities; Mobility &Exchange supporting; Communication & Dissemination

# Long term R&D program

## *PA1 Forest resources and sustainable wood production*

- ***IP 1.1 Ecosystem dynamics modelling & Risk Management***
- ***IP 1.2 Silvicultural systems supporting wood production***
- ***IP 1.3 Forest logging and technical infrastructure***
- ***IP 1.4: Forest economy & Multifunctional forest management***

## *PA2 Biomass and bioenergy*

- ***IP 2.1 Efficiency increase of the energy production from wood***
- ***IP 2.2 Transfer of advanced technologies for the wood biomass decomposition into practice***

## *PA3 Pulp & paper technology treatment*

- ***IP 3.1 Incubator of the special paper production and online non-destructive testing***
- ***IP 3.2. Functional fibers formation and paper surface treatment development***

## *PA4 Recycling and cascading systems of wood and wood product use*

- ***4.1.Wood cascade use of the mechanical processing***
- ***4.2. Increase of the old wood products recycling volume after the expiration period***

## *PA 5 Regional development in the context of bioeconomy*

# Demonstration cases

- The demonstration case objective is to implement a workflow of coordination and support actions to facilitate knowledge transfer from CE to practice.
- Demonstration activities represent a flexible way to link CE Priority areas and Innovation priorities. DC combine their impact into tangible outputs.
- DC will also demonstrate relation and connection of Coordination and Support Actions with CE Infrastructure development program and CE Research and Innovation program

CSA Final - 12 Demonstration cases:

**DC01** **Support for sustainability of forest soils**

**DC02** **Supporting forest adaptation to climate change in commercial forests**

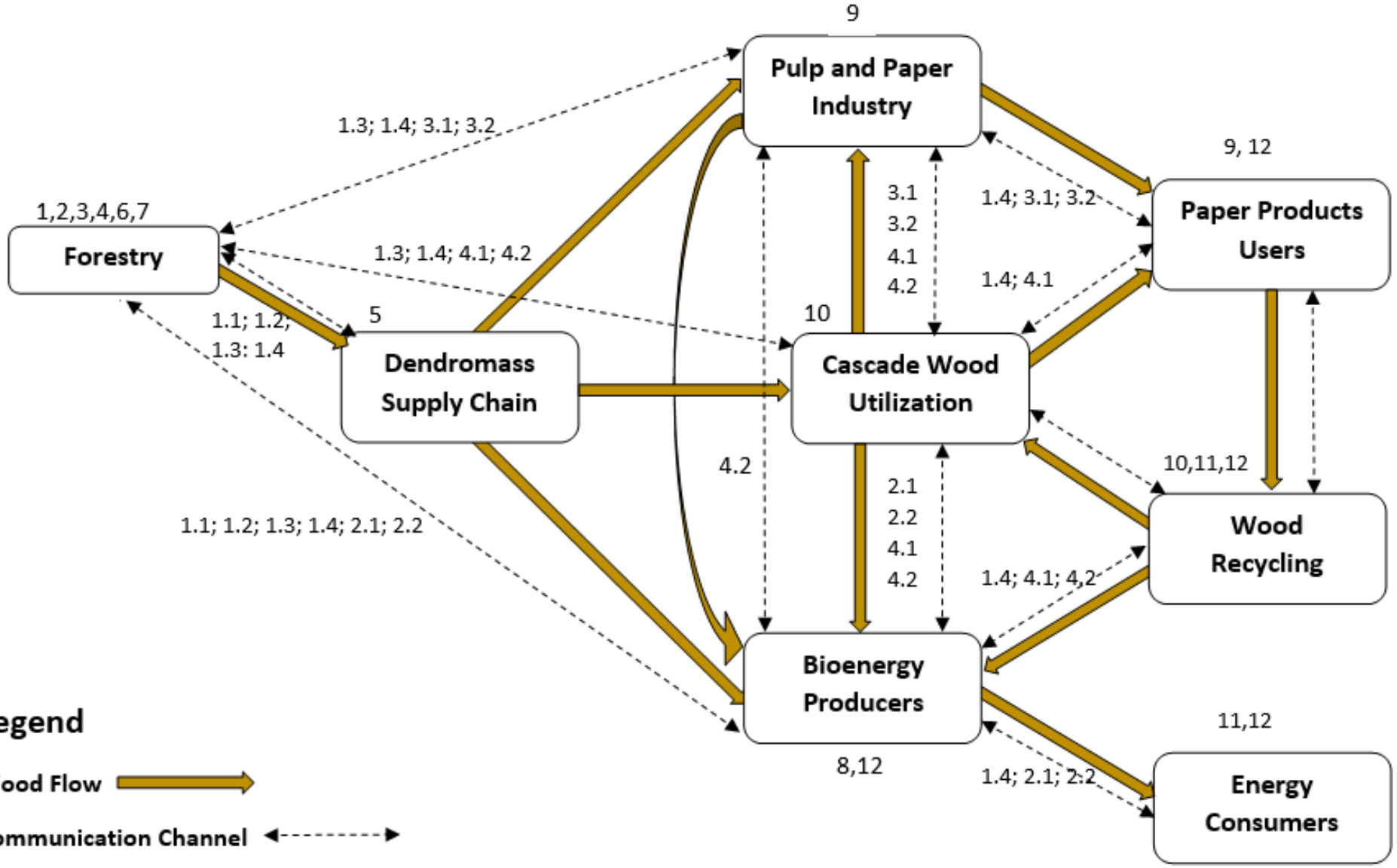
**DC03** **Forest protection service**

**DC04** **Improving production capabilities of silvicultural systems…**

**DC05** **Implementation of intelligent technologies into wood assortment and wood processing**

……..

# DC interlink based on PA & IP




**Innovation priorities: 1,1 …. 4,2 ; Demonstration case: 1 … 12;**

# Demonstration case DC05

LIGNO SILVA CENTRE OF EXCELLENCE OF FOREST-BASED INDUSTRY

## Implementation of intelligent technologies into wood assortment and wood processing

### Rationale for the case selection

DC focus on implementation of **3D scanner** into the chain of processing of wood in sawmills. Scanner scans and digitally reconstructs the internal defects of the log allowing the assessment of the optimum cutting solution in real time. **Laser cutting technology** allow realised optimised cutting solution based on highest resale value of final products. These unique technologies will be interconnected in a fully automated and robotized production line.

Domestic sawmilling processed an average of 4.5 million $m^3$ industrial roundwood. Waste generated in sawmilling is ~1.3 million $m^3$ (29 %).

Applying pilot line (3D + 2D scanner, laser cutting) it is expected at hardwood:

- **increasing the yield of 1 $m^3$ of log from present 71 % to 90 % at lumber product**
- **increasing the yield of 1 $m^3$ of log from present 45 % to 60 % of the final product**
- **saving in wood consumption € 10 per $m^3$ (at a price of logs 50 € / 1 $m^3$)**

# Demonstration case DC05

## Objectives

- Demonstrate an establishment of pilot line of innovation technologies (3D scanner - 2 D scanner - Laser cutting) as a model case for sawmill companies.
- Demonstrate assortments innovative practices and handling of wood as a basis for an increase yield of wood logs to maximize revenues from the sale of wood.
- Improve the knowledge of wood producers and processors in optimizing the yield of raw wood assortments.

## Questions

- How can assortment methods and assortment process before forest logging be improved?
- How can assortment process of stem-wood manipulation in cross-cutting be improved?
- How can handling and cutting losses be decreased and wood yields be increased?

# Demonstration case DC05

## Key infrastructure

3D CT scanner CT Log scanner

2D WoodEye scanner

Laser cutter

## Products:

Assortments model

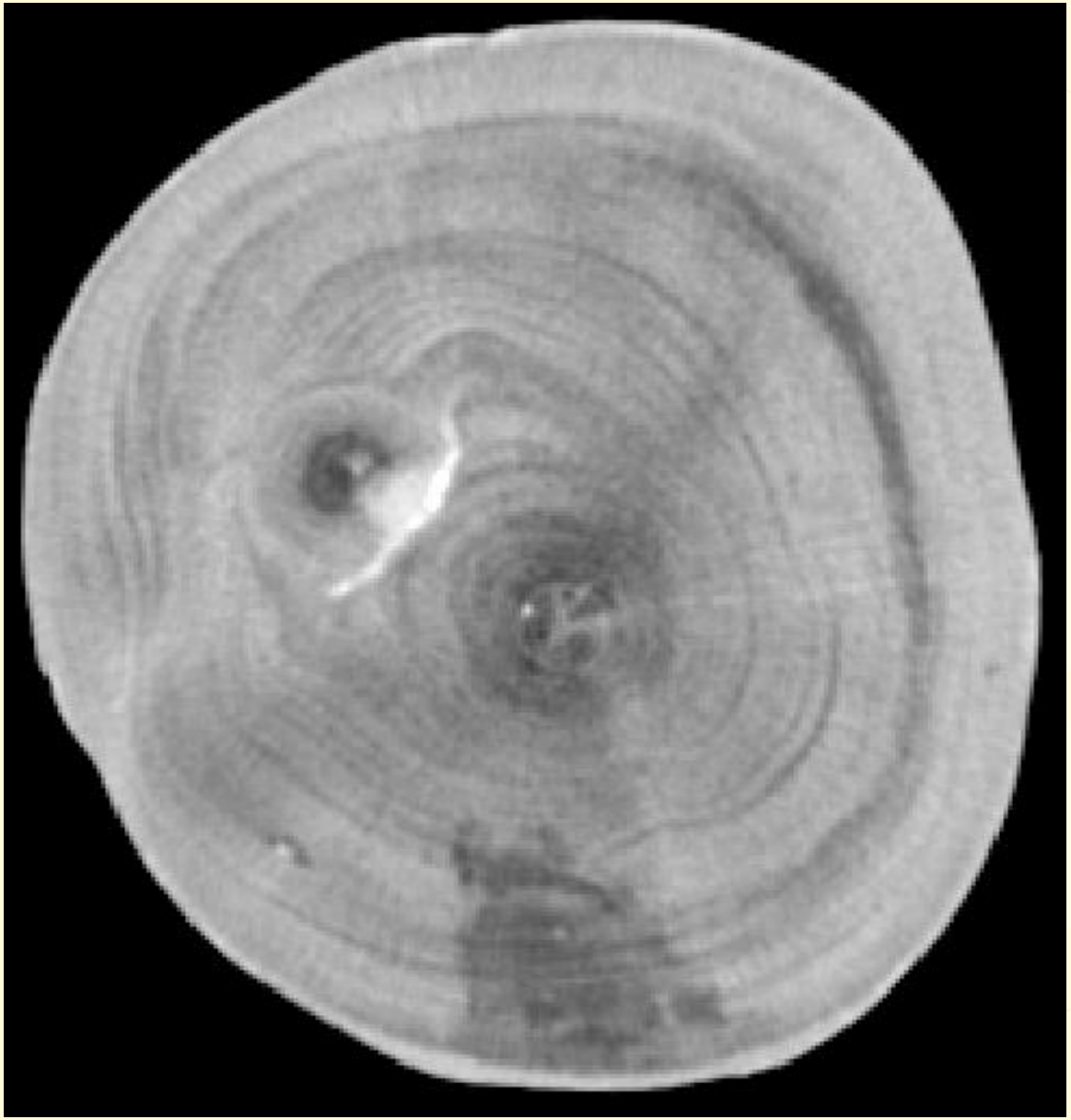
Assortment procedure

Wood defect detection algorithms for 2D and 3D scanners

## Services:

Proposal of IT connection of 3D and 2D scanners and laser cutting technology in sawmill.

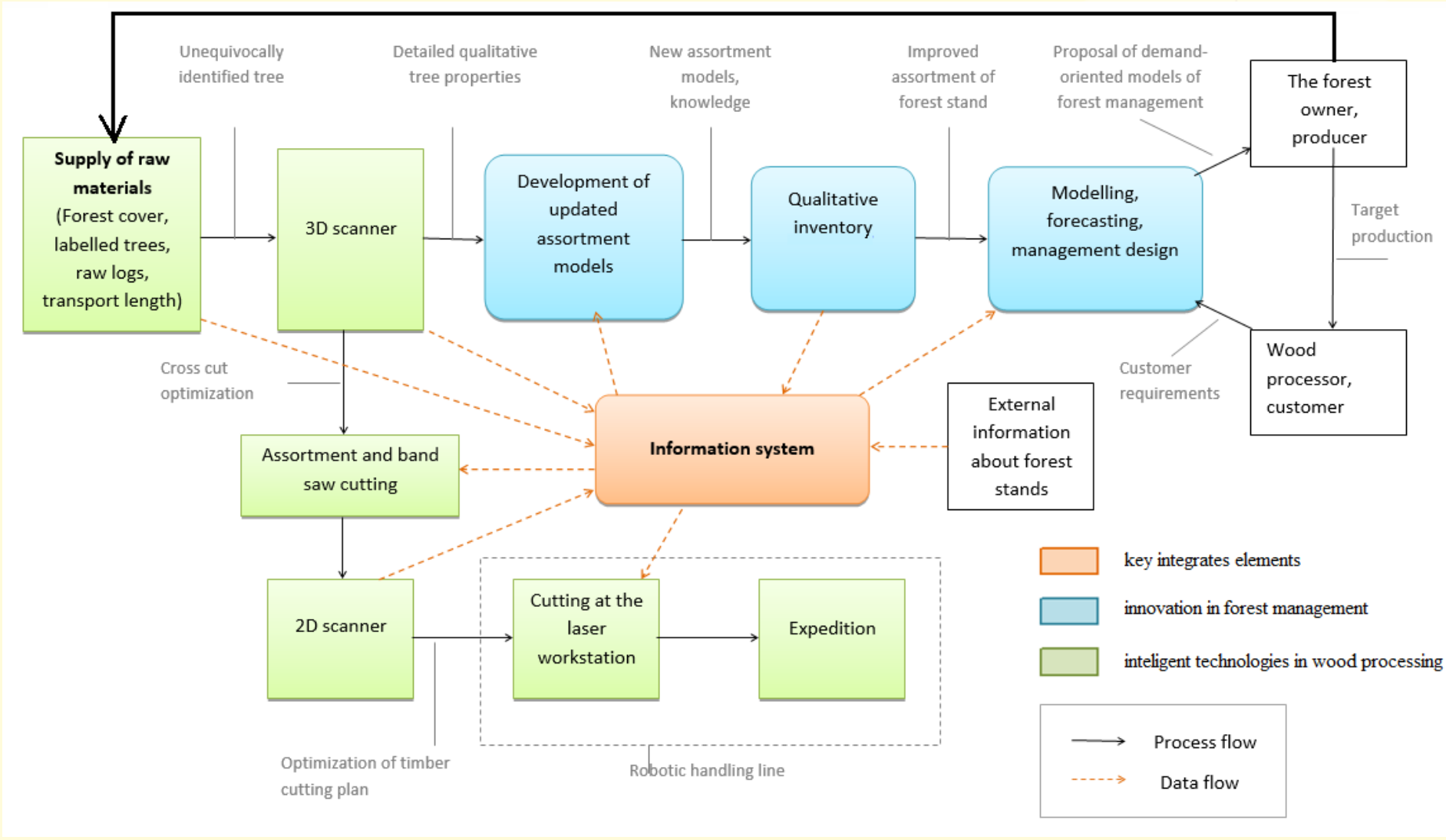
Proposal of IT and IS connection of wood producer and wood processor



# Demonstration case DC05

LIGNO SILVA CENTRE OF EXCELLENCE OF FOREST-BASED INDUSTRY

Conceptual scheme of process and data flows of industrial R & D centre to optimize the chain of production, supply and processing of wood



## Generic stakeholder

Wood processors in sawmills

Companies licenced for forest management planning

## Specific stakeholders

Quercus ltd Lučenec. - the company is owner of a robotic technological line for processing and cutting logs and lumber equipped with 2D scanner WoodEye and laser cutting machines. The line is in the testing stage in laboratories condition.

Forest of the Slovak Republic, state enterprise. The company develops a new procedure of forest assortment in preparation for logging and tests new system of logs labelling with aim to increase resale value of wood.

Technical University Zvolen, Faculty of Forestry & Czech University of Life Science, Faculty of Forestry and Wood Sciences – PhD thesis, hosting and joining short-term visits and other exchange activities.

# Services & products:

## Innovation degree & Technological readiness level indicators

| Service / Product | Innovation degree description | Technology readiness level |
|---|---|---|
| The new generation of assortment models | Variant changes | TRL8 |
| The new variant of forest stand assortments | Variant changes | TRL6 |
| New algorithms for wood defect detection based on 3D scanning technology | Generation change | TRL4 – TRL7 |
| More powerful algorithms to detect wood defect based on 2D scanning technology timber | Generation change | TRL4 – TRL7 |
| The new structural concept of sawmill lines with 3D & 2D scanner linked laser cutting – IS/IT connection | Genus change | TRL 7 |

# Demonstration case DC05

LIGNO SILVA CENTRE OF EXCELLENCE OF FOREST-BASED INDUSTRY

| | The 6 months periods of the 2nd phase project implementation | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Preparatory phase: infrastructure procurenment, targeted visits, study visits, benchmarking visits | | | | | | | | | | |
| Pilot testing, data gathering, algorithm development, experts stays | | | | | | | | | | |
| Organization of promotion events (conferences, workshops) & Dissemination activities (Exhibition, fairs) | | | | | | | | | | |
| Publication activities (studies, guidelines, best practices, reports, articles, etc.) & Property right protection | | | | | | | | | | |
| Education and training activities | | | | | | | | | | |
| Bridge to industry - advisory services; stakeholders forum, creation of cross-sectoral alliances | | | | | | | | | | |
| Estimated sources for CSA (EUR) | 10000 | 35000 | 35000 | 15000 | 35000 | 20000 | 20000 | 20000 | 15000 | 25000 |
| Total Budget for CSA (EUR) | 230000 | | | | | | | | | |

- Market analyses of 3D scanners and 3D CT scanner procurement
- Analysis of processes and data flows in pilot line and implementation of for the entire system of technological innovation
- Study tour & training 3D scanner control, operation, programming,
- Initiating of PhD theses: detection of wood defects, optimize cutting plans
- Installing the scanner into a pilot line, testing in trial operation
- Study: proposals for the implementation and connectivity technologies in pilot line and communication interfaces
- Pilot testing of scanner, knowledge transfer from supplier
- External supervision of PhD student: detection of wood defects, optimize cutting plans
- PhD students study stays in CoE
- Participation in trade fairs
- Workshop: Implementation of 3D scanner in sawmill wood processor
- Proceedings from workshop
- Feasibility study: implementation of 3D CT scanner in expedition and manipulation log stocks of wood producents
- Advisory and consulting at 3D scanner implementation in sawmill or in expedition and manipulation log stocks
- Participation in international trade fairs
- Conference: Implementation of 3D scanner in sawmill wood processor; increase of wood yield, economy and return on investment
- Conference monograph in established publisher (e.g. Elsevier )
- Property right protection
- Stakeholders forum
- Press conferences, media tours

In conclusion, let us repeat the main idea of our project: Forestry is understood primarily as the industry, as wood producer.

We can be a strong partner in the processing chain and identify trends in the forestry-based sector.

It is not only my belief, but nicely expressed it Herbert Grill in the *Forest & Rings Journal*, when he said:

*"... the best prospers the one who well recognize the needs of the buyers and prepares the wood they needs"*

EUROPEAN FOREST INSTITUTE

LIGNO SILVA CENTRE OF EXCELLENCE OF FOREST-BASED INDUSTRY

VÝSKUMNÝ ÚSTAV PAPIERA A CELULÓZY, a.s.

Národné lesnícke centrum

# LOOKING FORWARD FOR COOPERATION

# CE LignoSilva expectation & vision

## EC expectations

- New and strong knowledge institution, able to become bacon in their own countries/regions at a heart of possible far-reaching reform process.
- Real target is not „yet another excellence science and technology project“ but a new institution.
- EC do not want to see another good Coordination Action, but true New Institution claiming a new position in national and international science and innovation scene.

## Vision

- Established  CE as an excellent bearer of innovation and know-how transfer into the area of wood production, processing, use  and recycling
- Achieve a position of a relevant entity with scientific perspective, actively participating and professionally guiding the complex multi-layered relationships in a forestry and wood processing complex
- Stimulate sustainable development of the forest-based sector based on the synergy of excellent science and practice

# CE Long term life-cycle sustainability