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State of the Art
of the **COST Action E40**

Innovative utilisation and products of large dimensioned timber including the whole forest-wood-chain

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Action E40 - Innovative utilisation and products of large diameter timber

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State of the Art Report

COST Action E40

"Innovative utilization and products of large dimensioned timber
including the whole forest-wood-chain"

Overall introduction – Where did we start and what has been achieved?

Alfred Teischinger

Many countries in Europe face specific problems and challenges regarding efficient processing and marketing **large dimensioned timber** (Ø > 40 cm), which are primarily caused by necessarily large scale and mostly cost intensive harvesting and logging methods. Consequently, large dimensioned wood from several European regions can't compete with small diameter timber, which is more suitable for highly automated and therefore cost efficient wood processing. The initial situation of the large diameter process chain and the challenges to be discussed in the COST Action are shown in the following diagram (Fig 1).

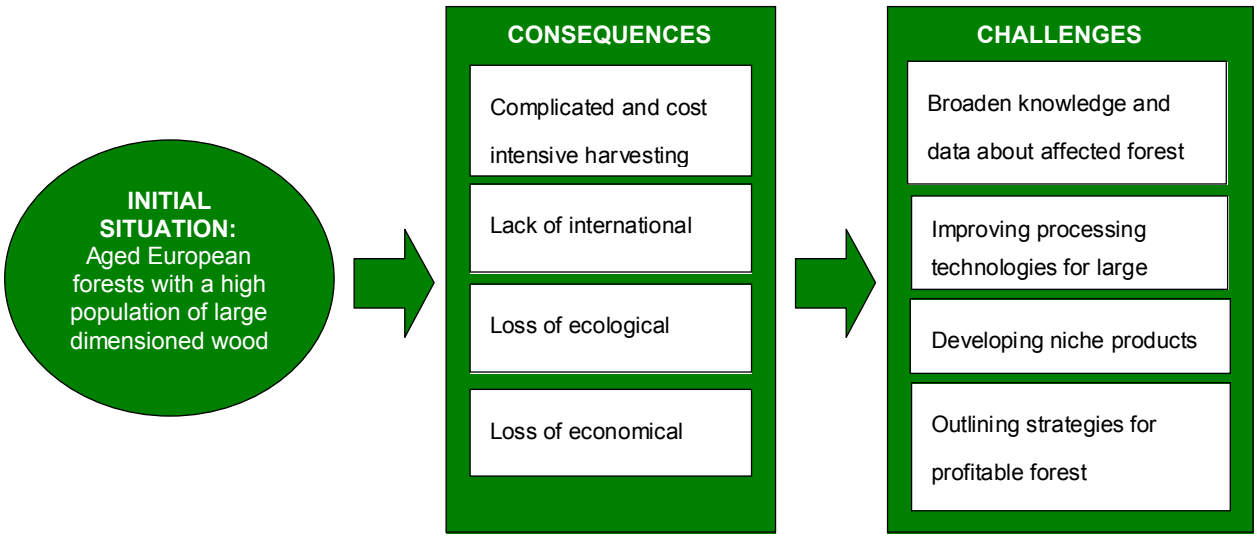

Fig 1 - Initial situation, consequences and challenges of the COST Action E40 "Innovative utilization and products of large dimensioned timber including the whole forest-wood-chain"

Although it is well known that large dimensioned timber (LDT) has specific properties in terms of strength, fibre length or density caused by different growing conditions, the modern wood based industry can't benefit from these properties because of a lack of scientifically proved evidence and methods for proper measurement and processing and therefore it is not willing to pay higher prices.

As a matter of fact, the lack of innovative technologies and marketing strategies for large dimensioned wood affects both the sustainable development of European forests in terms of aging and loss of stability and the economic situation of rural areas which is closely related to the income from forest products.

This **COST Action** ("Innovative utilization and products of large dimensioned timber including the whole forest-wood-chain") focused on establishing a standardized database, delivering information about properties of large dimensioned wood in European forests as well as characteristics of this special kind of wood in view of selected properties such as strength, density or fibre length. Based on this knowledge, strategies for innovative technical methods for processing, product development and marketing of this large diameter timber have been discussed and presented. Also the establishing of a market-orientated "label" for large dimensioned timber, coming from a guaranteed sustainable wood industry, has been discussed in order to enable European and international competitiveness of products made from this special kind of wood.

1 Scientific programme

The multidisciplinary action was structured into four scientific working groups (WGs), each group directed by an expert in the special field in order to guarantee professional guidance and high quality in the scientific approach. Special emphasis has been put on the fact that the working groups have not only been seen as groups of experts carrying out special research work in a certain field, but that they also established a network and feedback between the various working groups.

Figure 2 shows a strong interrelation of forest management, wood properties, process parameters and product properties. Concerning LDT this interrelation is especially pronounced and has to be taken into consideration.

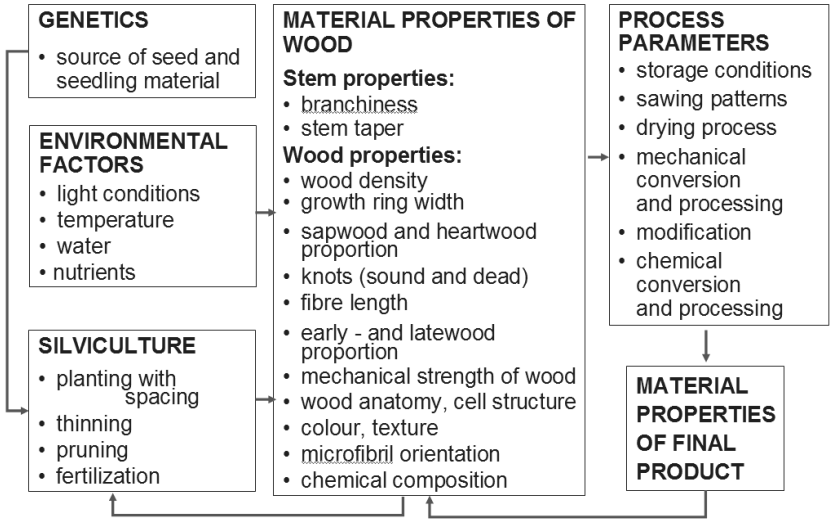

Fig 2 - Interrelation of forest management, material properties, process parameters and properties of the final product (adapted from Kellomäki 2002)

1.1 Working group 1: Data analysis about the large dimensioned timber situation and forest management (WG leader: M. Patzelt followed by S. Tarasiuk and G. Jednoralski)

Investigation about relevant data derived from both primary and secondary data in the field of silvicultural practice, actual timber stock variations, forest infrastructure, regional frame conditions and relevant stakeholders. Basic data collection on each partner country provides information at a national level.

Timber Stock Analysis (TSA)

- Analyses of wood resources and wood use in regions with aged forest;

Silviculture Analysis (SA)

- Analysis of forest composition and structure from the aspect of naturalness and silvicultural practices;
- Analysis of silvicultural goals, guidelines and measures;

Wood Supply Chain Management (W-SCM)

- Analysis of existing forest infrastructure;
- Analysis and description of harvesting and transport system (Fig 3);
- Analysis of wood supply and its demand on national and European scale;
- Scenarios for improvement/replacement of existing harvesting/transport systems;

Fig 3 - Arduous and dangerously wood working (source: R. Stingl, ihf/BOKU)

1.2 Working group 2: Research on large dimensioned wood characteristics and processing technologies (WG leader: U. H. Sauter)

The aim of this working group was an investigation of clear evidence of special properties of large dimensioned wood in order to increase quality output of this kind of timber by adapted processing methods. Innovative measurement methods like computer tomography and other non destructive measuring methods have been analyzed in order to provide proper information for further processing of large dimensioned timber (Fig 4).

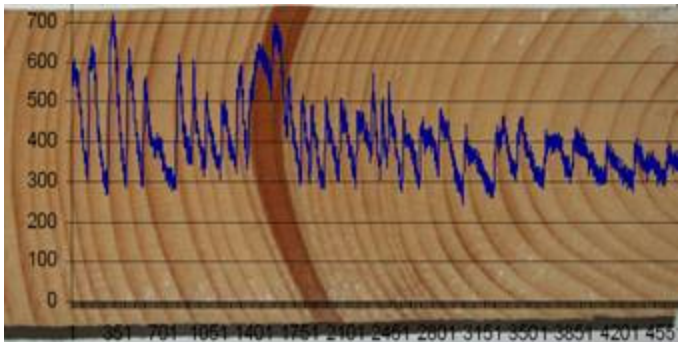

Fig 4 - Density along of the cross-section and within an annual ring (source: R. Stingl, ihf/BOKU)

Wood properties

- Improved methods for the evaluation of fiber length, density and spiral grain;
- Measurement of the basic wood properties to assess the specific wood characteristics and their variation in large dimensioned wood;
- Modeling of the internal tree wood property variations and assessing the timber quality of the corresponding standing trees (Fig 5).

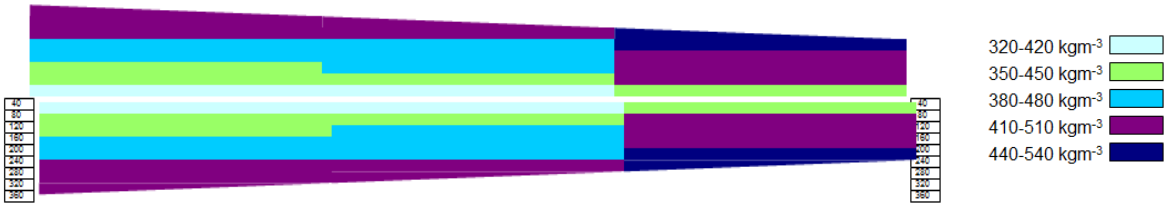

Fig 5 - Example of a stem model on wood density distribution

Scanning and Grading

- Identification and measurement of specific internal characteristics of large dimensioned wood on the basis of products by already existing methods and such scanning methods, which still have to be improved (Fig 6)
- Development of improved visual grading and scanning criteria and rules;
- Defining standardized quality criteria for large dimensioned wood concerning strength, density and other properties.

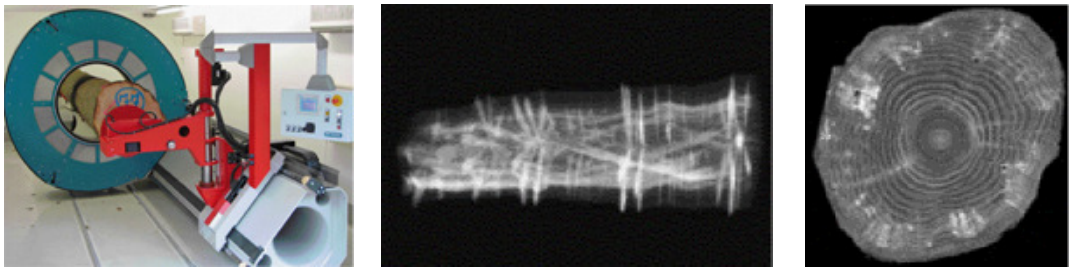

Fig 6 - Internal scanning of wood properties (source: FVA Freiburg and MICROTEC)

1.3 Working group 3: Innovative processing technologies and methods (WG leader: M. Brunner followed by J. Sandak)

According to the data and stem models obtained and the defined quality criteria, property optimized utilization of large dimensioned wood is possible but many restrictions have to be taken into consideration (Fig 7).

Fig 7 - "Heavy wood & heavy equipment" - transport, conveying and logistics of large dimensioned wood in a saw mill are special challenges (source: R. Stingl, ihf/BOKU)

The following issues have been discussed thoroughly:

- Development of an optimized sawing structure for large dimensioned wood according to resources, supply-demand and mill capacities;
- Optimization of sawing techniques with reference to traditional sawing methods (Fig 8);
- Determination of conversion factors and machining properties (timber, veneer);
- Optimization and adaptation of different drying technologies for fast alternating air movement (vacuum drying, vacuum press drying, microwave drying);

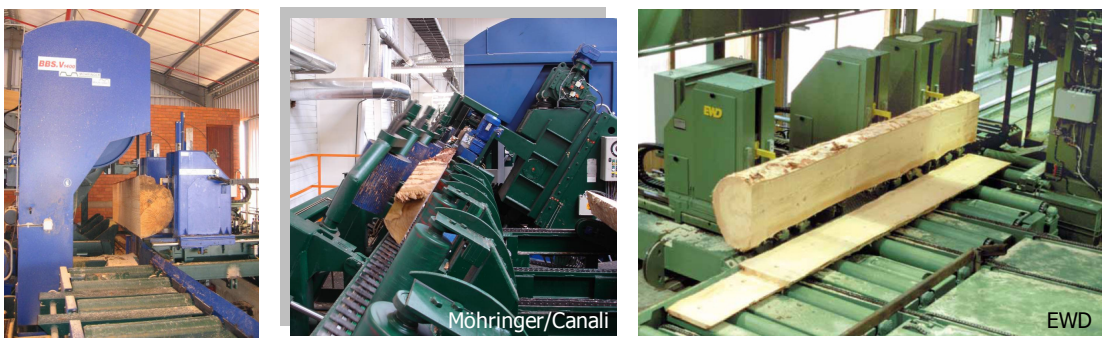

Fig 8 - Typical primary processing systems for LDT

1.4 Working group 4: Product development and marketing strategies (WG leader. T. Beimgraben followed by A. Borras Esquius)

Both traditional and innovative products according to basic stem models (wood property models) of large dimensioned wood properties have been optimized and proposed. Innovative **product development tools** (e.g. ECODESIGN) have been introduced as a specific tool for product design and communication with the end user. In specific workshops new ideas of product development and marketing strategies have been developed (Fig 9).

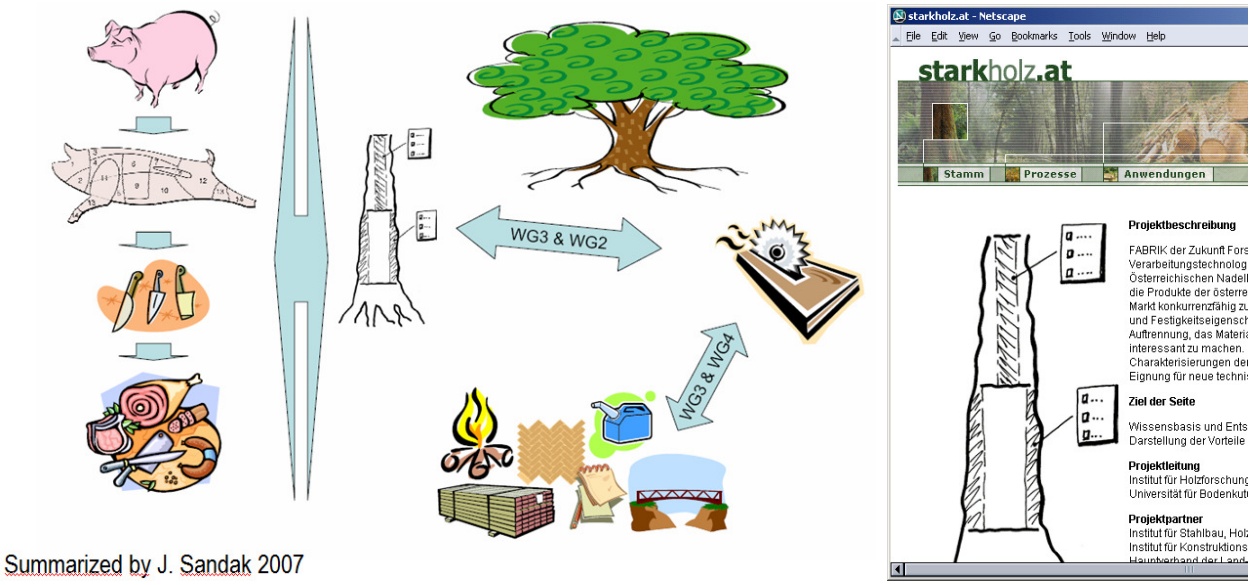

Fig 9 - Integrated concept to make advantage of the high variability of LDT by a specific log break down, further processing and specific products made from LDT including an internet portal for LDT

The following specific items have been taken into consideration:

Product planning

- Analysis and evaluating knowledge, experience and traditions in the use of large dimensioned wood;
- Common product features and specifications of forest regions;
- Trends in design and in a wider social and cultural context;
- Web based product development tools such as ECODESIGN so as to support the ecological and sustainable design process.

Product design and development

- Creation of new product concepts;
- Optimization of specific joints, improvement of traditional construction methods;
- Optimization of wood-wood connections so as to increase solid timber technologies;

Labelling 'large dimensioned wood products'

- Developing large dimensioned wood-criteria in order to support product labelling and marketing;
- Designing a new label for products of large dimensioned wood focusing the ecological and sustainable criteria of the products;

Outlining rural development strategies on the basis of the results of the action to be put into action

- Idea of "event purchasing" by including the consumer into the whole process chain and offering the consumer to visit the site where the wood of his products has grown.

Further details on the achievements of the various working groups are provided in the following chapters of this report.

2 Summary and general aspects

The action has shown the very complex situation of LDT and the different approach to deal with LDT all over Europe. New knowledge from various research projects but also knowledge from practise (from forestry to wood processing) could be compiled and discussed in the course of the action. Essential results and information are compiled in the current state of the art report in the following chapters of this report and the comprehensive literature sources to each chapter make a further and more detailed reading possible.

3 General literature (specific literature - compare the various chapters)

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Zeltner, S. 1999: Perspektiven der Starkholznutzung in der Schweiz. Schlußbericht. Holzkaufmann, CH-7014 Trin, Bavurca 42

Homepage of the COST action E40: http://www.boku.ac.at/costE40/

Fig 10 - Audience interested in a LDT-poster discussion (Biel)

Fig 11 – Engaging podium discussion with representatives from science, forestry and wood industries (Biel)

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The State of the Art report summarizes the work done within the COST Action E 40 „Innovative utilisation and products of large dimensioned timber including the whole forest-wood-chain". It gives an overview about the stock of LDT which is available in various countries as well as the potential for utilisation and processing of this timber. Several projects carried out in the last years on this topic (especially in Germany) are described. Product ideas and advantages as well as disadvantages of LDT are summarized and evaluated.

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