

EFORWOOD  
Tools for Sustainability Impact Assessment

**Report on process identification and aggregation including data for ToSIA  
test chains**

STFI-Packforsk



EFI Technical Report 84, 2011

**Report on process identification and aggregation including data for ToSIA test chains**

STFI-Packforsk

Publisher: European Forest Institute  
Torikatu 34, FI-80100 Joensuu, Finland  
Email: [publications@efi.int](mailto:publications@efi.int)  
<http://www.efi.int>

Editor-in-Chief: Risto Päivinen

Disclaimer: The views expressed are those of the author(s) and do not necessarily represent those of the European Forest Institute or the European Commission. This report is a deliverable from the EU FP6 Integrated Project EFORWOOD – Tools for Sustainability Impact Assessment of the Forestry-Wood Chain.

## Preface

This report is a deliverable from the EU FP6 Integrated Project EFORWOOD – Tools for Sustainability Impact Assessment of the Forestry-Wood Chain. The main objective of EFORWOOD was to develop a tool for Sustainability Impact Assessment (SIA) of Forestry-Wood Chains (FWC) at various scales of geographic area and time perspective. A FWC is determined by economic, ecological, technical, political and social factors, and consists of a number of interconnected processes, from forest regeneration to the end-of-life scenarios of wood-based products. EFORWOOD produced, as an output, a tool, which allows for analysis of sustainability impacts of existing and future FWCs.

The European Forest Institute (EFI) kindly offered the EFORWOOD project consortium to publish relevant deliverables from the project in EFI Technical Reports. The reports published here are project deliverables/results produced over time during the fifty-two months (2005–2010) project period. The reports have not always been subject to a thorough review process and many of them are in the process of, or will be reworked into journal articles, etc. for publication elsewhere. Some of them are just published as a “front-page”, the reason being that they might contain restricted information. In case you are interested in one of these reports you may contact the corresponding organisation highlighted on the cover page.

Uppsala in November 2010

*Kaj Rosén*

EFORWOOD coordinator

The Forestry Research Institute of Sweden (Skogforsk)

Uppsala Science Park

SE-751 83 Uppsala

E-mail: [firstname.lastname@skogforsk.se](mailto:firstname.lastname@skogforsk.se)





**EFORWOOD**

Sustainability Impact Assessment  
of the Forestry - Wood Chain



Project no. 518128

EFORWOOD

Tools for Sustainability Impact Assessment

Instrument: IP

Thematic Priority: 6.3 Global Change and Ecosystems

### **Deliverable D5.1.4**

**D 5.1.4 Report on process identification and aggregation including data for ToSIA test chains. In a FWC sustainability perspective, key aspects and processes are identified an interacting final value chains. Aggregation level of processes is suggested to be used for further work.**

Due date of deliverable: 30.10.2006

Actual submission date: 30.10.2006

Start date of project: 011105

Duration: 4 years

Organisation name of lead contractor for this deliverable: STFI-Packforsk

Revision [FINAL]

<b>Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)</b>		
<b>Dissemination Level</b>		
<b>PU</b>	Public	X
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	

## CONTENTS

<b>1</b>	<b>OBJECTIVES</b> .....	<b>3</b>
<b>2</b>	<b>DEFINITION OF CONCEPTS</b> .....	<b>5</b>
2.1	Consumption as part of the supply chain .....	5
<b>3</b>	<b>MAPPING</b> .....	<b>7</b>
3.1	INTERACTIVE CHAIN 1: Wood incl. wood-based panels.....	7
	Input products: .....	7
	Output products:.....	9
	Map of solid wood supply chains.....	11
3.2	INTERACTIVE CHAIN 2: Paper and Paperboard (fibre).....	12
	Input products: .....	12
	Output products:.....	14
	Map of fibre supply chains.....	16
3.3	INTERACTIVE CHAIN 3: Bioenergy .....	17
	Input products: .....	17
	Output products:.....	17
	Map of bioenergy supply chains .....	18
<b>4</b>	<b>QUANTITATIVE DATA COLLECTION FOR ToSIA TEST CHAINS</b> .....	<b>19</b>
4.1	FBI products.....	19
4.2	Test Chains .....	19
	TEST CHAIN 1: A forest-defined pine chain in Scandinavia for furniture and bio-energy .....	20
	TEST CHAIN 2: A product-defined fine paper/newspaper chain mainly based on eucalyptus and including recycling .....	21
	TEST CHAIN 3: A regional-defined spruce chain in Baden-Wurttemberg.	22
4.3	Case Studies:.....	23
4.4	"Case Studies" and the European FWC.....	23
<b>5</b>	<b>INDICATORS FOR PRODUCTS</b> .....	<b>24</b>
5.1	Categorising of indicators.....	24
5.2	Test analysis .....	25
<b>6</b>	<b>APPENDIXES: TEST CHAINS DATA SETS</b> .....	<b>26</b>

## 1 OBJECTIVES

This deliverable includes the results of the mapping process of Work Package 5.1.1 (Mapping, aggregation of processes and value chains for final products) in Module 5 (Industry to consumer interactions) of the Eforwood project.

Main objectives of this deliverable are the following ones:

- a. To state the role of WP5.1 within the general Eforwood project context.
- b. The identification of the methods and processes to be fulfilled for working out with WP 5.1. Methods should be related to:

Mapping for processes related to FWC products in the final links of the supply chain, including the interaction between industrial manufacturers and distributors, retailers, professional users and end-users (consumers).

Aggregation of the before-mentioned processes, establishing the boundaries and limits of FWC final interaction between industry and end-users.

This deliverable fits in the Module 5 specific objectives in the extent that planning and actions presented here will be the operational basis for further work, including the development and fulfilment of WP 5.1. The focus of WP 5.1 is intrinsically related with the more general objectives of Eforwood. Mapping and aggregation of processes will be useful for further identification of reference chains at test, regional and EU level, having an operational frame in which new FWC tests may be implemented. Furthermore, to map and aggregate processes and products in interacting value chains will lead in next years of the Eforwood project to an appropriate implementation of sustainability impact assessment (SIA) tools applied to similar chains. The sustainability issue is a key point of Eforwood, focusing on evaluating the impact in terms of sustainability along different forest and wood-based interacting value chains.

Module 5, and particularly WP 5.1, will contribute to the general objectives of Eforwood by including the consumption perspective in the global analysis, being crucial for a comprehensive understanding of the final links of the supply chains. Forestry-Wood-Chain products are organised in a supply chain in which raw materials, intermediate materials and finished goods are procured through a chain of processes that supply one another. This chain of processes is reflected in the modular structure of the project. The contribution to the rest of Eforwood modules will be clear in the extent that this deliverable will identify the final links of the FWC, complementing the analogous work performed by the rest of modules in preceding stages of the FWC (Module 2: Forest Resources Management; Module 3: Forest to Industry Interactions; Module 4: Processing and Manufacturing):

Particularly, mapping of this deliverable has been aligned with that one of Module 4, so industrial boundaries are agreed and no overlapping is generated in the global FWC. The inputs of Module 5 are the outputs of the processes in Module 4. Potential contribution of WP 5.1 to other modules includes the implementation of interacting processes between industry and consumption in ToSIA, which can be characterised as a dynamic FWC pathway analysis model. Thus, this deliverable should make clear the processes between industry and consumption when implementing further FWC in ToSIA. Moreover, testing the tool in a stepwise procedure with different cases (regional, etc.) will allow adjustments to be made according to the experiences gained in the starting stages of Eforwood. Virtually, changes might be proposed to upstream modules to improve FWC product's functional performance with a view to improve the level of sustainability in interacting value chains. By fulfilling these aims, WP 5.1 will contribute to the enhancement of ToSIA utility for stakeholders and the European forest industry in general.



## 2 DEFINITION OF CONCEPTS

### 2.1 CONSUMPTION AS PART OF THE SUPPLY CHAIN

Consumers purchase and use products with full or partial origin in the forest. Commodity type FWC products are distributed to interacting value chains for further processing and adding value. Forest-based products are incorporated into more and less complex products consisting of various materials. Main task of WP 5.1 is to establish the methodology needed for identifying the final processes included in the supply chains of forest-based products. Under this scope, this deliverable covers the part of the FWC where the chain comes virtually to an end, with consumers as the closing link. In the “industry to market” part of the FWC, one can distinguish the following major subjects:

- i. transportation and logistics systems,
- ii. production processes in interacting value chains,
- iii. systems for recovery of used materials,
- iv. policy issues related to the area, and
- v. intermediaries and consumers needs, views and perceptions.

The detailed analysis of supply chains in the FWC in Module 5 through the mapping and aggregation of processes comprises of environmental matters (material use, energy use and emissions from production and logistics processes, wasted products and waste creation), economic matters (much of the added values occur along this part of the FWC) and social values (safe products, availability...).

A **supply chain** or supply network is a coordinated system of entities, activities, information and resources involved in moving a product or service from supplier to customer. The entities of a supply chain typically consist of manufacturers, converters, service providers, distributors, and retail outlets. Supply chain activities transform raw materials and components into a finished product along the primary and secondary industrial transformation before being distributed to the end-user.

Frequently there may be a chain of intermediaries, each passing the product down the chain to the next organisation, before it finally reaches – after a series of processes - the consumer or end-user. These processes can be described by a process mapping. **Process mapping** is a technique using workflow diagrammes to bring forth a clearer understanding of a process or series of parallel processes along the interactive supply chains within the scope of the project and their different modules:

- Module 3 “Forest to Industry Interaction”
- Module 4 “Processing and Manufacturing”
- Module 5 “Industry to Consumer Interactions”

The final products referred to in this project and managed in task 5.1.1 are from the three different interactive chains:

**Interactive chain 1: WOOD incl. wood-based panels**

**Interactive chain 2: PAPER**  
**Interactive chain 3: BIOENERGY**

In the following pages the interactive chains will be explained in further detail in the mapping process.

## 3 MAPPING

### 3.1 INTERACTIVE CHAIN 1: WOOD INCL. WOOD-BASED PANELS

**Definition:** Solid wood is a term commonly used to distinguish between lumber (wood that has been sawn and prepared for use) and engineered wood (wood-based panels). Engineered wood products are manufactured by binding together wood strands, fibres or veneers with adhesives to form a composite material. Engineered wood products includes plywood, oriented strand board (OSB) and fibreboard.

#### **Input products:**

##### ***Primary processed wood products***

#### **Solid wood**

##### ***Sawlogs and veneer logs***

Roundwood that will be sawn (or chipped) lengthways for the manufacture of sawnwood or railway sleepers (ties) or used for the production of veneer (mainly by peeling or slicing). It includes roundwood (whether or not it is roughly squared) that will be used for these purposes; shingle bolts and stave bolts; match billets and other special types of roundwood (e.g. burls and roots, etc.) used for veneer production.

##### ***Sawnwood***

Wood that has been produced from both domestic and imported roundwood, either by sawing lengthways or by a profile-chipping process and that, with a few exceptions, exceeds 5 mm in thickness. **It includes** planks, beams, joists, boards, rafters, scantlings, laths, boxboards and "lumber", etc., in the following forms: unplaned, planed, finger-jointed, etc. **It excludes** sleepers, wooden flooring, mouldings (sawnwood continuously shaped along any of its edges or faces, like tongued, grooved, rebated, V-jointed, beaded, moulded, rounded or the like) and sawnwood produced by resawing previously sawn pieces.

#### **Wood- based panels**

This product category is an aggregate comprising veneer sheets, plywood, particle board, OSB and fibreboards.

##### ***Veneer sheets***

Thin sheets of wood of uniform thickness, rotary cut (i.e. peeled), sliced or sawn. It includes wood used for the manufacture of laminated construction material, furniture, veneer containers, etc. It excludes wood used for plywood production within the same country.

##### ***Plywood***

A panel consisting of an assembly of veneer sheets bonded together with the direction of the grain in alternate plies generally at right angles. The veneer sheets are usually placed symmetrically on both sides of a central ply or core that may itself be made from a veneer sheet or another material. It includes *veneer*

*plywood* (plywood manufactured by bonding together more than two veneer sheets, where the grain of alternate veneer sheets is crossed, generally at right angles); *core plywood* or *blockboard* (plywood with a solid core (i.e. the central layer, generally thicker than the other plies) that consists of narrow boards, blocks or strips of wood placed side by side, which may or may not be glued together); *cellular board* (plywood with a core of cellular construction); and *composite plywood* (plywood with the core or certain layers made of material other than solid wood or veneers). It excludes laminated construction materials (e.g. glulam), where the grain of the veneer sheets generally runs in the same direction. Non-coniferous (tropical) plywood is defined as having at least one face sheet of non-coniferous (tropical) wood.

***Particle board (including oriented strandboard (OSB))***

A panel manufactured from small pieces of wood or other ligno-cellulosic materials (e.g. chips, flakes, splinters, strands, shreds, shives, etc.) bonded together by the use of an organic binder together with one or more of the following agents: heat, pressure, humidity, a catalyst, etc. The particle board category is an aggregate category. It includes particle board; oriented strandboard (OSB) and flaxboard. It excludes wood wool and other particle boards bonded together with inorganic binders.

***Oriented strandboard (OSB)***

A structural board in which layers of narrow wafers are layered alternately at right angles in order to give the board greater elastomechanical properties. The wafers, which resemble small pieces of veneer, are coated with e.g. waterproof phenolic resin glue, interleaved together in mats and then bonded together under heat and pressure. The resulting product is a solid, uniform building panel having high strength and water resistance. It includes: waferboard and oriented strandboard (OSB).

***Fibreboard***

A panel manufactured from fibres of wood or other ligno-cellulosic materials with the primary bond deriving from the felting of the fibres and their inherent adhesive properties (although bonding materials and/or additives may be added in the manufacturing process). It includes fibreboard panels that are flat-pressed and moulded fibreboard products. It is an aggregate comprising hardboard; medium density fibreboard (MDF); and insulating board.

***Hardboard***

Fibreboard of a density exceeding  $0.8 \text{ g/cm}^3$ . It excludes similar products made from pieces of wood, wood flour or other ligno-cellulosic material where additional binders are required to make the panel; and panels made of gypsum or other mineral material.

***Medium density fibreboard (MDF)***

Fibreboard of a density exceeding  $0.5 \text{ g/cm}^3$  but not exceeding  $0.8 \text{ g/cm}^3$ .

***Insulating board***

Fibreboard of a density not exceeding  $0.5 \text{ g/cm}^3$ .

## ***Secondary processed wood products***

### ***Further Processed Sawnwood***

Wood sawn or chipped lengthwise (including strips and friezes for parquet flooring, not assembled) **and** continuously shaped (tongued, grooved, rebated, V-jointed, beaded, moulded, rounded or the like) along any of its edges or faces, whether or not planed, sanded or finger jointed. **It excludes:** sawn or chipped wood with further treatment of edges and/or faces other than planing, or sanding.

### ***Wooden wrapping and packaging Material***

Packing cases, boxes, crates, drums and similar packings, of wood; cable-drums of wood; pallets, box pallets and other load boards, of wood; pallet collars of wood. Casks, barrels, vats, tubs and other coopers' products and parts thereof, of wood, including staves.

### ***Builder's joinery and carpentry of wood***

Including windows and doors and coverings thereof as well as cellular wood panels, assembled parquet panels, shingles and shakes.

### ***Wooden furniture***

Seats with wooden frames as wooden camping and garden seats etc. and parts thereof. Except: seats convertible into beds, swivel seats, medical seats. Wooden furniture other than seats as of a kind used in offices, in the kitchen, bedrooms and elsewhere, as well as parts of all these.

### ***Prefabricated buildings preponderantly made of wood***

E.g.: Log cabins, houses prefabricated from particle board.

## **Output products:**

The following **solid wood output product groups** were approved by the Module 5 partners. In accordance with the corresponding solid wood chain partners of Module 4 the product groups were aggregated and defined as follows:

### **Solid wood-furniture:**

- Home and office furniture
- Kitchen/ bathroom furniture
- Outdoor furniture

### **Solid wood-joinery:**

- Floor covering
- Doors & windows

### **Solid wood-packaging:**

- Pallets
- Boxes

### **Solid wood-construction:**

- External & internal wall (incl. timber frame)
- Floor systems
- Roof

**Wood-based panels:**

- Veneer sheets
- Plywood
- Particle board
- Fibreboard

These output products are procured to the final consumer. There is a chain of intermediaries, each passing the product down the chain to the next organisation. This process is known as the distribution chain. **Common distribution channels in the solid wood chain** are:

- Direct
- Wholesaler
- Retailer (independent sales chains and stores)
- End-user

Beyond that, the mapping of individual and aggregated processes in WP 5.1 comprises of:

- Use (product life span)
- Recovery logistics (collection, transport)
- Waste management (landfill, incineration, use in other industries)

## Map of solid wood supply chains

Figure 1 shows graphically the mapping and aggregation of solid wood supply chains

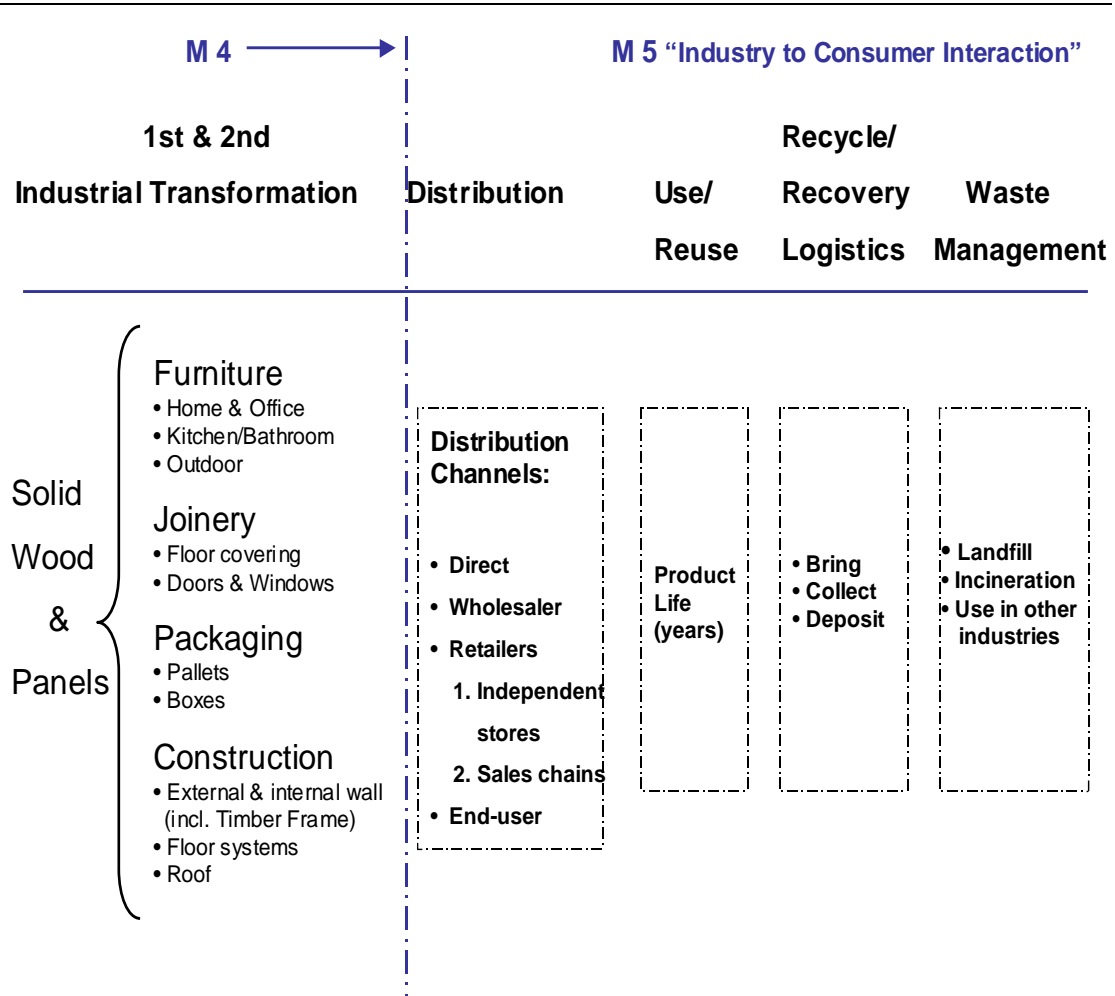


Figure 1: Mapping of solid wood supply chains

## 3.2 INTERACTIVE CHAIN 2: PAPER AND PAPERBOARD (FIBRE)

**Definition:** Paper is a thin, flat material produced by the compression of fibres. The fibres used are usually natural and composed of cellulose. The most common source of fibres is pulpwood, wood chips, particles or residues by mechanical and/or chemical process for further manufacture into paper, paperboard, fibreboard or other cellulose products.

### **Input products (from M4):**

The paper and paperboard category includes graphic papers; sanitary and household papers; packaging materials and other paper and paperboard.

#### ***Graphic papers***

The graphic papers category is an aggregate category including newsprint; uncoated mechanical; uncoated woodfree and coated papers. Products in this category are generally manufactured in strips or rolls of a width exceeding 15 cm or in rectangular sheets with one side exceeding 36 cm and the other exceeding 15 cm in the unfolded state.

#### ***Newsprint***

Paper mainly used for printing newspapers. It is made largely from mechanical pulp and/or waste paper, with or without a small amount of filler. Weights usually range from 40 to 52g/m<sup>2</sup> but can be as high as 65g/m<sup>2</sup>. Newsprint is machine finished or slightly calendered, white or slightly coloured and is used in reels for letterpress, offset or flexo printing.

#### ***Uncoated mechanical***

Paper suitable for printing or other graphic purposes where less than 90% of the fibre furnish consists of chemical pulp fibres. This grade is also known as groundwood or wood-containing paper and magazine paper, such as heavily filled supercalendered paper for consumer magazines printed by the rotogravure and offset methods.

#### ***Uncoated woodfree***

Paper suitable for printing or other graphic purposes, where at least 90% of the fibre furnish consists of chemical pulp fibres. Uncoated woodfree paper can be made from a variety of furnishes, with variable levels of mineral filler and a range of finishing processes such as sizing, calendering, machine glazing and watermarking. This grade includes most office papers, such as business forms, copier, computer, stationery and book papers. Pigmented and size press "coated" papers (coating less than 5g per side) are covered by this heading.

#### ***Coated papers***

All paper suitable for printing or other graphic purposes and coated on one or both sides with carbon or minerals such as china clay (kaolin), calcium carbonate, etc. Coating may be by a variety of methods, both on-machine and off-machine, and may be supplemented by supercalendering.



### ***Sanitary and household papers***

This covers the stock of a wide range of tissue and other hygienic papers for use in households or commercial and industrial premises. Examples are toilet paper and facial tissues, kitchen towels, hand towels and industrial wipes. Some tissue is also used in the manufacture of baby napkins, sanitary towels, etc.

The parent reel stock is made from virgin pulp or recovered fibre or mixtures of these.

### ***Packaging materials***

Paper or paperboard mainly used for wrapping and packaging purposes. **It excludes:** Unbleached kraft paper and paperboard that are not Sack kraft paper or Kraftliner and weighing more than 150 g/m<sup>2</sup> but less than 225 g/m<sup>2</sup>; felt paper and paperboard; Tracing papers; not further processed uncoated paper weighing 225 g/m<sup>2</sup> or more.

### ***Case materials***

Papers and boards mainly used in the manufacture of corrugated board. They are made from any combination of virgin and recovered fibres and can be bleached, unbleached or mottled. **It includes:** kraftliner, testliner, semi-chemical fluting, and waste-based fluting (Wellenstoff).

### ***Folding boxboard***

Often referred to as Cartonboard, it may be single or multiply, coated or uncoated. It is made from virgin and/or recovered fibres, and has good folding properties, stiffness and scoring ability. It is mainly used in cartons for consumer products such as frozen food and for liquid containers. **It includes:** paper and paperboard covered or coated with plastics.

### ***Wrapping papers***

Wrappings (up to 150 g/m<sup>2</sup>): Papers whose main use is wrapping or packaging made from any combination of virgin or recovered fibres, bleached or unbleached. They may be subject to various finishing and/or marking processes. **It includes:** sack kraft, other wrapping krafts, sulphite and greaseproof papers as well as coated paper and paperboard not uniformly bleached throughout the mass, except Multi-ply.

### ***Other papers mainly for packaging***

This category embraces all papers and boards mainly for packaging purposes other than those listed above. Most are produced from recovered fibres, e.g. greyboards, and go for conversion, which in some cases may be for end-uses other than packaging. **It includes:** Composite, not coated, paper and paper board of flat layers stuck together.

### ***Other paper and paperboard N.E.S. (not elsewhere specified)***

Other papers and boards for industrial and special purposes. This category includes cigarette papers and stock of filter papers, as well as gypsum liners and special papers for waxing, insulating, roofing, asphaltting, and other specific applications or treatments. **It includes:** wallpaper base; Unbleached kraft paper and paperboard that are no Sack kraft paper or Kraftliner and weighing more than

150 g/m<sup>2</sup> but less than 225 g/m<sup>2</sup>; felt paper and paperboard; Tracing papers; not further processed uncoated paper weighing 225 g/m<sup>2</sup> or more. Raw copying and transfer papers, in rolls or sheets except carbon or self-copy paper.

**Output products (from M5):**

***Converted products made of pulp, paper or board***

***Graphic***

- Newspapers
- Magazines & brochures
- Books
- Directories
- Catalogues
- Etc.

***Packaging***

- Corrugated boxes
- Cartonboards
- Sacks and bags
- Liquid carton-board containers
- Moulded pulp containers
- Etc.

***Personal care products***

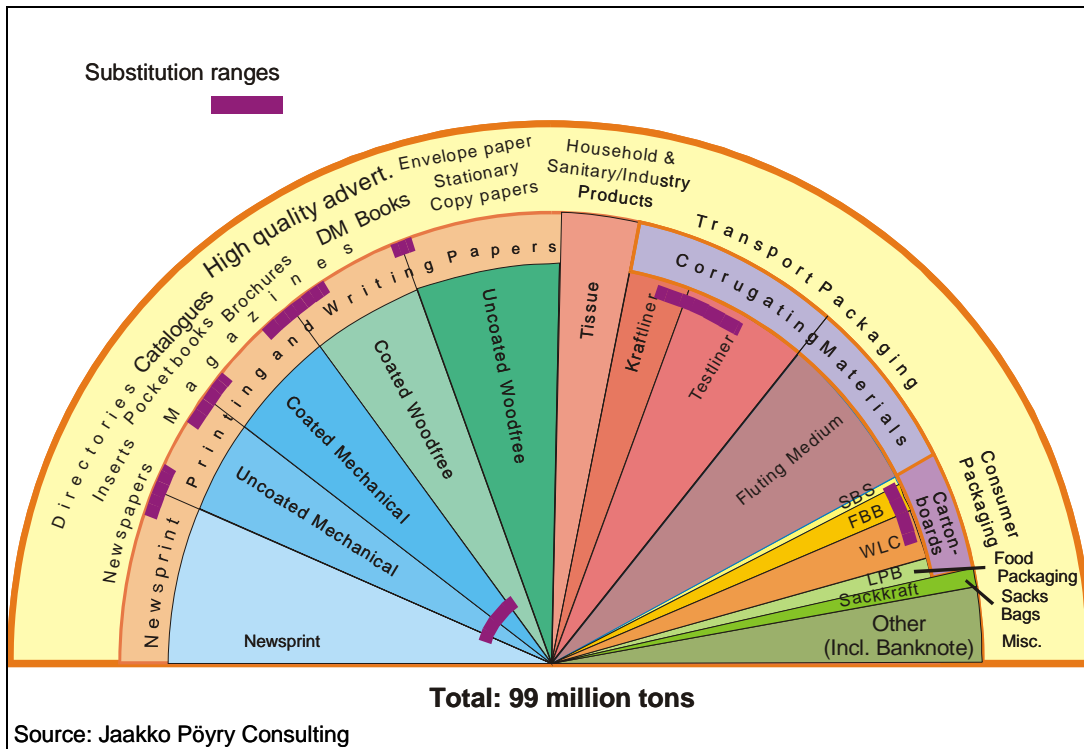
- tissues (napkins, toilet paper...)
- Diapers
- Etc.

***Specialised paper***

- Cigarette paper
- Bank notes
- Etc.

Non-converted output products include office papers, such as business forms, copy and computer paper.

This is summarized in figure 2, where the total paper and board consumption in EU is outlined for 2005.



**Figure 2: schematic overview of the pulp, paper and board grades**

The output products are procured to the final consumer. There is a chain of intermediaries, each passing the product down the chain to the next organisation. This process is known as the distribution chain. **Common distribution channels in the fibre chain are:**

- Direct (commercial or public)
- Wholesaler
- Retailer (independent sales chains and stores)
- End-user

Beyond that, the mapping of individual and aggregated processes in WP 5.1 comprises of:

- Use (product life span)
- Recovery logistics (collection, transport)
- Waste management (landfill, incineration, use in other industries)

**Map of fibre supply chains**

Figure 3 shows graphically the mapping and aggregation of fibre supply chains

<b>M 5 “Industry to Consumer Interaction”</b>					
	Industrial Transformation		Distribution Channels	Use/ Reuse	Recycle/ Recovery Logistics
Fibre from M4	Graphic	newsprint products magazines & brochures books	Direct (professional) 1. commercial 2. public	Education Information Entertainment Health Safety Equity	
Sheet/Roll	Packaging	molded pulp containers liquid carton-board containers carton-board container corrugated boxes sacks bags	Wholesaler  Retailers 1. Independent stores 2. Sales chains	Preservation Protection Convenience Wellbeing	
	Tissue	personal care products (diapers, etc.) tissues (napkins, toilet paper)	End-user		1. Bring 2. Collection at source 3. Deposit system

**Figure 3: Mapping of fibre supply chain**

### 3.3 INTERACTIVE CHAIN 3: BIOENERGY

**Definition:** Bioenergy can be understood as energy produced from biomass, which means the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste (DIRECTIVE 2001/77/EC). In Eforwood bioenergy is defined as wood based bioenergy.

#### **Input products:**

##### ***Energy from wood directly from forests***

Comprises wood used for energy taken directly from forest, other wooded land or from trees outside forest, such as orchards, hedges etc. This category thus includes self-consumption.

##### ***Post-consumer wood energy***

Post-consumer wood energy comprises wood derived from used palettes and boxes, demolition wood etc.

##### ***Wood (processing) residues***

comprise residues used for energy including wood and bark from sawmills, wood based panel mills, pulp and paper mills, furniture and secondary processing plants.

#### **Output products:**

##### ***Industrial bioenergy consumption (by-products from M4 or from M3: bark, black liquor, saw dust, chips etc.)***

- Heat (steam)
- Electricity

##### ***Industrial bioenergy production (M4)***

- Pellets

##### ***Commercial bioenergy used for producing heat/electricity (by-products from M4 or from M3: bark, chips stumps etc.)***

- Forest chip (M3)
- Wood residue (M4)
- Heat (steam)
- Electricity

##### ***Commercial bioenergy production (chip from M3)***

- Chip (for small scale use, i.e. < 1MW)
- Pellets

These output products are procured to the final consumer. There is a chain of intermediaries, each passing the product down the chain to the next organisation. This process is known as the distribution chain. **Common distribution channels in the bioenergy chain** are:

- Direct
- Wholesaler
- Retailer (independent sales chains and stores)
- End-user

Beyond that, the mapping of individual and aggregated processes in WP 5.1 comprises of:

- Use (product life span)
- Recovery logistics (collection, transport)
- Waste management (landfill, building material, forest fertilisation)

### Map of bioenergy supply chains

Figure 4 shows graphically the mapping and aggregation of bioenergy supply chains

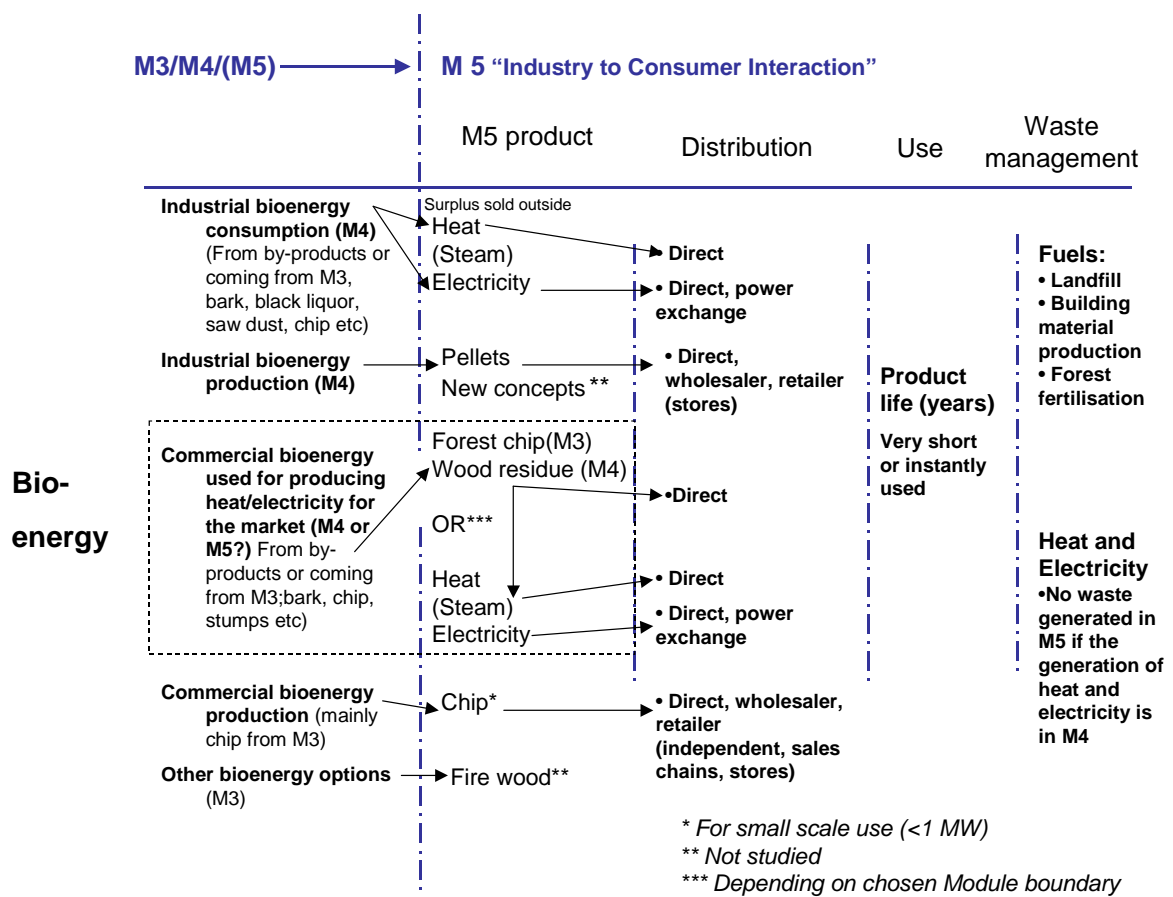


Figure 4: Mapping of bio-energy supply chains

## 4 QUANTITATIVE DATA COLLECTION FOR TOSIA TEST CHAINS

### 4.1 FBI PRODUCTS

**ToSIA** applies to FWCs at various scales of geographic area and time perspective. Therefore, **test chains** were defined taking into account different approaches (forest-defined, industry-defined, consumption-defined). The rationale for executing the Test Chains exercise is the later integration into three Regional Cases.

### 4.2 TEST CHAINS

*IP Board decision on Test Chains:*

"It was confirmed that the Test Chains are:

- A forest-defined pine chain in Scandinavia for furniture and bio-energy
- A product-defined fine paper/newspaper chain mainly based on eucalyptus and including recycling, and
- A regional-defined spruce chain in Baden-Wurtemberg.

As a next step ML will ensure that the chains form a consistent sequence. The aggregation level will be checked and it should be approximately the same for all Modules. Modules are responsible for checking the compatibility with the neighbouring links/Modules in the chain and for agreeing with each other in cases when choices need to be made between various alternatives.

It was agreed that for the stakeholder meeting in September, a catchy presentation of ToSIA will be made, keeping in mind Daniel Deybe's comments.

It was agreed that the deadline for the Modules to provide data for the Test Chains and Lead+ indicators is end of September.

The modules will be provided with clear guidelines for this.

**TEST CHAIN 1: A forest-defined pine chain in Scandinavia for furniture and bio-energy**

From M4 to M5:

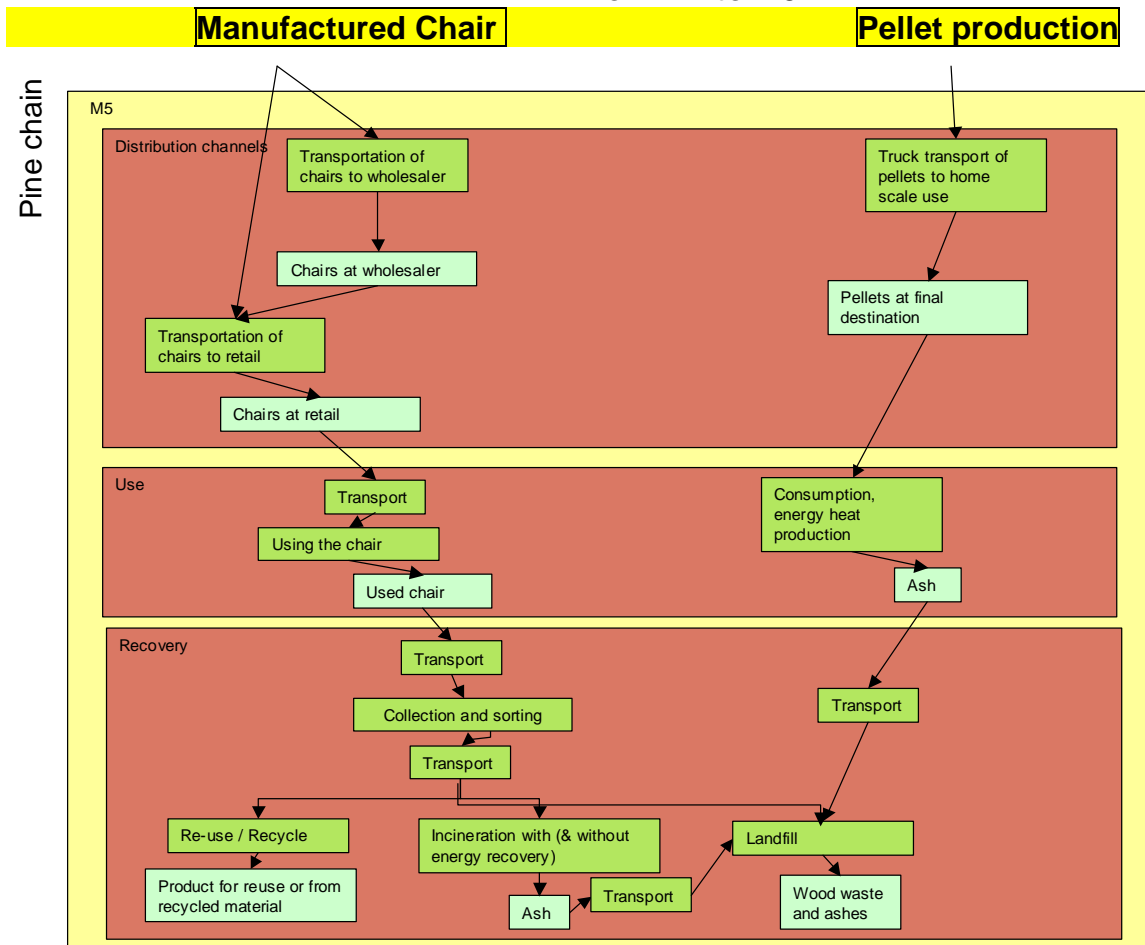


Figure 5: Graphical presentation of the forest-defined pine chain



**TEST CHAIN 2: A product-defined fine paper/newspaper chain mainly based on eucalyptus and including recycling**

From M4 to M5:

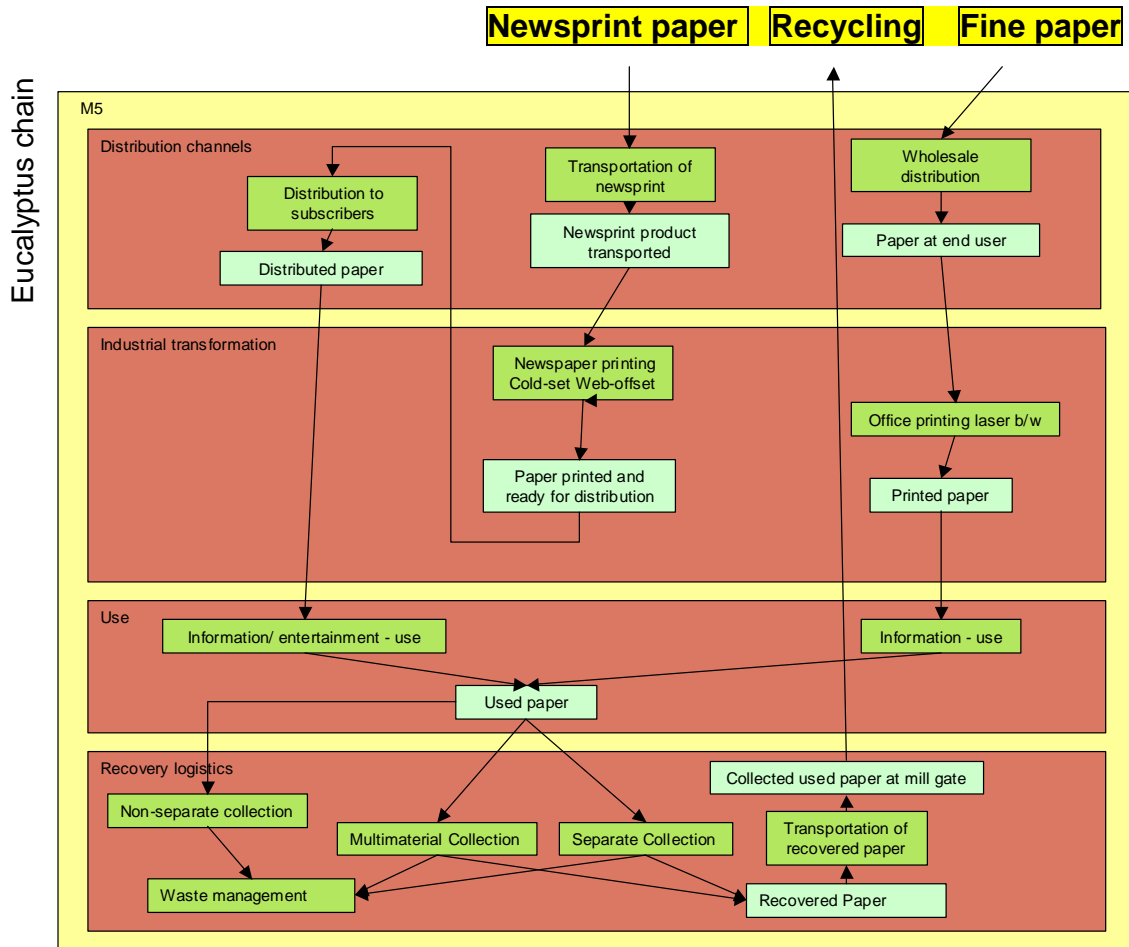
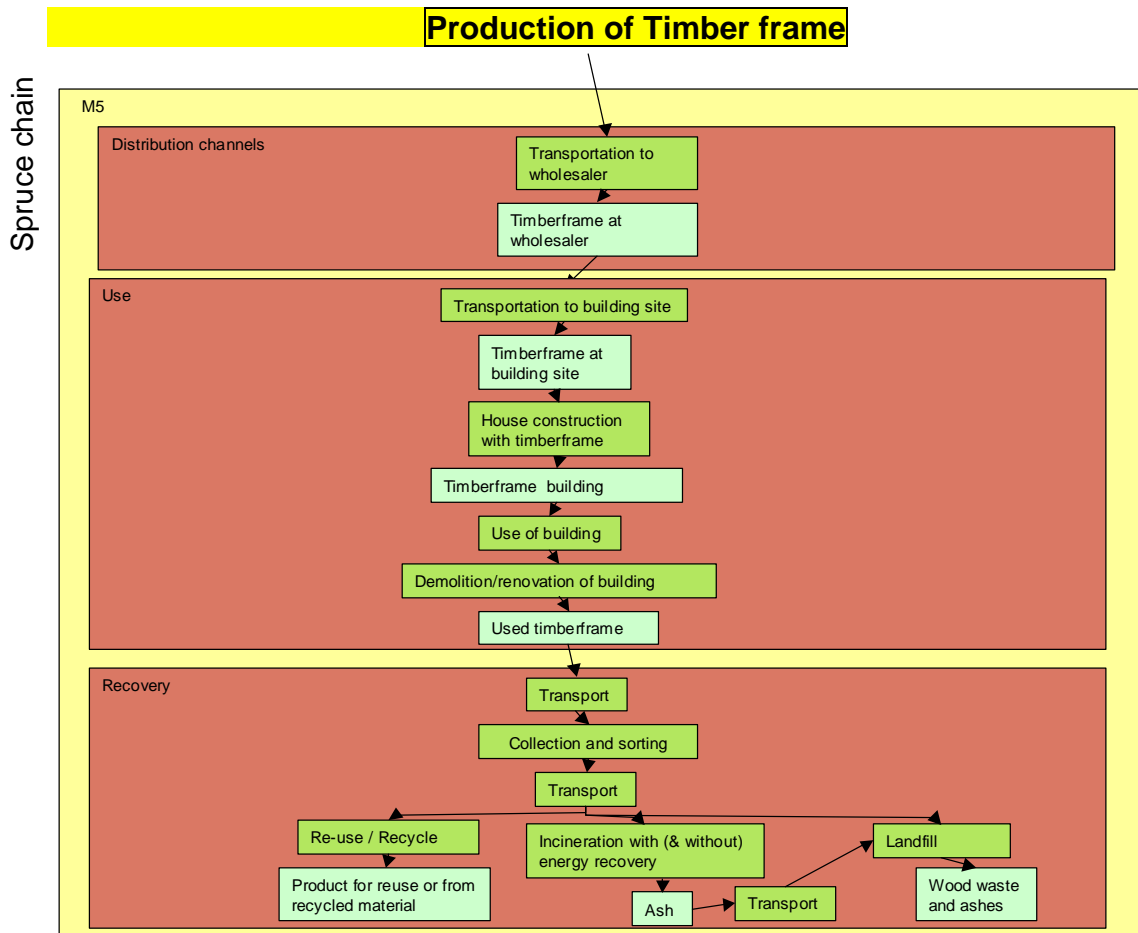


Figure 6: Graphical presentation of the product-defined eucalyptus chain

**TEST CHAIN 3: A regionally-defined spruce chain in Baden-Wurttemberg**

From M4 to M5:



**Figure 7: Graphical presentation of the regionally-defined spruce chain**

### 4.3 CASE STUDIES:

*IP Board decision on "Regional Cases":*

"It was agreed that the Regional Cases will be called:

- the Scandinavian Production Case
- the Baden-Württemberg Case
- the Iberian Consumption Case

It was decided that for the moment, the project will concentrate on these three cases and more can be added later, if appropriate.

M5 will coordinate the Iberian consumption Case.

### 4.4 "CASE STUDIES" AND THE EUROPEAN FWC

*IP Board Decisions on the European FWC:*

"It was agreed that in parallel with the Test Chains and Regional Cases, each Module, on a country basis, should start to map the processes covering approx. 80 % of material flows. It was agreed that the planning of the European FWC should start now, especially considering the expectations of the European Commission. It was agreed to start with an inventory of available data sources such as statistics. This will be communicated to the Modules

It has still not been decided on a comprehensive and operational definition of the Case Studies. This will have to wait until we have gathered experience from the Test Chain exercise. However, the data should primarily be used to map and describe the processes and to give values for the "Lead +" indicators.

## 5 INDICATORS FOR PRODUCTS

The proposed lead indicators are arranged according to three sustainability dimensions for the Forestry Wood Chain. Those have been named in the EFORWOOD Description of Work (2005: 4).

*Environmental:* biodiversity, carbon sequestration, soil fertility, pollutants and wastes, water quality, energy efficiency in production, water use efficiency, change of natural resource stock and degree of recycling.

*Social:* employment, consumers' requirements for and expectations of products and services, cultural values, recreational possibilities, rural development, human health and well being.

*Economic:* competitiveness, value-adding, development of existing and new markets, real income, investment capital formation, cost-benefit, energy use and production." (EFORWOOD , 2005: 4)

Lead indicators are introduced with the intention to meet that categorization.

### 5.1 CATEGORISING OF INDICATORS

#### IP Board decision on indicators:

"The IP Board approved the suggestion of WP1.1 on the following structure for further work with indicators (cf. also WP1.1 internal draft report on EFORWOOD Sustainability Indicators for the Forestry Wood Chain, May 2006, Appendix 1):

- Economic / Social / Environmental
- Themes – indicators - detailed description (including parameters, classifications)
- Lead – General FWC – module specific indicators

The IP Board agreed to the following tentative number of indicators to be used for enabling Modules to start their work (cf. the second draft on indicators):

- Lead indicators: approx. 6
- EFORWOOD Whole chain indicators: 26
- Module specific indicators: 53  
(M2: 34, M3: 21: M4: 22, M5: 22)

Regarding the spatial scale of indicators, it was agreed that ToSIA will focus on the regional / national level and the more local/enterprise level could be addressed by partial models in Modules 2-5.

Collecting the data and asses if they can be accepted to the database is the role of WP1.2. If not, WP1.2 returns the data to the Module for improvements. WP1.2 has simple rules on the when data can be accepted. (If it is complete, etc.) WP1.2 is not evaluating the quality of data contents, this work is dedicated to the modules. The procedure of data collection requires close communication between M2-5 and WP1.2. The draft set of Lead+ indicators and whole chain indicators sofar resulting out of this process are given in appendix 1.

## 5.2 TEST ANALYSIS

Using the "Lead +" indicators", a subset of the still further refined "EFORWOOD SI draft indicator set" the Modules are requested to start collecting data for these indicators (WP 1.2). Initiating data collection on the "Lead +" indicators" helps testing and further developing the details of indicator specifications needed for data collection in WP 1.2. The experience of this "test data collection" on the basis of the "Lead +" indicators" should also allow the further development of this set, including that some indicators might be dropped or added. For others, the definitions and/or measurable units might change. Note that considerable work will also likely be necessary in the context of building metadata standard specifications and building up the database. Gaining experience early on this aspect is one of the objectives.

On the EFORWOOD stakeholder meeting in Kerkrade on 13<sup>th</sup> September 2006 "Lead +" indicators produced by WP1.1 were presented. These "Lead +" indicators will be prioritised when the data collection for the Test Chains, "Case Studies" and European FWC, starts. Furthermore, based on the "EFORWOOD SI draft indicator set 3" the Modules will have the possibility to start collect data for these preliminary indicators.

## 6 APPENDIXES:

## 6.1 APPENDIX 1:

### INDICATOR SET, DRAFT SET 3 – VERSION 28/08/2006

	Set	No	Indicator	Indicator full name
E C O N O M I C	Lead + indicator	1	Gross value added and gross domestic product	Gross value added (GVA) at factor cost and Gross Domestic Product (GDP) contribution in total, by module and process
		2	Production and transport costs	Cost of inputs of raw material, labour, energy, corporate tax, capital charge and transport costs in total, by module and process
		3	Trade balance	Imports and exports of wood and products derived from wood and in total, by module and process
		4	Resources and material use	Use of resources and other material (including wood, non-wood goods, recovered raw material) in total, by module and process
	Additional whole chain FWC indicators	5	Enterprise structure	Number of holdings, plants and mills classified by size classes in total, by module and process
		6	Investment and Research & Development	Gross fixed capital formation (investment) and R& D expenditure in total, by module and process and as % of GDP
		7	Innovation	New products in total and in % of turnover by module and process
		8	Total production	Production of products in total and in % by module and process
		9	Revenue	Gross and net revenue in total, by module and process
S O C I A L	Lead + indicator	10	Employment	Number of persons employed in total, by module and process, classified by gender, age class and rural or urban area
		11	Wages and salaries	Wages and salaries (gross earnings) in total, by module and process classified by gender and type of employment
		12	Occupational safety and health	Frequency of occupational accidents and occupational diseases in total, by module and process
		13	Education and Training	Education time and training expenditure per employee in total, by module and process as % of turnover classified by gender and highest level of education
	Additional whole chain FWC indicators	14	Quality of employment	Number of persons employed in total, by module and process classified by skills, type of employment and equality of treatment
E N V I R O N M E N T	Lead + indicator	15	Energy generation and use	Energy generation (from renewables) and energy use in total, by module and process classified by origin including the share of self-sufficiency
		16	Greenhouse gas balance	Greenhouse gas balance including greenhouse gas emissions in total, by module and process from energy use, industrial processes, waste as well as carbon sequestration in woody biomass, in soils of forest and other wooded land and harvested wood products
		17	Transport	Transport distance and volume of freight in total, by module and process per mode of transport
		18	Water	Water use classified by origin, class as well as water pollution in total, by module and process
		19	Forest area	Area of forest and other wooded land, classified by forest type and related growing stock in total, by module and process
		20	Recycling and recovery	Recycling and recovery of wood products, by-products and waste in total, by module, process and sector

T A L	Additional whole chain FWC indicators	21	Soil condition	Soil fertility, acid levels, contamination and erosion by soil type in total, by module and process
		22	Emissions to air	Emissions to air in total, by module and process
		23	Naturalness	Area of forest and other wooded land, classified by "undisturbed by man", by "semi-natural" or by "plantations", each by forest type in total, by module, process and sector
		24	Corporate responsible sourcing	Consumption of products from renewable sources in total, by module, process and sector
		25	Generation of waste	Generation of waste classified by type, by source in total, by module, process and sector
	<b>NEW</b>	<b>No</b>	<b>Indicator</b>	<b>Indicator full name</b>
E C O	Indicators under considerat.	26	Compliance costs	Compliance costs (red-tape related costs)
S O C		27	Community participation and service provision	No additional text available
		28	Corporate management systems	No additional text available
E N V		29	Use of hazardous chemicals	Index of consumption of chemicals by toxicity class (N, T and T+)