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EFORWOOD

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PD 4.1.8
Report describing the way of handling the data collection needed in ToSIA, by suggest useable databases, define groups of products and set up autonomous trend factors

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CONNECTIONS BETWEEN INDICATORS AND DATABASES

The connections between Eforwood indicators and databases to be used in data collection in Module 4 are presented in table 1.

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Indicators / Databases	1	2	4	7	8	9	10	11	12	13	14	15	19
Table 2. Annual reports					X		X	X					
Table 3. ILO October Inquiry						X							
Table 4. Pöyry Pulp and Paper Databases	X	X	X	X									
Table 5. EcoInvent									X	X		X	X
Table 6. ELCD											X		
Table 7. KCL EcoData			X						X	X	X	X	X
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Table 9. Various databases for solid wood chain used by BRE	X	X	X	X	X	X	X	X	X	X	X	X	X
Table 10. Pöyry Wood Products Databases	X	X	X	X									
Table 11. Various databases for solid wood chain used by VTT		X	X	X	X	X			X		X		
Table 12. Various databases for bioenergy used by VTT	X	X	X	X	X	X	X	X	X	X	X	X	X

Indicators used in data collection in case studies , as in Deliverable PD0.0.15 "*Manual for case study data collection - Background document for EFORWOOD Training - Working document for EFORWOOD Task Force on Indicators*"

(1) Gross value added
(2) Production cost
(4) Resource use, incl. recycled material
(7) Total Production
(8) Employment
(9) Wages and salaries
(10) Occupational safety and health
(11) Education and training
(12) Energy generation and use
(13) Greenhouse gas emissions and carbon stock
(14) Transport
(15) Water Use
(19) Generation of waste

1 INTRODUCTION (RESPONSIBLE: KCL)

This report is part of an EU project called EFORWOOD, which aims to provide methodologies and tools that will integrate Sustainability Impact Assessment of the whole European Forestry Wood Chain (FWC). This deliverable has been done by Module 4, which consists of European companies and organizations focused on processing and manufacturing stages of FWC in Europe. This report is describing the way of handling the data collection needed in ToSIA, by suggest useable databases, define groups of products and set up autonomous trend factors. This report has been written by several persons, so the reader should take this into account while reading the report. The organization responsible for each chapter is presented in each heading.

ToSIA requires large amounts of high quality data in order to be able to give reliable results. The modules of EFORWOOD need to provide that data. Chapter 2 of this deliverable lists usable databases that will be used in data collection for case studies and/or at European level in Module 4. Module 4 provides data for industrial processes in fibre chain, solid wood chain and bioenergy chain. The databases used in Module 4 are described in this deliverable as tables, which present indicators and processes to which the database is applicable to. Tables also show the name and source of the database and describe the type and availability of data. Databases are also described shortly with information of site and time representativeness and uncertainty of information.

The data collection in Module 4 is done by using product groups and different regions in Europe. Each region consists of several countries where the products groups and technologies in industrial processes are assumed to be relatively similar. Chapter 3 in this deliverable presents and describes the product groups and regions in Europe for fibre chain, solid wood chain and bioenergy chain.

Since data is needed not only for 2005 but also for 2015 and 2025, Module 4 needs to consider the autonomous changes and developments in the processes in the future. The method called “autonomous trend factors” is presented in Chapter 4.

2 DATABASES

The data for ToSIA should be as specific and reliable as possible. Possible sources for data are various, of which Module 4 has selected the best ones to be used in EFORWOOD. Databases used in data collection for case studies and/or at European level are described in this chapter. Each partner responsible for data collection has reported their data sources with short descriptions. The indicators and processes for which the database can be used have also been reported. The reporting takes place in table format, and the name of the table is the name of the database. List of all databases presented in this deliverable can be seen in the beginning of this report (page 4).

ISO 14044 (2006) standard presents data quality requirements, of which the following points have been selected for this report:

- Source
- Geographical (site) representativeness
- Time specific representativeness
- Uncertainty of information

Data type and availability has been classified similarly as in Deliverable PD0.0.15 "*Manual for case study data collection - Background document for EFORWOOD Training - Working document for EFORWOOD Task Force on Indicators*":

A. Specific and empirical

a. follow up routines from enterprises
b. data from experiments or scientific measurements
c. branch statistics.

B. Generic and derived

a. official statistics
b. weighting or scaling factors relevant for adaption of generic data to specific data for the actual case. E.g. average data of costs per cutting form (final felling/thinning) is adapted to the case in question with the aid of case specific shares of cutting forms.

C. Model-based and estimated

a. modelling; e.g. harvest costs and time use model.
b. experts' judgment.

2.1 Fibre chain

The fibre chain includes chemical pulping (market kraft pulp), mechanical pulping in integrated mills, deinking process of recycled paper in integrated mills, and paper/board manufacturing. The responsible partners for fibre chain data collection are JPC, KCL, KCPK and STFI-Packforsk.

2.1.1 Social indicators (KCPK)

Table 2. Annual reports

Applicable to which indicator(s)	Employment Occupational safety and health Education and training
Applicable to which process(es)	Pulp and paper manufacturing
Name of the database	Annual reports
Source	Various sources
Type and availability of data (see the classes above)	A. Specific and empirical a. follow up routines from enterprises c. branch statistics
Short description	Annual reports are yearly published overviews of companies' economic, social and environmental performances. Information is publically available and company specific.
Use in Eforwood	Social data for pulp and paper processes / companies
(Geographical) site specific representativeness	Data is available for various geographical regions and therefore also applicable to various regions
Time specific representativeness	Data yearly available
Uncertainty of information	Data is mill-specific or company- (more than one mill) specific data. Sometimes aggregation of data sources is necessary, uncertainty and accuracy will then increase.

Table 3. ILO October Inquiry

Applicable to which indicator(s)	Wages and salaries
Applicable to which process(es)	Pulp and paper manufacturing
Name of the database	ILO October Inquiry
Source	http://laborsta.ilo.org
Type and availability of data (see the classes above)	B. Generic and derived a. official statistics b. weighting or scaling factors relevant for adaption of generic data to specific data for the actual case.
Short description	The ILO October Inquiry is a unique source of data on occupational wages and hours of work, covering up to 159 occupations in 49 industry groups for about 70 countries each year. It collects national data on wage rates, earnings, normal hours of work and hours actually worked or paid for, by sex, where available.
Use in Eforwood	Data on wages and salaries for various industrial processes
(Geographical) site specific representativeness	Data is available for about 70 countries (worldwide)
Time specific representativeness	Data is yearly collected (1983-2006)
Uncertainty of information	The information is reported by countries in a variety of ways, and may come from different types of sources (administrative records, surveys of employers, etc.), using different concepts and definitions, one should therefore be careful making direct comparisons between data.

2.1.2 Economic indicators (JPC)

Table 4. Pöyry Pulp and Paper Databases

Applicable to which indicator(s)	Gross value added Production cost Resource use, incl. recycled material Total Production
Applicable to which process(es)	Pulp and paper manufacturing
Name of the database	Pöyry Pulp and Paper Databases
Source	Pöyry Forest Industry Consulting Oy
Type and availability of data (see the classes above)	A. Specific and empirical a. follow up routines from enterprises b. data from experiments or scientific measurements c. branch statistics
Short description	Pöyry Pulp and Paper Databases are a continuously updated pulp and paper specific database primarily intended for economic calculations. The Databases contain unique and detailed process descriptions of various pulp, paper and board grades.
Use in Eforwood	Economic data for pulp and paper processes.
(Geographical) site specific representativeness	The Databases contain country specific information and cover the global pulp and paper industry.
Time specific representativeness	The Databases were established 40 years ago. The Databases are updated continuously and depending on the data in question, the newest figures are from 2006/2008.
Uncertainty of information	Both typical process and mill-specific data.

2.1.3 Environmental indicators (STFI-Packforsk + KCL)

In the fibre chain, STFI-Packforsk is responsible for data collection of environmental indicators for newsprint, carton board and container board. KCL is responsible for data collection of environmental indicators for market pulps, woodcontaining magazine paper and woodfree fine paper.

Table 5. EcoInvent

Applicable to which indicator(s)	Energy generation and use Greenhouse gas emissions Generation of waste Water use
Applicable to which process(es)	Pulp and paper manufacturing
Name of the database	EcoInvent
Source	The EcoInvent Centre
Type and availability of data (see the classes above)	A. Specific and empirical c. Branch statistics
Short description	EcoInvent is a Swiss LCA database. It is a joint initiative of institutes and departments of the Swiss Federal Institutes of Technology Zürich.
Use in Eforwood	Environmental data (emissions and waste) for pulp and paper processes
(Geographical) site specific representativeness	Data is applicable mainly to Nordic Countries and Europe
Time specific representativeness	Depending on the data in question, mainly from 2000 →2007
Uncertainty of information	Data is for typical processes, not mill-specific data.

Table 6. ELCD

Applicable to which indicator(s)	Transport
Applicable to which process(es)	Pulp and paper manufacturing, transportation
Name of the database	ELCD
Source	ELCD
Type and availability of data (see the classes above)	A. Specific and empirical b. data from scientific measurements
Short description	ELCD is the European commission's information hub on life cycle thinking based data.
Use in Eforwood	Environmental data (emissions and energy) for transportation
(Geographical) site specific representativeness	Data is applicable mainly to Nordic Countries and Europe
Time specific representativeness	Depending on the data in question, mainly from 2000 →2007,
Uncertainty of information	Data is for typical transportation processes

Table 7. KCL EcoData

Applicable to which indicator(s)	Energy generation and use Raw material use Greenhouse gas emissions and carbon stock Generation of waste Transport Water use
Applicable to which process(es)	Pulp and paper manufacturing, transportation
Name of the database	KCL EcoData
Source	Oy Keskuslaboratorio – Centrallaboratorium Ab, www.kcl.fi
Type and availability of data (see the classes above)	A. Specific and empirical a. follow up routines from enterprises b. data from experiments or scientific measurements
Short description	KCL EcoData is a continuously updated unit process database primarily intended for life-cycle inventory calculations related to forest products. KCL EcoData contains unique and detailed process descriptions of various pulp, paper and board grades.
Use in Eforwood	Environmental data (emissions and waste) for pulp and paper processes and transportation
(Geographical) site specific representativeness	Data is applicable mainly to Nordic Countries and Europe
Time specific representativeness	Depending on the data in question, mainly from 2000 →2007, updated continuously through co-operation with the industry
Uncertainty of information	Data is for typical processes, not mill-specific data.

Table 8. IEA

Applicable to which indicator(s)	Energy generation and use
Applicable to which process(es)	Pulp and paper manufacturing
Name of the database	International Energy Statistics, IEA
Source	www.iea.org
Type and availability of data (see the classes above)	B. Generic and derived a. official statistics b. weighting or scaling factors relevant for adaption of generic data to specific data for the actual case.
Short description	IEA is the energy forum for 27 industrialized countries. It has country specific energy production data, including heat and electricity production profiles from different fuels.
Use in Eforwood	Energy profiles in different countries for pulp and paper processes
(Geographical) site specific representativeness	Data is applicable mainly to all Europe
Time specific representativeness	Newest data from 2005
Uncertainty of information	Data is country specific

2.2 Solid wood chain

The solid wood chain includes sawn timber, particle board, construction elements, joinery and furniture. The responsible partners for solid wood chain data collection are BRE, JPC, TUZVO and VTT.

Table 9. Various databases for solid wood chain used by BRE

Applicable to which indicator(s)	All indicators
Applicable to which process(es)	All processes
Name of the database	1. BRE Environmental profiling 2. Various Internet base sources 3. Professional literature 4. Scientific thesis 5. National statistics
Source	BRE Environmental profiling www.unece.org www.nafi.com.au www.economy.nrw.de www.ttf.co.uk www.forestryscotland.com www.forestry.gov.uk www.dti.gov.uk www.fao.org europa.eu westworld.dmu.ac.uk www.esprid.org data.euro.who.int
Type and availability of data (see the classes above)	A. Specific and empirical B. Generic and derived C. Model-based and estimated
Short description	1) LCA database 2) Various BRE datasets 3) Generic dataset publically available
Use in EFORWOOD	Total production of different types of solid wood products as defined in M4.
(Geographical) site specific representativeness	Data is specific to central and south Europe
Time specific representativeness	Published 1997 - 2005
Uncertainty of information	Source data set in public domain are not 3rd party verified. Additionally, they will have to be manipulated if presented in aggregate form.

Table 10. Pöyry Wood Products Databases

Applicable to which indicator(s)	Gross value added Production cost Resource use, incl. recycled material Total Production
Applicable to which process(es)	Solid wood and panel board processes
Name of the database	Pöyry Wood Products Databases
Source	Pöyry Forest Industry Consulting Oy
Type and availability of data (see the classes above)	A. Specific and empirical a. follow up routines from enterprises b. data from experiments or scientific measurements c. branch statistics
Short description	Pöyry Wood Product Databases are a continuously solid wood and panel board specific database primarily intended for economic calculations. The Databases contain unique and detailed process descriptions of various solid wood and panel board grades.
Use in Eforwood	Economic data for solid wood and panel board processes.
(Geographical) site specific representativeness	The Databases contain country specific information and cover the global pulp and paper industry.
Time specific representativeness	The Databases were established 30 years ago. The Databases are updated continuously and depending on the data in question, the newest figures are from 2005/2008.
Uncertainty of information	Both typical process and mill-specific data.

Table 11. Various databases for solid wood chain used by VTT

Applicable to which indicator(s)	Production cost Resource use, incl. recycled material Total Production Employment Wages and salaries Energy generation and use Transport
Applicable to which process(es)	Solid wood and panel board processes
Names and sources of the database	1. Metsäteho Oy 2006 2. Eurostat 3. Confederation of Finnish Industries, EK 4. Environmental report 2005, Finnish Forest Industries Federation 5. RT Environmental declaration 2005 6. VTT's own sources
Type and availability of data (see the classes above)	A. Specific and empirical B. Generic and derived
Use in EFORWOOD	Total production of different types of solid wood products as defined in M4.
(Geographical) site specific representativeness	Data is specific to Finland and Europe
Time specific representativeness	Published up to 2006
Uncertainty of information	Very high reliability data

2.3 Bioenergy

Bioenergy is an Eforwood value chain covering over 50 % of the wood raw material utilisation. For the modelling work bioenergy is though a little bit complex as in e.g. Scandinavia about 80 % of the utilisation today is integrated to the solid wood and pulp and paper processes. In other words – wood industry by-products like bark, wood chips and black liquor is combusted within the industry producing heat and electricity mainly for internal use and it is therefore in practically impossible to handle these sub-processes as equal processes. On the other hand – most of the indicator data for internal bioenergy utilisation will probably be included in the general pulp and paper (P&P) and solid wood (SW) processes and therefore indicator data could be calculated twice if the bioenergy processes were studied separately.

For the case studies, M4 has suggested a simplified modelling approach for Bioenergy where the bark and black liquor combustion within Pulp and Paper industry will be part of the processes, heat (or combined heat and power, CHP) production within solid processing will as well be part of the main processes. Bioenergy utilisation will be recognized as indicators within these processes. Furthermore, if some heat or electricity is sold the flows will as well appear as indicator data. Pellet production is recognized as an own process within solid wood processing (see PD 4.1.8).

If possible, HP and CHP within P&P and SW could be studied trough simplified processes (efficiency, heat/electricity production proportion) to be able to create a better picture of the flows and utilisation of bioenergy. How to proceed will be decided when the data collection and the first case study calculations for 2005 are ready. This was discussed in Uppsala 10-11.4.2008.

2.3.1 Pellet process data collection

Data needed for describing the indicators of the pellet process cannot be found in statistics. Most of the data will be generated by a simplified process model and the data needed as input is collected from literature and companies.

Table 12. Various databases for bioenergy used by VTT

Applicable to which indicator(s)	All indicators
Applicable to which process(es)	Pellet process
Names and sources of the database	http://www.pelletcentre.info/cms/site.aspx?p=878 (European Pellet Centre) http://www.escansa.com/propellets/propellets.htm http://www.iea.org/Textbase/stats/index.asp (IEA Energy Statistics) www.eubionet.net http://www.ecn.nl/phyllis/ (Database on the properties of biomass and waste) http://www.pellettienergia.fi/?lang=1&pv=10&av=65&pg=linkit&id=127 (Pellets in Finnish) http://www.pelletsindustrin.org/ (Pellets in Sweden) http://www.cepi.org/content/default.asp?pageid=101
Type and availability of data (see the classes above)	A. Specific and empirical B. Generic and derived C. Model-based and estimated
Short description	• Indicators 1,2,4,8, 12 and 13 are secondary data = calculated with process model • Indicator 7 is Fixed (first set of calculations: 80 000 t; two more production levels (5 000 t and 25 000 t) will be described later, in June 2008 • Indicators 9-11 are not evaluated separately, same data as for SW may be used • Indicator 14 is not included in the data collection of this process • Indicators 15 and 19 are not needed, neglectable
Use in EFORWOOD	Indicator values for pellet processes
(Geographical) site specific representativeness	Data is European data
Time specific representativeness	
Uncertainty of information	

3 GROUPS OF PRODUCTS AND REGIONS IN EUROPE

Since ToSIA requires enormous amounts of data, Module 4 has decided to enable the task by collecting data for several groups of products, which represent 60-80% of total production in Europe. The product groups for fiber chain, solid wood chain and bioenergy chain are presented in this chapter. The production processes of those products, i.e. "the model mills", have been presented in more detailed level in PD4.1.7 "*Report describing the manufacturing processes in case studies*".

The production processes and products are assumed to be quite similar in different parts of Europe. For data collection, Europe has been divided into four regions in fiber chain and into three regions in solid wood chain. The countries in each region have been already presented in PD4.1.7 but are now presented again. This report presents the differences of product groups in all regions of Europe.

3.1 Fibres (KCL)

Table 13. Fiber products in M4

Product	What is included	Comments or notes
Bleached chemical (market) pulp	Bleached softwood sulphate pulp, bleached hardwood sulphate pulp	Softwood sulphite pulp, hardwood sulphite pulp, unbleached pulp, mechanical pulps are NOT included
Integrated newsprint	Newsprint from virgin and/or recycled fibers	
Woodcontaining magazine paper	LWC-paper, SC-paper	Mechanical pulp is typically TMP
Woodfree Fine paper	Uncoated and/or coated papers, made from kraft pulps	
Containerboard	Bleached/ unbleached kraftliner, testliner, fluting	
Carton board	White-lined chipboard, folding boxboard	

Table 14. Differences in product furnish and mill median capacities in different regions of Europe in the Fiber chain

	Region 1	**Region 2**	**Region 3**	**Region 4**
Newsprint	280 000 t/year 100% DIP	No production	No production	270 000 t/year 50% DIP 50% Mech. pulp
Wood-containing paper	290 000 t/year 10% DIP 35% BSKP 55% Mech. pulp	50 000 t/year - % DIP 40% BSKP 60% Mech. pulp	No production	310 000 t/year - % DIP 35% BSKP 65% Mech. pulp
Woodfree paper	110 000 t/year 33% BSKP 66% BHKP	25 000 t/year 25% BSKP 75% BHKP	10 000 t/year 33% BSKP 66% BHKP	85 000 t/year 33% BSKP 66% BHKP
Container board	75 000 t/year 100% RP	20 000 t/year 100% RP	20 000 t/year 100% RP	290 000 t/year 100% kraft pulp
Cartonboard	65 000 t/year 50% RP 30% DIP 20% kraft pulp	60 000 t/year 85% RP 15% DIP	No production	180 000 t/year 55% kraft pulp 45% mech. pulp
Market kraft pulp	135 000 t/year BSKP	205 000 t/year BHKP	65 000 t/year BHKP	190 000 t/year BSKP

In the table above, the abbreviations mean the following:

- BHKP Bleached hardwood kraft pulp
- BSKP Bleached softwood kraft pulp
- DIP De-inked pulp
- RP Recovered paper
- Mech. Pulp Thermomechanical pulp or groundwood pulp

Table 15. Regions of Europe in Fibre chain

Region 1: Central Europe	**Region 2: Southern Europe**	**Region 3: East Europe**	**Region 4: Nordic Countries**
Austria	Spain	Czech Republic	Finland
Belgium	Italy	Hungary	Norway
Denmark	Portugal	Poland	Sweden
France	Greece	Romania	
Germany	Cyprus	Bulgaria	
Ireland	Malta	Slovak Republic	
Netherlands		Latvia	
Switzerland		Lithuania	
United Kingdom		Estonia	

3.2 Solid wood chain (BRE)

Table 16. Product groups for wood based products

Product	What is included	Comments or notes
Softwood sawnwood	Model mills	
Hardwood sawnwood	Model mills	This product is still under consideration by experts as it creates a problem between value/volume data collection M3/M4/M5
Particle board	Model mills	
Industrial Production of Construction Elements	External walls and floor construction	Large production
Manufacturing of construction elements	External walls and floor construction	SME production
Industrial production of joinery	Doors and windows	Large production
Manufacturing of joinery	Doors and windows	SME production
Industrial production of furniture components	Indoor furniture (i.e. kitchen units)	Large production
Manufacturing of furniture components	Indoor furniture (i.e. kitchen units)	SME production

Table 17. Differences in products in different regions of Europe for Wood-based products

	Region 1	**Region 2**	**Region 3**
Softwood sawn timber	Smaller production than region 3	Bulk orientated sawn timber products; often strength graded.	Large production of high quality sawn timber for secondary conversion and construction
Hardwood sawn timber	Smaller production than region 3	Remarkable production of low and high quality timber; big and small mills	Very small production volume and only few small mills
Particle board	No plywood and smaller than in region 3.	Very big bulk production. High level of automation at some mills.	Very limited production
Industrial Production of Construction Elements	No integrated production	Standard products from domestic species. Automated mills.	High quality products from Nordic timber. Automated mills
Manufacturing of construction elements	Large proportion of production	Individual products from domestic species. Manual work.	Special products through manual orientated operations
Industrial production of joinery	Small proportion of production	Standard products from imported wood. Automated mills.	High quality products from pine heartwood timber. Automated mills.
Manufacturing of joinery	Majority of production	Individual products from imported species.	Special products from pine heartwood through manual orientated operations
Industrial production of furniture components	Small proportion of production	Standard products from imported wood and domestic species. Technology of the mills vary a lot	Large variety of different type of products. White birch important material
Manufacturing of furniture components	Majority of production	Standard and individual products from imported wood and domestic species. Manual oriented production	Special quality products from different (hard wood) species. Manual work emphasised.

The wood based products grouped countries into 3 basic clusters with the following responsibilities:

- BRE Region 1: Central and Southern Europe
- TUZVO Region 2: Eastern Europe
- VTT Region 3: Nordic countries

Table 18. Regions of Europe for Wood-based products

Region 1: Central Europe	**Region 2: East Europe**	**Region 3: Nordic Countries**
Austria	Czech Republic	Finland
Belgium	Hungary	Norway
Denmark	Poland	Sweden
France	Romania	
Germany	Bulgaria	
Ireland	Slovak Republic	
Netherlands		
Switzerland		
United Kingdom		
Spain		
Italy		
Portugal		

3.3 Bioenergy (VTT)

Within the case studies, pellet production will only be included in the Scandinavian case study (2005). The same model mills will be included in the Baden-Württemberg case study but the material flow will be defined as zero. As this area is rapidly increasing pellet production, the flows will be present in the scenarios. Defined regions for pellets will only be two, Scandinavia and the rest of Europe, Table 19.

Table 19. Differences in pellet production for different regions 2005

	Region 1. Scandinavia	Region 2. Europe
Countries	Denmark Finland Norway Sweden	Central Europe Eastern Europe
Difference	Main area for production and consumption 2005	Developing area, leading countries: Austria, Estonia, Italy, Germany and Poland.

4 AUTONOMOUS TREND FACTORS (KCPK + JPC)

The text below is abstracted from PD 4.2.6. ”*Conceptual outline of response functions and draft response functions for case studies*” of the EFORWOOD project. The purpose of the report is to give information to other Module 4 partners on response functions and show why and how they can be created and applied in the EFORWOOD project.

Background

It has been agreed, that in addition to the base year 2005 information, ToSIA could be used for running:

- two "reference future" cases, called A1 and B2 for years 2015 and 2025 (for more information, please see EFORWOOD PD 1.4.7)
- a set of scenarios which deal with changes in legislation/policies, bioenergy use, technology and consumption patterns. (Note: the Eforwood scenario work group is currently defining the scenarios)

A response function for an indicator depicts quantitatively how the indicator value changes when some factors of references futures are being altered.

Module 4

Module 4 partners need to provide indicator values for the reference futures and scenarios. In here, we focus on the generation of the indicator values for the reference futures.

Data points for the reference futures

We start the work with reference futures A1 and B2. We need to calculate values for all processes and indicators for A1 for the years 2015 and 2025 and for B2 for the years 2015 and 2025.

In M4 we have used the term "autonomous trend factor / autonomous development" to describe the "projections of indicator values into future". The autonomous trend factor takes into account several key assumptions about changes in the process drivers in the reference future storylines.

Here, *we do not need to construe continuous response functions*. What we need for the two reference futures are two discrete values for the indicators for 2015 and 2025. Thus, Module 4 partners should estimate the needed values - single data points - for the indicators with their tools and models, whichever combination best fits the task. The Scenario Group, EFI-GTM and ToSIA experts will provide some background information on general drivers, and this information can be used in the compilation of the indicator projections. The list below, adapted from PD 1.4.7, shows the general drivers that are supposed to be used in this work and their sources:

***Main drivers*:**

- GDP percentage growth rate per country, per year until 2030 (from international outlooks, under IPCC scenarios)
- Population by country until 2030 (from international outlooks, under IPCC scenarios)
- Oil price ($/barrel) until 2030 (from international outlooks, under IPCC scenarios)
- Tax level (% of the gross income)

- Technological development (expressed as investment % ,or R&D spending, from EFI-GTM – *note: M4 experts have given input to this*)
- Government regulation (expressed as relative rate)
- Global trade barriers/ trade intensity (from EFI-GTM, as ref future assumption)
- Consumption/demand (million units/y) (from EFI-GTM)
- Share renewables (%) (from international outlooks, under IPCC scenarios)
- Hazards (%losses per year) (from international outlooks, under IPCC scenarios)

Secondary drivers

- Currency exchange rate (%) (from EFI-GTM, as ref future assumption)
- Production costs per unit commodity (€/unit) (from EFI-GTM, in iterative way with module expert – *note: M4 experts have given input to this*)
- Transport cost (€/unit/km) (from EFI-GTM, in iterative way with module expert)
- Average size of mills (avg capacity)(from EFI-GTM, in iterative way with module expert)
- Interest rate % (from EFI-GTM, as ref future assumption)
- Forest area (kha per country per 5 years (in iterative way with module 2 expert)
- Area of reserves (kha per country per 5 years (in iterative way with module 2 expert)
- Total national fellings, m3 per country per spp group per 5 years (in iterative way between EFI GTM and with module 2 expert)

As mentioned above, there are several ways to get the data points for years 2015 and 2025. *One way to develop "indicator projections" could be as follows*:

1. defining crucial issues that influence a process (e.g. fine paper production), based on the reference future descriptions
2. selecting and quantifying those of the issues that change in the reference futures -> process drivers (done partly by M1, please see the list above)
3. developing a projection for each indicator of a process
    a) taking an indicator
    b) selecting the process drivers that have an impact on this indicator
    c) finding the interdependencies between the indicator value and the selected drivers
    d) generating the indicator value

Note: In point 2. the methods presented in the PD 4.2.6. ”*Conceptual outline of response functions and draft response functions for case studies*”, Chapter 2 of PD4.2.6 (or some other suitable method) should be used. Points 3b)-3d) should be done using module and/or process specific tools, models and expertise.

5 CONCLUSIONS (KCL)

The databases to be used for data collection in EFORWOOD were listed in this deliverable. The accuracy and reliability of data to be used in processes of Module 4 was estimated to be very high in general, since the data from databases was classified mainly as specific and empirical data. Many partners in Module 4 have their own data sources and databases with data that has been collected for years in co-operation with the forest industry. This long-term data collection and knowhow gives a good and trustworthy basis for the data to be used for ToSIA and EFORWOOD.

In order to enable the data collection for all Europe, Module 4 has divided Europe into regions. M4 uses divisions of three regions in solid wood chain and four regions in fibre and bioenergy chain for similar technologies and product groups. Each region represents similar types of products and processes and thus the data collection will be simplified. The differences between processes are mainly in production volumes, product furnishes in fibre chain, and automation levels in solid wood chain. The production volumes and automation levels in solid wood chain affect the product types strongly, i.e. large volume production is bulk production with high automation levels, and smaller scale production can process more individual products.

Bioenergy is closely connected to pulp and paper processes and solid wood processes, since it is mostly produced on-site from process residues e.g. bark. This is a challenge to data collection in spite of the regional approach, since double counting has to be avoided. Bioenergy production and consumption in Module 4 processes can be seen in process (energy) indicator values. Thus only separate pellet production and use was considered in this deliverable.

EFORWOOD includes not only data collection, but also future possibilities of European forestry value chain are estimated. Changes in the processes and indicator values have to be estimated for reference futures and scenarios. This is done with autonomous trend factors. The autonomous trend factors indicate the changes on indicator values when some factors or drivers are altered. This way the autonomous changes in processes can be taken into account. The method is described in more detail in PD4.2.6.