



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 D1.2.5
Database of test chains and summary report of database development

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PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

Abstract

This document describes the process of the EFORWOOD database development, defines the database structure, describes the internet-based data collection tool and depicts the main statistics of collected data.

The EFORWOOD database was built by work package (WP) 1.2. It contains information describing forestry wood chains (FWC) provided by respective EFORWOOD modules and will be used by the ToSIA model (WP 1.4).

Currently the database is structured according to the specification of “single test chains”. The current database is stored at project partner Institute of Forest Ecosystem Research, Ltd (IFER).

The database can be accessed using the EFORWOOD database client, the software tool developed to enter data, design FWCs and generate XML¹ as an input for ToSIA. Access to the EFORWOOD database is limited to approved users only.

Executive Summary

The purpose of this document is to

- i. summarize all the steps made in the process of the database development
- ii. describe the actual database structure
- iii. describe a new software solution for the data collection
- iv. present an overview of the database for the single test chains

This new deliverable resumes and extends deliverables D1.2.1 “Database structure“, D1.2.2 “Procedure for data submission to the database“ and PD1.2.4 “Software solution for the interface between EFORWOOD database and ToSIA model“.

The EFORWOOD database contains information describing forestry wood chains (FWC) provided by respective EFORWOOD modules and will be used by the ToSIA model (WP 1.4). Work package (WP) 1.2 is responsible for the EFORWOOD database development and maintenance. The database serves as a data source to the ToSIA model. Data are collected by modules 2-5. Currently the database is structured according to the specification of “single test chains”. The database structure is open to be further adapted and developed in line with the development of data needs and data availability. It can be further extended during the later project phases and cover the project case studies and the European FWC analysis.

The first version of the database structure was designed based on discussions between WP 1.2 and WP 1.4 in February 2006. The database was implemented as a relational database in an open source database system MySQL. Due to continuous changes in the database structure it was converted into MS Access that is more suitable for adjusting the database structure. Once the database structure is unchanging, the database will be implemented without using MS Access.

During the first data collection round the data was collected using MS Excel sheets and manually entered into the database. Based on this experience it was decided to develop a

¹ XML – eXtensible Markup Language is a simple, very flexible text format used for data exchange in a form of structured text. For more information, please see <http://www.w3.org/XML>

software tool to enable internet based data collection. The tool is called EFORWOOD Database Client. It is based on the client-server technology and it enables multiple on-line acces to the actual database that is stored and maintained on a dedicated computer located in IFER. The EFOREWOOD Database Client also enables designing chains and generates XML as an input for ToSIA. Access to the EFORWOOD database is limited to approved users only.

The structure of EFORWOOD database reflects informational content and logical relationships as they are formulated by respective EFORWOOD modules.

The general FWC as defined by EFORWOOD is structured into four hierarchical levels. First level is a FWC itself. There are currently three single test chains. Second level breaks the chain into four separate modules. Every module consists of several stages, which are natural steps in a FWC flow. The last, most important and most detailed level, is represented by processes. Transformation of energy and materials takes place within a process. Linking individual processes will permit to follow the flows along the chains. All processes are connected to each other via its input / output products.

EFORWOOD database describes both static and dynamic part of the FWC. The static part describes processes (main process attributes, input products of a process, output products of a process, indicators of a process). The dynamic part describes sequencing of processes in chains. Lookup lists are preferably used whenever a set of predefined values is known prior to entering data.

There are three single test chains in the database:

1. A regional-defined spruce chain in Baden-Württemberg
2. A forest-defined pine chain in Scandinavia for furniture and bio-energy
3. A product-defined fine paper/newspaper chain including recycling

There are 89 processes defined within the three single test chains and set of 24 indicators.

This document does not deal with the data quality. There will be a special deliverable D1.2.6 “Report on data quality” to provide quality assessment of the collected data.

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1 Introduction

The purpose of this document is to

- v. summarize all the steps made in the process of the database development
- vi. describe the actual database structure
- vii. describe a new software solution for the data collection
- viii. present the main statistics of the collected data for the single test chains

This new deliverable resumes and extends deliverables D1.2.1 “Database structure“, D1.2.2 “Procedure for data submission to the database“ and PD1.2.4 “Software solution for the interface between EFORWOOD database and ToSIA model“.

The EFORWOOD database contains information describing forestry wood chains (FWC) provided by respective EFORWOOD modules and will be used by the ToSIA model (WP 1.4). Work package (WP) 1.2 is responsible for the EFORWOOD database development and maintenance. The database serves as a data source to the ToSIA model. Data are collected by modules 2-5.

Currently the database is structured according to the specification of “single test chains”. The database structure is open to be further adapted and developed in line with the development of data needs and data availability. It can be further extended during the later project phases and cover the project case studies and the European FWC analysis.

The data collection is still in progress. Indicator values are still amended and refined. This document D1.2.5 will be updated in month 24 of the EFORWOOD project; especially the statistics will be generated based on the actual status of the data.

This document does not deal with the data quality. There will be a special deliverable D1.2.6 “Report on data quality” to provide quality assessment of the collected data.

2 Database development

The first version of the database structure was designed based on discussions between WP 1.2 and WP 1.4 in February 2006. The database structure respected the specific requirements of ToSIA developers as defined in that early stage of the model development. At that moment the database was implemented as a relational database in an open source database system MySQL². Due to continuous changes in the database structure it was easier to use more user friendly tool than MySQL to design and manage the database. Therefore the database is designed by MS Access. Since the European Commission requires only an Open Source solution to be used for the final software product of the project, the database will be later implemented without using MS Access.

During the first data collection round the data was collected using MS Excel sheets and manually entered into the database. Blank excel files were preformatted and sent to module leaders for further distribution within modules in the beginning of September 2006. A cover letter explaining the data needs was distributed together with the forms. MS Excel, as any other spreadsheet, allows inserting a lot of inconsistency into data. Therefore, manual check for data consistency was the most laborious part of the data collection.

² MySQL is open source database system. For more information please see www.mysql.com

Based on the first collection round experience, it was decided to develop a software tool to enable internet based data collection, the EFORWOOD Database Client. The EFORWOOD Database Client is a tool designed to allow EFORWOOD partners to enter data into the common EFORWOOD database and to design chains.

Main advantages of the EFORWOOD Database Client are:

- Setting aside „all allowing“ Excel for data entry
- Setting aside „all allowing“ PowerPoint for chain designing
- Setting aside hand typing data into the database
- Visualisation
- Possibility to automatize announcements of missing values
- Formalization of database status announcements
- Possibility to integrate data transfer to ToSIA

The EFORWOOD Database Client is based on the client-server technology to enable multiple on-line access to the actual database that is maintained on a dedicated computer located in IFER. (See chapter 4 for more details about the technology).

The current database is stored at IFER. It is accessible using a software tool developed at IFER and based on the client-server technology. EFORWOOD Application Server runs on dedicated computer located in IFER and accessible via the Internet. The server is connected to the actual EFORWOOD database. The database can be accessed using the EFORWOOD database client, the software tool developed to enter data, design FWCs and generate XML as an input for ToSIA. Access to the EFORWOOD database is limited to approved users only.

3 Database structure

The structure of EFORWOOD database reflects informational content and logical relationships as they are formulated by respective EFORWOOD modules.

The general FWC as defined by EFORWOOD is structured into four hierarchical levels. First level is a FWC itself. There are currently three single test chains. Second level breaks the chain into four separate modules. Every module consists of several stages, which are natural steps in a FWC flow. The last, most important and most detailed level, is represented by processes. Transformation of energy and materials takes place within a process. Linking individual processes will permit to follow the flows along the chains. All processes are connected to each other via its input / output products. One link between two following processes is defined by output product of the source process and the input product of the target process.

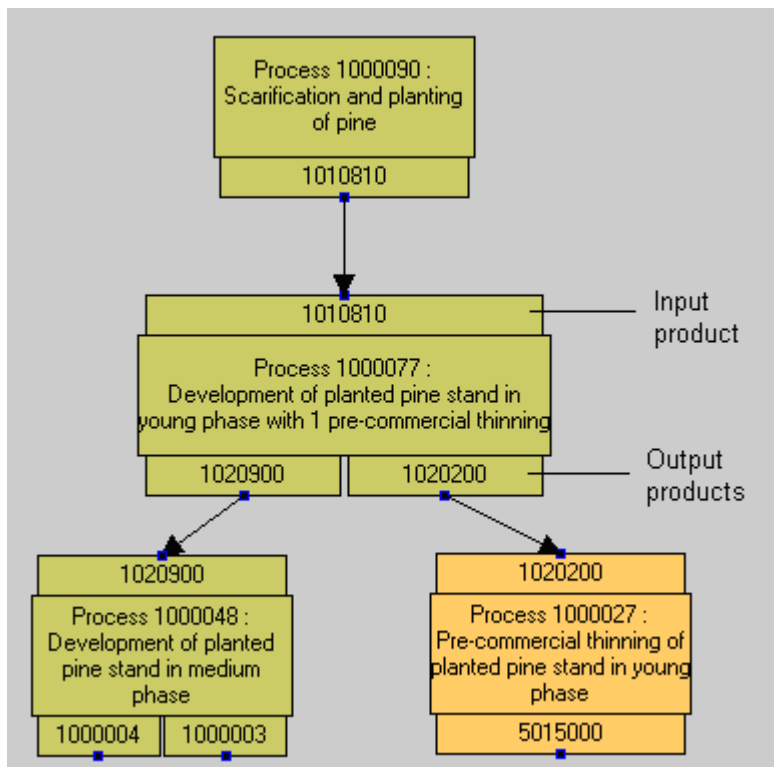


Fig. 1. EFORWOOD database structure: FWC

EFORWOOD database describes both static and dynamic part of the FWC.

- The static part describes processes:
 - main process attributes (table *Processes*)
 - input products of a process (table *InputProducts*, *ConversionFactorsIn*)
 - output products of a process (tables *OutputProducts*, *ConversionFactorsOut*)
 - indicators of a process (tables *IndivatorValues*, *IndicatorValueAttributes*)
- The dynamic part describes sequencing of processes in chains (table *ChainTopology*).

Lookup lists are preferably used whenever a set of predefined values is known prior to entering data. The main advantages of using lookup lists are fast data editing, database consistency (only predefined values may be entered) and possibility to predefine the conditionality of lookup lists. From technical point of view, lookup list is a table that consists of two columns: ID and description. The ID is a unique code entered into the database and the description is a verbal explanation of the ID's meaning. This description replaces the ID in the EFORWOOD Database Client. Lookup lists table names in the EFORWOOD database stats with the letter *x* to be easily recognised.

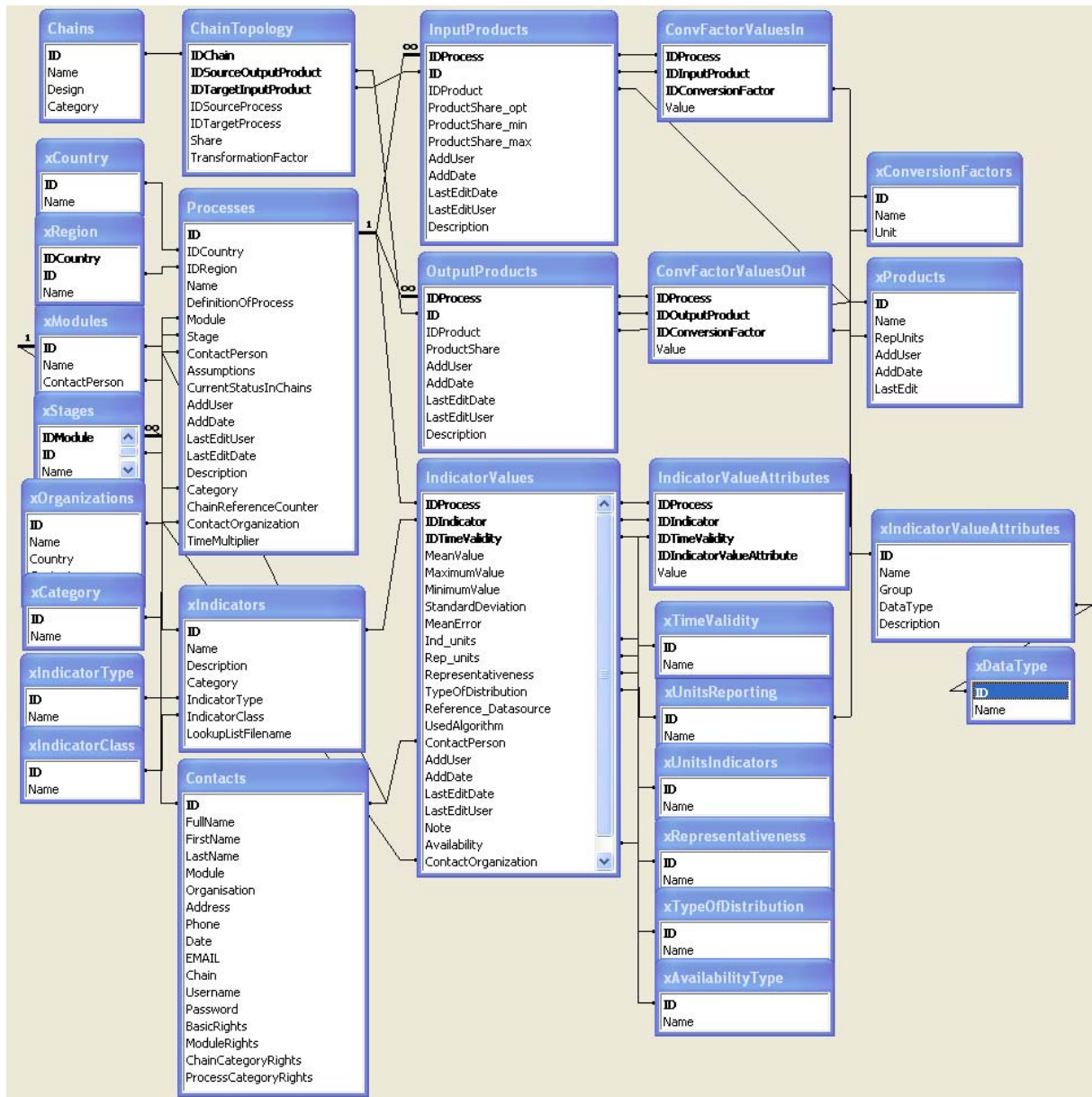


Fig. 2. EFORWOOD database structure

4 Technology description

To make the process of data collection and database building as effective as possible and to provide partners with instant access to the database, it was decided to make the EFORWOOD database accessible using client-server technology. To implement this solution, two new software applications in addition to an existing EFORWOOD database were developed. These applications are the EFORWOOD Application Server (in the following referred to as Server) and the EFORWOOD Database Client (in the following referred to as Client). So now the data collection system consists of three parts:

- **EFORWOOD database:**
The storage for all EFORWOOD data. It is built as relational database currently using Microsoft Access. To ensure data safety the database is backed up every day and contains a table with the history of all changes to the database.

- **EFORWOOD Application Server:**
This application runs on a dedicated computer located in IFER and is accessible via the Internet. The server is connected to the actual EFORWOOD database. It handles multiple simultaneous connections of Client applications and serves as interface to the database providing the data over the network. Other important functions of the server include:
 - managing the user permissions for each user allowing to access/change just the portion of data for which the user has authorization
 - export contents of the database in XML format for ToSIA
 - simple messaging (the operator can send messages to the Clients connected to the Server)

- **EFORWOOD Database Client:**
This software tool is necessary for each partner who wants to access the EFORWOOD database. It can be downloaded from the EFORWOOD internet portal. When started, this software connects to the Server via the Internet and authorizes using username and password provided to each user. The Client allows the user to access contents of the database using hierarchically organized forms and overview tables. The client also contains the chain editor which enables the users to design chains visually using graphical representation of processes and their interconnections. The authorized users can also use the Client to obtain the complete content of the database in XML format (used as ToSIA input).
A standard installation routine was prepared to install the client on a computer, including registration of all necessary dependencies and creating of shortcuts.

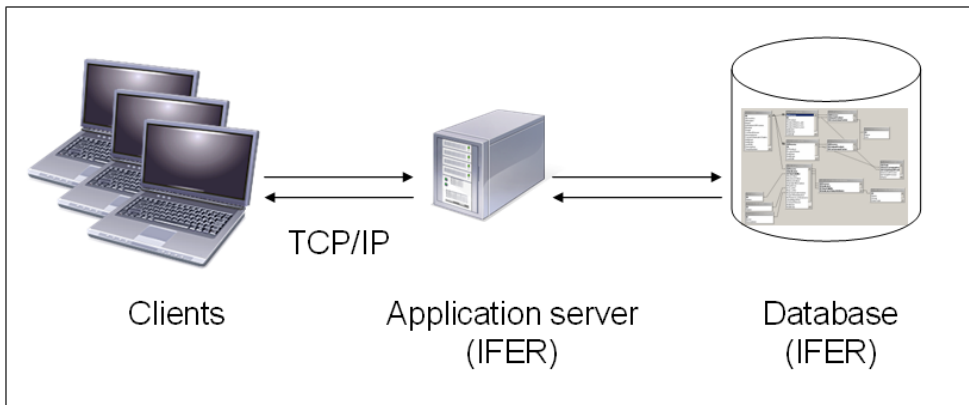


Fig. 3. Client server technology

The EFORWOOD Database Client itself consists of two parts:

- o Data editor (to enter data about processes: products and indicators)

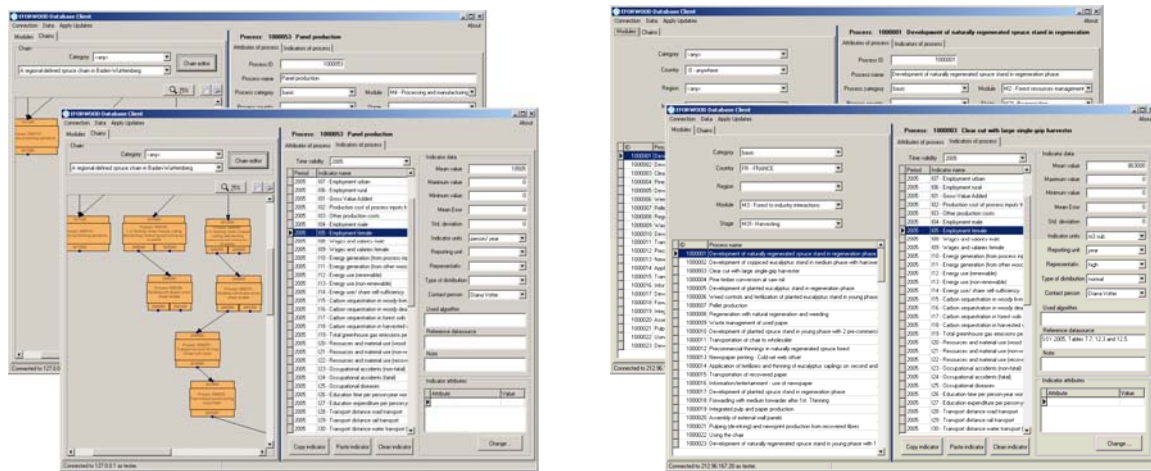


Fig.4. EFORWOOD Database Client: Data editor

- o Chain editor (to graphically design chains)

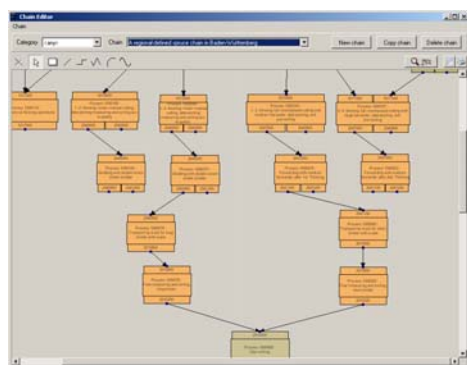


Fig. 5. EFORWOOD Database Client: Chain editor

A process is graphically represented in the following way:

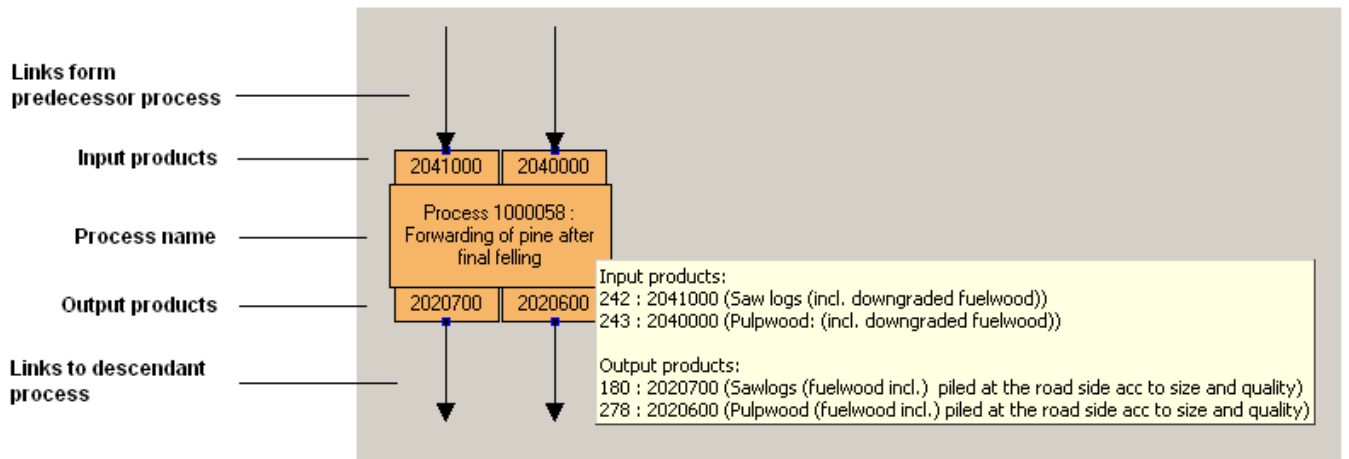


Fig. 6. EFORWOOD Database Client: Graphical representation of a process

Processes are colored according to modules.

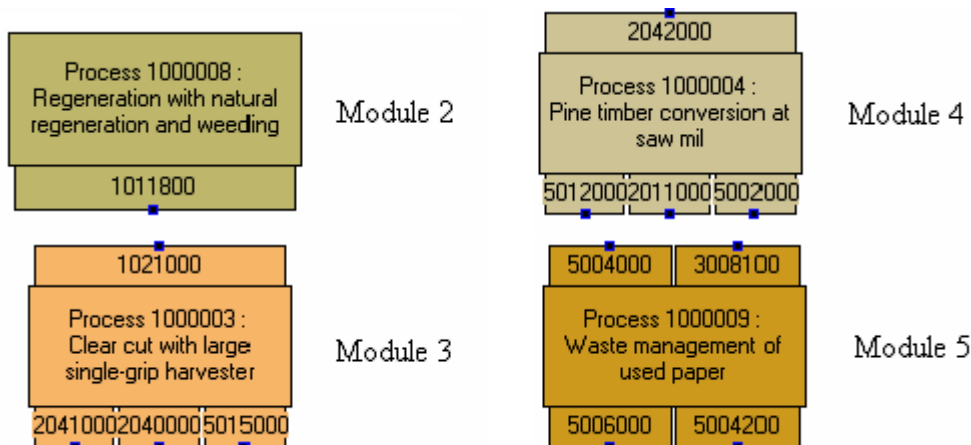


Fig. 6. EFORWOOD Database Client: Graphical representation of a process – colours of modules

There is a system of user permissions to ensure the data consistency.

- Module data editing permission specifies whether the user has the permission to edit data of a certain module. The data of processes for which the user does not have "Module data editing permission" are visible but read-only.
- Chain editing permission specifies whether the user has the permission to open the chain editor and work with chains according to their "Chain category permission" and "Process category permission"
- Chain category permission specifies whether the user has the permission to create, delete and modify the chains of a certain category. The category of the chain is specified during its creation by the authorized user and cannot be changed later. The chains from categories for which the user does not have "Chain category permission" are open as read-only in the chain editor (but still can be used as templates to create chains in categories for which the user has this permission).
- Process category permission specifies whether the user has the permission to create and modify the processes of a certain category. The category of the process is specified during its creation by the authorized user and cannot be changed later.

- The lookup list editing permission specifies whether the user has the permission to open the lookup list editor and edit lookup lists.

5 Database overview

Single test chains were designed using the EFORWOOD data client / Chain editor based on the PowerPoint file “*TestChainStructures_A1_100507.ppt*”.

There are three single test chains in the database:

1. A regional-defined spruce chain in Baden-Württemberg
2. A forest-defined pine chain in Scandinavia for furniture and bio-energy
3. A product-defined fine paper/newspaper chain including recycling

There are 89 processes used in the single test chains:

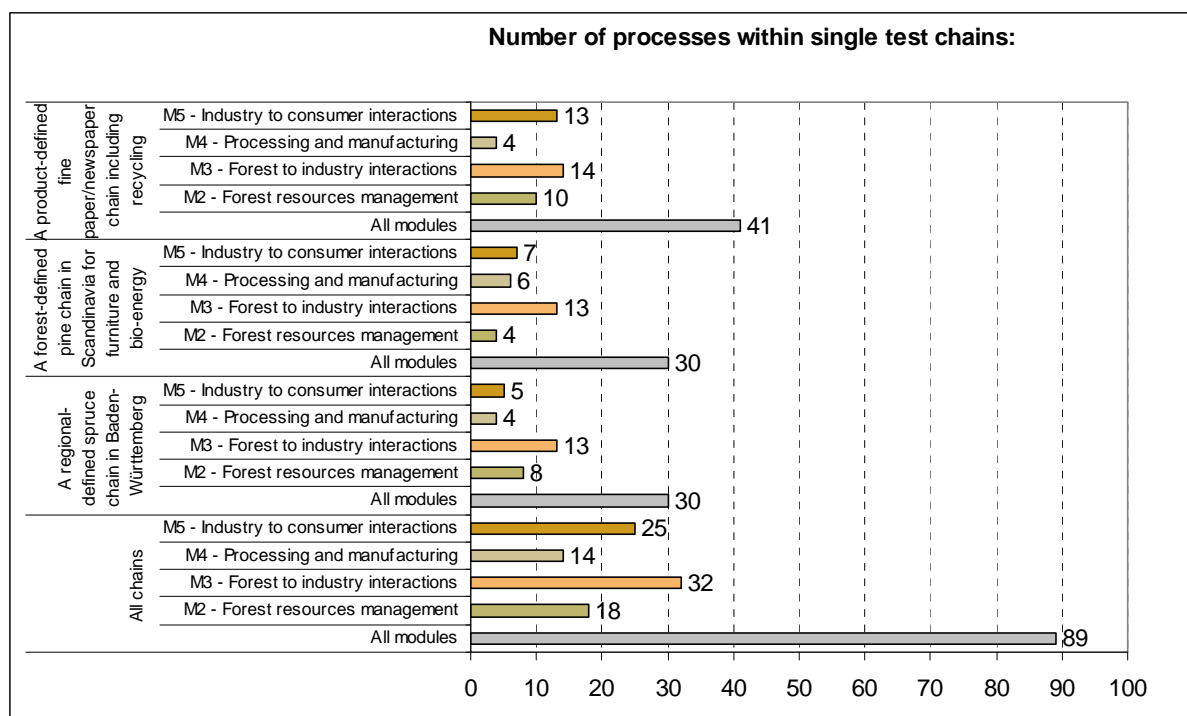


Chart 1. Number of processes within single test chains

The set of indicators was based on the documents “*FWC Indicator Draft Set 5*” and “*Report on Indicator Working Groups on data collection protocols for Single FWC*”. The set of sub-indicators was consulted with the indicator data collection protocol working group leaders. The “*FWC Indicator Draft Set 5*” document lists 31 indicators; 9 of them are marked as “*EFORWOOD ToSIA data collection: NOT INCLUDED*”; 2 of them are marked as “*Newly proposed*”, 1 is marked as “*Under consideration*” and 6 of them are marked as “*Specifications to be elaborated*”.

Data collection protocols of each indicator group describes 24 indicators (Indicator 18 Recycling and recovery was deleted).

	Full set of indicators (<i>EFORWOOD Indicator Draft Set 5.doc</i>)		Data collection protocols (<i>Compilation of data protocol for single test chains.doc</i>)
	Whole list of indicators	Included for EFORWOOD ToSIA data collection	
Total number of indicators	31	13	24

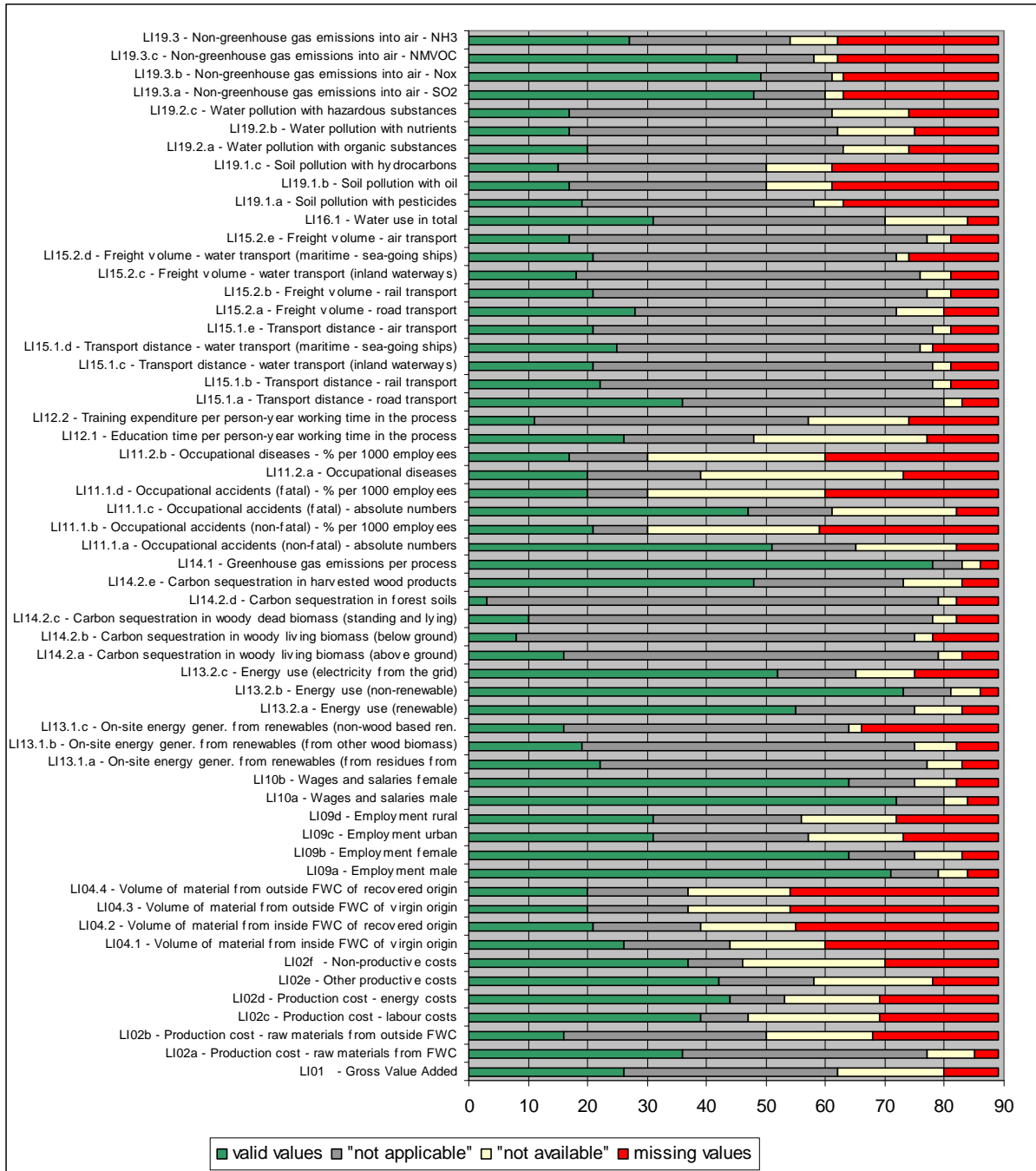
Table 1. Indicators overview

As a result of previous documents, the EFORWOOD database uses 24 indicators and 105 sub-indicators.

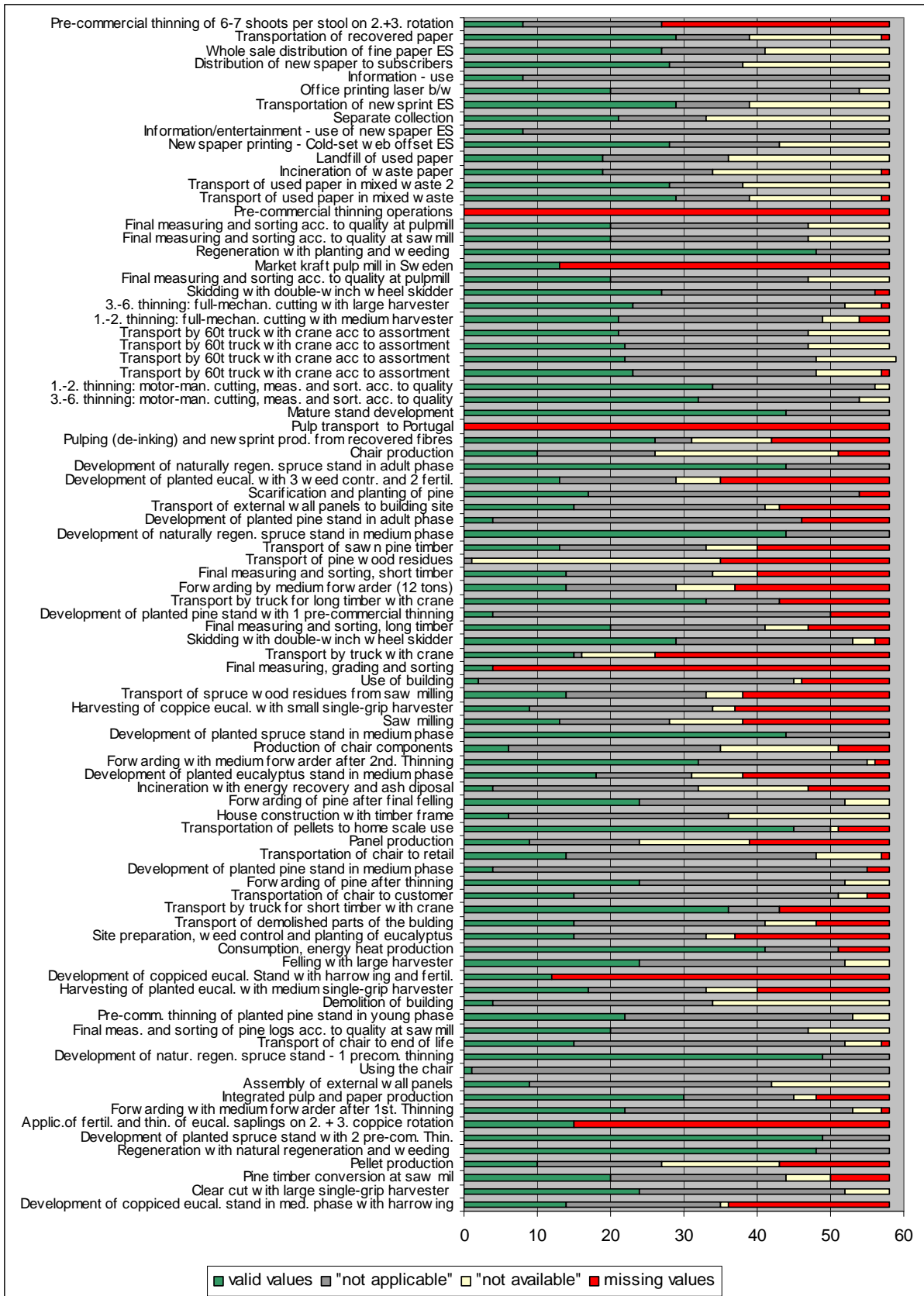
	Whole list of indicators	Reduced according to the <i>EFORWOOD Indicator Draft Set 5.doc</i>
Total number of indicators	24	12
Total number of sub-indicators	105	58
Total number of sub-indicator values (for 89 processes)	9354	5162
Number of collected sub-indicator values	2447	

Table 2. List of indicators in the EFORWOOD database

Count of indicator values per indicators



Count of indicator values per processes



6 Conclusions and outlook

WP 1.2 facilitates data collection and data sharing for other project components, specifically to WP 1.4 and 1.5. Therefore the database structure respects the specific requirements of ToSIA developers. The set of indicators used in the EFORWOOD database was implemented by WP 1.2 based on information from WP 1.1; information on FWC structures, production processes and indicators is provided by modules 2-5.

Two data collection rounds were carried out up to now. During the first data collection round, MS Excel sheets were used to collect data. During the second data collection round, an internet-based approach was used; data was collected using the software tool called EFORWOOD database client. The latest experience with data collection proved the usefulness of the internet-based approach; especially setting aside hand-rewriting data from excel sheets delivered by module experts into the database, visualisation of FWC, providing partners with instant access to the database and integrating data transfer to ToSIA are the most beneficial improvements. It is planned to add more functionality to the EFORWOOD database client when it is used for the Case studies; especially the possibility to provide authorized users with overviews of collected data. There is also a strong call for a function that would enable bulk import of the data. Taking into account various sources and formats of data, it would be very difficult to implement this functionality.

The database structure is open to be further adapted and developed in line with the development of data needs and data availability. At the same time, the EFORWOOD database client can be improved to facilitate filling the database. Especially connection to module 2 specific database is very desirable. To do it, harmonization of the module 2 specific database and the overall EFORWOOD database must be solved.

During the process of collecting data for the single test chains several bugs in the EFORWOOD database client were fixed and the database structure was slightly adjusted to fit the ToSIA requirements. It turned out that detailed data collection protocols are very important for the data quality. The data collection for the case studies will be based on the latest experience and therefore it can be assumed it will be more efficient.