



EFORWOOD

Sustainability Impact Assessment
of the Forestry - Wood Chain



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EFORWOOD

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Abstract

This deliverable is part of an EU project called EFORWOOD. Aim of EFORWOOD is to provide methodologies and tools that will integrate Sustainability Impact Assessment of the whole European Forestry Wood Chain (FWC). The object of this report is to present the work done and lessons learned in Work Package 4.1 Data collection for manufacturing processes of fibre chain, solid wood chain and bioenergy chain. The data was collected for different purposes in different stages of the project, starting from the test chain, continuing with the case studies Baden-Wurtemberg case, Scandinavian case and Iberian case and finally EU-FWC case study. The data will be used in the Tool for Sustainability Impact Assessment (ToSIA). The report discusses also the difficulties and responsibilities in data collection and the quality of results from partners' point-of-view.

In the end of the project, the challenging task of data collection was fulfilled with certain simplifications. They were necessary because of the many industrial processes included in M4 and also because of the demanding EU case data collection and lack of statistics. In general the partners of M4 consider the quality of data in ToSIA from moderate to low because of the high level of aggregation and assumptions.

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1 Introduction

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 focused on processing and manufacturing stages of FWC in Europe.

M4 is dealing with the manufacturing processes within EFORWOOD. Three different value chains are studies for the industrial processes; the Fibre chain, the Solid wood chain and the Bioenergy chain.

This report aims to give a complete overview of the work done and lessons learned in Work Package 4.1 Data collection during the 4 years of EFORWOOD. It also reports the responsibilities, difficulties and quality of data collected from the point of view of M4 partners.

2 Responsibilities of each partner in WP4.1

2.1 Responsibilities of KCL

Katri Behm from KCL was coordinating the WP4.1 in Months 25-42.

Data collection of KCL focused on environmental indicators of market pulp, magazine paper and fine paper processes in Baden-Württemberg and Iberian case study and EU-FWC study in all regions of Europe. Data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

KCL was also involved in creating the fibre chain topology to the Baden Württemberg case study and M4 topologies of fibre chain, solid wood chain and bioenergy chain in EU-FWC in the Data Client.

Conversion factors, split ratios, input and output shares and import/export issues of fibre chain were also part of KCL's work in WP4.1 and KCL had an active role in solving different type of problems that came up especially with the import/export issues.

In the last year of the project PFIC noticed the error in the reporting units of the entire fibre chain (see chapter 5.4 in this report). KCL took part in developing a way to correct the results.

KCL took part in the development of indicators in Energy group, Environmental indicators group and Transport group.

Data collection was quite a challenging task especially for M4, where there are nearly 20 industrial processes involved. Enormous amount of extra work was needed during the last year in solving the methodological problems and problems in the data collection.

2.2 Responsibilities of INNVENTIA (formerly STFI-Packforsk)

Anna von Schenck from INNVENTIA was coordinating the WP4.1 in Months 1-24.

Data collection of INNVENTIA focused on environmental indicators of newsprint, carton board and container board production in all case studies in all regions of Europe. Also data of fine paper in the Scandinavian case study was collected by INNVENTIA. Data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

INNVENTIA was also involved in creating the topologies of the fibre chain to the Baden Württemberg and Scandinavian case study in the Data Client.

Conversion factors, split ratios and input/output shares of newsprint, carton board and container board were also part of INNVENTIA's work in WP4.1.

INNVENTIA took part in the development of indicators in Transport group.

2.3 Responsibilities of KCPK

Data collection of KCPK focused on social indicators of all pulp and paper production in all case studies in all regions of Europe. Data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

KCPK acted as a leader of the Energy indicator group and coordinated the development of the technology scenario together with VTT.

2.4 Responsibilities of PFIC (formerly JPC)

Data collection of PFIC focused on economic indicators of all pulp and paper production in all case studies in all regions of Europe. Additionally PFIC collected economic indicators for primary conversion processes in Baden-Württemberg and Scandinavian case studies and in EU-FWC in all regions of Europe. All data of transport processes in the fibre chain in the Iberian case study and in EU-FWC was collected by PFIC. Data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

PFIC was also involved in creating the topologies of the fibre chain to the Iberian case study and fibre and solid wood chains in EU-FWC in the Data Client.

Additionally PFIC was developing the model mill concept and import/export/bucket – concept. In the last year of the project PFIC noticed the error in the reporting units of the entire fibre chain (see chapter 5.4 in this report) and together with KCL and EFI developed the way to correct the results.

PFIC took part in the development of indicators in Economic and social indicators group, Energy indicator group and Waste indicator group.

2.5 Responsibilities of BRE

Data collection of BRE included social indicators of all solid wood processes in Baden-Württemberg case study and the Western Central Southern Europe and Eastern Europe

in EU-FWC. The environmental indicators of solid wood processes in Baden-Württemberg case study and the Western Central Southern Europe in EU-FWC were collected by BRE. In addition, economic indicators of secondary conversion processes in Baden-Württemberg case study and the Western Central Southern Europe in EU-FWC were collected by BRE.

All indicator values of transport processes in the solid wood chain in all case studies (except Iberian case study) and regions of Europe were collected by BRE.

All data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

BRE was also involved in creating the topologies of the solid wood processes to the Baden Württemberg case study and EU-FWC in the Data Client.

2.6 Responsibilities of VTT

Data collection of VTT included social and environmental indicators of all solid wood processes in Scandinavian case study and Nordic Countries in EU-FWC. In addition VTT collected data for economic indicators of secondary conversion processes in Scandinavian case study and Nordic Countries in EU-FWC. All indicator values of pellet production processes in all case studies and all regions of Europe were collected by VTT. All data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

VTT was defining the model mill concepts of solid wood processes and bioenergy processes.

VTT was developing the storyline of the technology scenario with KCPK.

VTT was also involved in creating the topologies of the solid wood processes to the Scandinavian case study and EU-FWC in the Data Client.

2.7 Responsibilities of TUZVO

Data collection of TUZVO focused on environmental indicators of solid wood processes in Eastern region in EU-FWC case study. Data was collected for year 2005 and reported also for reference futures A1 and B2 and scenarios for years 2015 and 2025.

TUZVO was also involved in creating the topologies of the solid wood processes to the Eastern region of EU-FWC in the Data Client.

3 Data sources used in data collection

The expected data sources were reported earlier in PD4.1.8 *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*. Preferred data type and availability for data collection of indicator values was classified in Deliverable PD0.0.15

“Manual for case study data collection - Background document for EFORWOOD Training - Working document for EFORWOOD Task Force on Indicators” as follows:

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.

Additionally to indicator data collection, information was collected concerning input and output shares of products in a process, split ratios of one-to-many or many-to-one flows, conversion factors to carbon, Euro, m³ and tons, and finally volume flows. The data was collected for 2005 and predicted to two reference futures A1 and B2 and 4 scenarios in two years, namely 2015 and 2025.

3.1 Data collection in the 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 PFIC, KCL, KCPK and INNVENTIA.

The data sources reported in PD4.1.8 were the most important data sources in the fibre chain as was expected. Most of the indicator data for 2005 was of class A) Specific and empirical data. Background data compiled by M1, including EFI-GTM runs, were widely used as a basis when collecting data for reference futures and scenarios. Also expert guesses and opinions were needed to some extent, especially when the split ratios were defined to EU-FWC. The transport tool developed by FCBA in EFORWOOD project was used for transport processes.

3.2 Data collection in the solid wood products 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, PFIC, TUZVO and VTT.

The data sources reported in PD4.1.8 were the most important data sources in the solid wood products chain as was expected. Most of the indicator data for 2005 was of classes

A) Specific and empirical data and B) Generic and derived data. Generally it was more difficult to find reliable data in the solid wood products chain than in the fibre chain. The number of production sites and different technologies used at mills made it difficult to find reliable data for the model mills.

Background data compiled by M1, including EFI-GTM runs, were widely used as a basis when collecting data for reference futures and scenarios. Also expert guesses and opinions were needed to some extent, especially when the split ratios were defined to EU-FWC. The transport tool developed by FCBA in EFORWOOD project was used for transport processes.

3.3 Data collection in the bioenergy chain

The bioenergy chain includes production of pellets. The responsible partner for bioenergy chain data collection was VTT.

The data sources reported in PD4.1.8 were the most important data sources in the bioenergy chain as was expected. All three data quality classes A) Specific and empirical data, B) Generic and derived data and C) Model-based and estimated data were used. Since the pellet production processes are relatively young, data is not available in statistics. Most of the data was collected from literature and companies.

Background data compiled by M1, including EFI-GTM runs, were used as a basis when collecting data for reference futures and scenarios. Also expert guesses and opinions were needed to some extent.

4 Achievements of WP4.1

Since huge amount of data was required, **the model mill approach** described in reports PD4.1.7 and D4.1.9 was introduced in Module 4. In addition, the data was assumed to be similar in the countries of certain **regions of Europe**. Especially in the areas where data from general sources was poorly available, this approach made starting the data collection easier. The model mill approach and the idea to make 4 regions in fibre & bioenergy chain and 3 regions in solid wood products chain were considered to be important and successful.

In the end of the project, large amount of **data was collected** from multiple data sources and reported in a consistent way in M4. This was the biggest and most important achievement of M4 partners in order to enable the functioning of the ToSIA tool. Also the main data gaps were identified.

The **coordination of WP4.1** and communication from the two leaders of the work package (Months 1-24 Anna von Schenck from INNVENTIA and Months 25-42 Katri Behm from KCL) was seen efficient.

5 Challenges in data collection in EFORWOOD

5.1 Definitions of indicators

The process of **indicators selection** was found to be rather heavy and long, which decreased the time of actual data collection. This should have been realized in the beginning because there was no common list of indicator to estimate sustainability. **Data collection protocols were changed too often and updated** numerous of times at a rather late stage of the project. Some of the data had been collected already, so there was a need to re-collect and/or re-calculate the indicator values. This naturally stretched the timetables with increased work load, was frustrating and made it difficult to use the resources in the best possible way. There is still a possibility that some of the indicator values are not consistent with the data collection protocol which has to be kept in mind when interpreting the results of ToSIA.

5.2 Data availability and data handling

Low data availability was a big difficulty especially for some indicators and regions of Europe. The most challenging was the data collection of social indicators in general and data from Eastern European region. Data collection was more demanding than estimated in advance so it was not possible to keep the deadlines all the time. In other words, there was not sustainability data available covering forestry wood chain. Some of the data is covered by 'expert guesses'.

Data for reference futures and scenarios was found difficult to provide. Background data compiled by M1, including EFI-GTM runs, were distributed to be used as a basis, but no information about all the assumptions behind the data provided in EFI-GTM table was available. It is possible that different partners have used the EFI-GTM results in different ways and the results of ToSIA might be affected by this.

The data client was created by IFER to ease the data collection and data handling in the project. However, some problems occurred and data was lost and/or changed during the project. There were also difficulties in creating and updating of the topologies in the client due to slow connections, crashing of the program and other problems in the software.

5.3 Communication

Gaps in communication took place from time to time. This was especially problematic when conversion factors, shares, split ratios and units were defined in all Modules. Overall checking of conversion factors was done in the end of the project, but these kinds of “common rules” should have been needed from the start already. This is not a specific problem in WP4.1 but in entire Eforwood.

The basic **operational principle of TOSIA has not been and is not clear** to all partners. This has resulted to a lot of confusion in the data collection several times during the project, e.g. correction factors in the fibre chain due to the wrong reporting

unit in the beginning (see chapter 5.4 in this report), allowed process units, and how to present processes that appear in the future to the chain.

Additional problems came when the **key people working in the project changed** in some of the companies. This caused some problems in the communication and information on the background assumptions was lost to some extent. This may have been avoidable if the documenting of assumptions and decisions had been clearer.

5.4 Specific issues in the fibre chain (pulp and paper)

Assumptions behind the data collection were not clear to partners in the fibre chain from the beginning of the project. In spite of the data collection protocol, **it was unclear for a long time that the indicator values had to be reported per input carbon**. This caused some problems, since the paper and board mills commonly produce some energy from some parts of the input wood, and the output carbon is not equal to input carbon. Since the indicator values had been reported per ton of output product, correction factors were needed in order to change the indicator values to be reported per input carbon. It is still challenging to interpret the results since the reference unit is different than what is commonly used in the industry.

5.5 Specific issues in the solid wood chain

Solid wood industry is very heterogeneous consisting of large number of products and huge number of mills, which made the data collection difficult. Indicator values are depending on the size of the mills. Information in the statistics is normally a mix different information sources and it was very difficult to identify differences between sizes of the mills.

5.6 Specific issues in the bioenergy chain

The bioenergy part included only pellet production, and it is obvious that bioenergy data collected in Eforwood does not represent the bioenergy production data in Europe. Pellet production is only one part of it. Focusing only to pellets was not the decision of M4. Since the pellet production processes are relatively young, **data is not available in statistics**. Most of the data was collected from literature and companies.

6 The quality of results from partners' point-of-view

The quality of indicator values was reported to be High/Medium/Low in the data client. All categories were used in M4 processes, but **most of the indicator data are of medium or low quality**. This is due to the level of aggregation needed in the project.

The conversion factors, split ratios and **all the multiplications based on assumptions and generalisations bring the results towards the low-quality definition**.

Cross linkages between processes and modules have not been taken into account in ToSIA. This results into a static system with no possibilities to change any assumptions etc.

The quality of products is not taken into account in the data collection in a unified way. This leads to conclusion that all products are of equal quality, which is not the case in reality.

Not all material flows are taken into consideration in the chain (e.g. no tissue is included) because the model is decided to cover 60-80%. This results in the situation where some parts of the chain may give too “good” or too “bad” results.

While analyzing the results of ToSIA it has to be taken into consideration that **the reference futures and scenarios are descriptions of some development paths of the future, neither estimates nor forecasts**. The data gives various views on the future, but its probability cannot be defined. This is especially crucial to remember when interpreting the results of Eastern Europe, where the economic environment is so turbulent that the future can hardly be predicted.

7 Lessons learned in WP4.1

Generally the project was found to be very educational.

Strong leadership and coordination was seen crucial in projects like Eforwood. It was noted that **communicating was working well inside M4 but should be more efficient between Modules**. Documenting of assumptions and decisions should be as transparent as possible and the documents should be available in one place. This was not a specific problem in WP4.1 but in the entire project.

The decision making processes took a long time in the project, e.g. the definition of studied indicators continued for over two years and the actual data collecting started very late. Again this could have been avoided with specific guidance from the coordinating partners and ToSIA developers at the beginning.

The difficulty of data collection came as a surprise to many of the partners. This concerns especially country specific EU-FWC data collection. The data collection might have been easier if industrial companies had been included in the project. This concerned especially solid wood industry, since data statistics for pulp and paper industry was more easily available and has been systematically collected and reported by the industry. Also commonly used assumptions e.g. wages and energy prices should have been coordinated by someone and distributed to all modules in an early stage of the project. Now these essential definitions came quite late or the definitions were often changed at the very last moment. The same thing applies to conversion factors, split ratios, and other additional information that was required in the data collection. This caused extra manual work in correcting figures several times.

Things mentioned above could have been solved if **a simplified test-chain would have been created, tested and analysed in an early stage of the project**. Some test runs were done but the results were never reported in a clear-enough way. This was not a specific problem in WP4.1 but in the entire project.

8 Conclusions

The final conclusion of WP4.1 was that the project was very challenging but a good experience. Data collection was demanding but in the end achievable with some simplifications and assumptions. Coordination of the work package was found successful but the communication between modules in order to find common principles and basic assumptions should have been better. However, networking between modules was improving towards the end of the project. Networking between M4 partners was seen as one of the best end results of this work package.

A lot was learned about life-cycle thinking and forestry wood chain in European level. The project created and applied new approaches to study carbon flows in area specific level, from production and consumer point of view and the most challenging, in European level. It is important to include bioenergy production to the forestry wood chain in more detailed level in the future.

Partners in WP 4.1 succeeded to combine information from different data sources and collect new indicators for chemical and mechanical forest industry and bioenergy processes. The combination of different data sources has been challenging, but taking into account the starting point and difficulties during the project M4 succeeded in it well.

EFORWOOD is the first integrated large project where the indicators of forestry wood chain have been developed from the forestry to the end use in European level. A lot of data has been collected and several new calculation approaches and factors have been created and applied in this project. Following the carbon flows along the value chain demanded imagination linked with modelling skills. It was not obvious from the beginning, how the split ratios or carbon contents (just to mention some) should be assessed and this was very challenging for the data collection in the whole Eforwood but especially for the industrial data in M4. The pulp and paper statistics was available in most cases because it has been collected and reported for many years by the industry. Most of the difficulties were faced with the solid wood data, especially with the country specific data, which was difficult to find.