



**EFORWOOD**

Sustainability Impact Assessment  
of the Forestry - Wood Chain



## **Deliverable D1.4.3 Description of modelling framework Deliverable D1.4.5**

### **First prototype TOSIA-FWC in open source technology for single chains**

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#### **Executive Summary**

##### Scope and purpose of the report

This combined deliverable report 1.4.3/1.4.5 presents ToSIA (Tool for Sustainability Impact assessment), predominant product of EFORWOOD. ToSIA is being developed as a decision support tool for Sustainability impact assessment of the European Forestry Wood Chain (FWC) and subsets thereof (i.e. selected Single FWCs and Case Studies with multiple regional FWCs). ToSIA will allow various end-users, such as the forest-based industry, national and international policy makers, and researchers, to analyse the sustainability effects of changes due to deliberate actions (e.g. in policies or business activities) or due to external forces (e.g. climate change, global markets).

The purpose of this document is to explain the general approach that ToSIA takes to assess the sustainability of FWCs. This delivery report provides a comprehensive documentation of the ToSIA modelling framework, referring to other documents for more detailed technical descriptions of the components. The report aims to inform both the researchers in other subprojects as well as interested stakeholders and the general public about the sustainability impact assessment (SIA) approach in EFORWOOD.

Attached to the model documentation is the first ToSIA prototype. In the Annex the features of the first prototype are outlined, including instructions how to use the prototype. The prototype itself with more detailed documentation of the Java code is attached in the file `tosia1.zip`.

From sustainability of wood supply to Sustainability impact assessment of the forest-based sector Since the Earth Summit in Rio de Janeiro in 1992 (UNCED), both forests and forestry have been added to the international agenda because of concerns about the sustainability of forests regarding biodiversity and its economic and social contribution to the development of the local communities. The forest-based sector has been at the forefront during the last 10-15 years in operationalising the sustainability concept and developing principles, criteria and indicators for sustainable forest management (SFM). Criteria and indicators have been developed to describe and help monitor progress in achieving SFM through several international, regional and national processes and fora.

Assessing sustainability of the forest-based sector means measuring environmental, economic, and social indicators for production technologies and other processes in the FWC, (see Wilhelmsson 2001). Sustainability Impact Assessment of the FWC means analysing the impact of changes, for example policy changes or technology changes, on the environmental, economic, and social sustainability indicators.

Indicators permit operationalising the concept of sustainability. In a generic sense, indicators can be viewed as factors or variables that can be used to measure the status and change of a system or process. The use of indicators allows for deconstructing of the sustainability assessment problem into manageable bits that can lend themselves to more formal or structured analysis

Review of existing tools and classification of the ToSIA model

Several existing tools from the literature are briefly presented with a focus on similarities and limitations of the approaches for the application in sustainability impact assessments for the FWC. None of the existing tools addressed all three sustainability dimensions along the whole FWC in a balanced way. Consequently the decision was made to develop ToSIA, the modelling framework for sustainability impact assessment of FWCs. ToSIA will be developed as a dynamic sustainability impact assessment model that is analysing environmental, economic, and social impacts of changes in forestry-wood production chains, using a consistent and harmonised framework from the forest to the end-of-life of final products.

#### The Sustainability impact assessment approach in EFORWOOD 4

The SIA of the forest-based sector in EFORWOOD builds on the conceptual representation of FWCs as chains of value-adding production processes. In ToSIA, the analytical framework is organised in a sequence of three main hierarchical levels: modules, stages, and processes. Four project modules are organisational representations of the four main phases of a FWC: Forest resources management, Forest to industry interactions, Processing and manufacturing, and Industry to consumer interactions. A module consists of several stages. Stages define natural steps in the FWC. One stage can be characterized by optional processes, which means that alternative FWCs can be produced by switching to different processes within the same stage. In ToSIA, a FWC consists of a number of interconnected processes. Multifunctionality of forests and levels of sustainability of the whole FWC are addressed by selecting sustainability indicators in relation to every defined process along the chain.

In ToSIA the sustainability impact assessment of each alternative FWC will be determined by aggregation of indicator values along the chain. This exercise requires the use of evaluation methods such as Multi-Criteria Analysis (MCA) or Cost-Benefit Analysis (CBA; see chapter 4.6). The main exercise behind these techniques is to transfer of the original indicator value onto a common scale of preferability. It is this common scale that eventually allows to aggregate indicators by summing up the dimensionless preference values a decision maker or a stakeholder assigns to them (i.e., the comparison of “apples and pears”).

By comparing alternative FWCs in terms of sustainability it is possible to improve the sustainability of FWCs and the trade-offs between different sustainability indicators can be identified.

Changes in the sustainability of the FWC will be analysed using scenarios of future conditions. Factors changing the future are tentatively grouped into three categories:

- Global trends: e.g. world market, climate change.

- EU policies: e.g. affecting taxation of fossil fuel consumption, subsidies for utilization of renewable energies, nature conservation policies.
- Innovative technology (i.e. internal changes within FWC); e.g. changes in forest management, innovation in production technology, development of new products

The scenarios will result in alternative FWCs with different sustainability impacts compared to the current FWCs.

### Description of the ToSIA modelling framework

ToSIA assesses sustainability of existing FWCs as well as impacts on sustainability of internal and/or external drivers such as global change, EU policy change or technological innovations.

ToSIA will be developed in EFORWOOD for Sustainability Impact Assessments at three different scales:

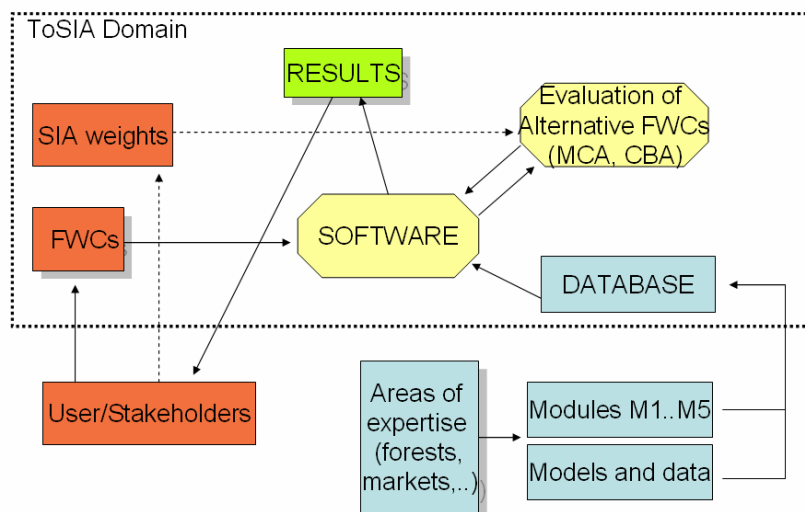
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- 1) Single FWC applications
- 2) FWC analysis in Case Studies with regional focus
- 3) European FWC analysis

The ambition is to cover 60-80 % of the material flows in the whole European FWCs including all major forest types, production lines and wood based products.

The ToSIA modelling framework is based on the following components: (1) the project modules (M1-M5) of EFORWOOD, that is, the areas of expertise (researchers) in the project using specific models and data to provide information about production processes, indicator values and material flows to the database; (2) the Database, where information e.g. on sustainability indicators is stored and organised in such way that permits efficient harmonisation with the software; (3) the software, which enables dynamic interaction with users/stakeholders for defining specific FWCs and criteria on sustainability, reads sustainability information related to the defined FWCs from the database, and calculates results on sustainability for comparing the selected chains based on evaluation methods.

## ToSIA and Its Environment



**Figure 0.1. ToSIA and its environment: Areas of expertise (researchers) in the project provide information (e.g. indicator values) to the database, where the information is stored and organised in such way that permits efficient harmonisation with the software. Dynamic interaction (through a user friendly interface) with users/stakeholders for defining specific FWCs and criteria on sustainability is enabled by the software (heart of the system), which afterwards reads sustainability information related to the defined FWCs from the database, and calculates results on sustainability using evaluation methods, finally delivered to the user (through the interface) for comparing the selected chains.**