

# SOCIAL LIFE CYCLE IMPACT ASSESSMENT OF PAPER-HEMP INSULATION MATERIAL



Riga (Latvia) June 2023

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## 1. GENERAL ASPECTS

### 1.1. Introduction

A social life cycle assessment (S-LCA) is a method that can be used to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. This looks at the extraction and processing of raw materials, manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. S-LCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative, and complements the environmental LCA. S-LCA does not provide information on the question of whether a product should be produced or not – although information obtained from an S-LCA may offer “food for thought” and can be helpful for taking a decision.

### 1.2. Commissioner of the LCA study, internal or external practitioner of the LCA study

The analysis and report have been carried out by Riga Technical University and its Institute of Energy Systems and Environment for Balticfloc.

It has been prepared only for the use of Balticfloc and this is the only company that can distribute this report or disclose it to other parts.

The study is only based on the current facts, circumstances and assumptions which are specified in the report. Should these facts, circumstances or assumptions would be different, our conclusions might be different.

Moreover, the results of the study should be considered in the aggregate regarding to the assumptions made and not taken individually. The intended target group is Business-to-Business.

### 1.3. Date of report, contact and deliverable tools

The present report has been issued in June 2023. The contact information of report developer is provided in the following table.

Company	Address	Participant	Contact
Institute of Energy Systems and Environment, RTU	Āzene street 12 – K1 (Riga, Latvia)	Maksims Feofilovs	Email: maksims.feofilovs@rtu.lv

The deliverables and tools for this project are:

- A Social Life Cycle Impact Assessment (S-LCA) report (this document) for internal use within company and companies its reports.

### 1.4. Statement that the study has been conducted according to the requirements of this standard

This document is consistent with the international standards: S-LCA is based on ISO 14040 (2006) and ISO 14044 (2006) framework for environmental LCA and ISO 26000 (2011) Guidance on Social Responsibility. Also is in live with Guidelines for Social Life Cycle Assessment of Products and Organizations (2020). The methodology used in S-LCA inventory and impact assessment is according to the UNEP Guidelines for Social Life Cycle Assessment of Products, which includes social impact indicators (e.g. Number of jobs created, Gender equity) linked to five main stakeholder groups worker, consumer, local community, society and value chain actors.

## 2. GOAL OF THE STUDY

### 2.1. Reasons for carrying out the study and its intended application and audience, i.e., providing information and data for an EPD® for business-to-business and/or business-to-consumer communication

This study aims to analyse the social life cycle of paper-hemp thermal insulation material based on the costs of resources and services consumed within the products life cycle (i.e., materials, transportation, or end-of-life handling) to assess what are social-economic impacts of the product. These results can be used to improve their social welfare of community in the future.

This document is a report of S-LCA performed according to set of methods in line with the LCA standards. The S-LCA aims to assess the potential or real social impacts of a product where social impacts are understood as the impacts on human capital, human well-being, cultural heritage, and social behaviour. The report includes a description of the declared unit, the system investigated (i.e. boundaries and model), key values and parameters of inventory, the result interpretation, and conclusions. The S-LCA report has been developed by the Energy Systems and Environment Institute of Riga Technical University for the sole use of Balticfloc.

## 3. SCOPE OF THE STUDY

The scope of the study comprises the Paper-hemp insulation material products. This report provides the data for S-LCA, as well as an interpretation of the results.

No grouping of products has been done during this study, and results are presented for one Declared Unit.

### 3.1. Product Characterization

Balticfloc Paper-hemp insulation material is thermal insulation materials for buildings which is made by mixing ground paper with specially treated hemp fiber. The thermal insulation material is made in sheets, and it is easy to use for insulation of buildings as it will not require special machinery necessary for loose fill ecowool. It is also very important that hemp is a material friendly to people and the environment, because during the processing of materials no CO<sub>2</sub> is emitted. Consumption of energy for production of hemp fiber is seven to eight times lower than for production of the same amount of synthetic fiber.

The most suitable hemp variety must be determined, from which to obtain fiber for production of ecowool. Ecowool is a loose, light, dry mass with capillary - porous structure, 86% of its composition consist of recycled cellulose fibre (crushed paper - wood fibre) and 14% of natural salt admixture - volatile flame retardants and antiseptics.

Hemp is a well-known crop in Latvia. The specifics of harvesting must be taken into consideration so that it can be used for production of ecowool. As a result, a fine fiber is obtained, which is mixed with ground wastepaper, heated in an oven and thermal insulation sheets are produced in a special technological process.

UN CPC code: 31449 Fibreboard of wood or other ligneous materials, Other fibreboard

**Table 1.** Main Characteristics of Balticfloc Paper-hemp insulation materials

Gross density	52.2 kg/m <sup>3</sup>
Panel thickness	50/80/100 mm
Thermal resistance	1.0 m <sup>2</sup> K/W

The content information of the final product is presented in the following table:

**Table 2.** Main content characteristics of Balticfloc Paper-hemp insulation materials

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Hemp fiber	1.22	0.0 %	100%
Paper waste	1.16	100%	85.7%
Bico Fibre	0.2	0.0 %	0%
Fire retardant	0.2	0.0 %	0%
TOTAL	2.78	41.7 %	79.6 %
Packaging materials	Weight, kg	Weight-% (versus the product)	
Metal wires	0.002	0.1 %	
PE bags	0.006	0.3 %	
TOTAL	0.008	0.4 %	

### 3.2. Declared unit

#### 3.2.1. Definition, including relevant technical specification(s)

By considering the functions of this product, the declared unit can be described as follows: the production of 1 m<sup>2</sup> of Paper-hemp insulation material with a thickness of 50/80/100 mm, with a useful life of 50 years.

The Paper-hemp insulation material mats are designed to be easy-to-install, structurally sound and with thermal insulation properties comparable to those of mineral wool.

#### 3.2.2. Reference Service Life (RSL)

The Reference Service Life (RSL) of Paper-hemp insulation material is 50 years.

#### 3.2.3. Product mass required for the declared unit: principal product, additional product for implementation and/or life in use and packaging

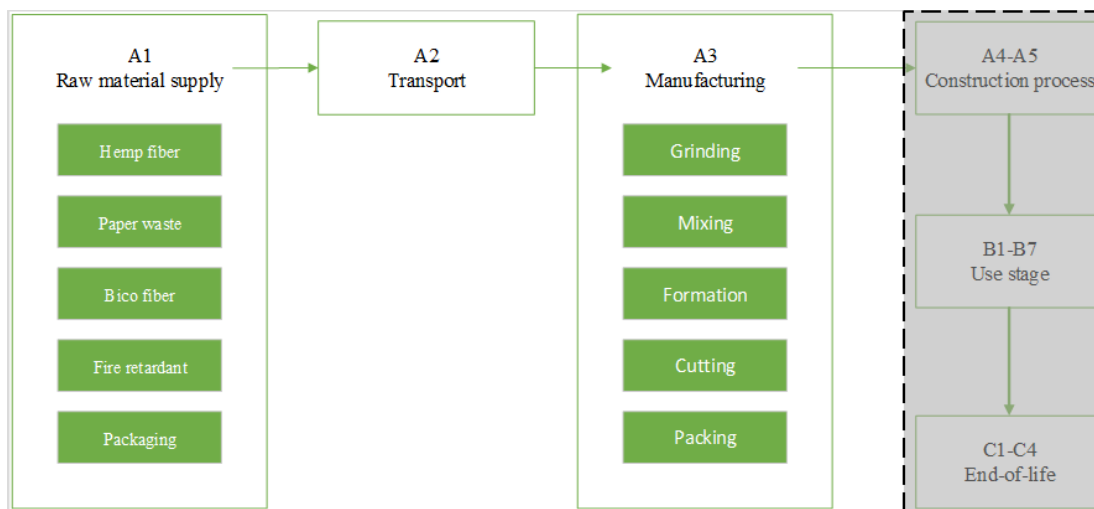
The financial values and basic data for calculating the declared unit of Paper-hemp insulation material are described in the Table 4 to and in Annex I LCA Inventory.

### 3.3. System boundary according to the modular approach

#### 3.3.1. Overview and definition of the systems boundaries and lifecycle phases studied (processes or data needs)

This S-LCA is a “cradle to gate” and the diagram can be seen in Figure 1.

**Figure 1.** System boundaries for the cradle to gate for the Paper-hemp insulation material.



Explanations:

Included

Not included

**Table 3:** Modules declared within the EPD scope.

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	EUR	EUR	LV	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Specific data used	> 90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	NOT RELEVANT					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	NOT RELEVANT					-	-	-	-	-	-	-	-	-	-	-	-

X: Module accounted for

ND: Module Not Declared

### 3.3.2. A1-A3 Product stage

The product stage for Paper-hemp insulation material is subdivided into “Raw material acquisition”, “Transport” and “Manufacturing” modules. The aggregation of the modules A1, A2 and A3 is a possibility considered by the Social Hotspot 2022 Category method w Normalization. Referred to the interpretation of results, the components with the biggest impacts will be explained. In this report, the relative impact of energy and raw materials into the A1-A3 stages are evaluated independently from the transport activities as well as from the manufacturing process.

#### ➤ **A1, Raw material supply**

This module considers the extraction and processing of all raw materials and energy which occur upstream of the studied manufacturing process (except for ancillary and packaging used in the product manufacturing process). The raw materials to produce one declared unit of Paper-hemp insulation material are shown in the following table:



**Table 4:** Input of materials for manufacturing 1 m<sup>2</sup> of Paper-hemp insulation material.

PARAMETER	VALUE (EUR/m <sup>2</sup> )
Hemp fiber	1.6
Paper waste	0.5
Bico fiber	0.63
Fire retardant	0.48
Metal wires	0.0004
PE bags	0.002

➤ **A2, Transport to the manufacturer**

The raw materials required for the construction of the Paper-hemp insulation material are first transported to the manufacturing place located in Latvia with the exception of hemp and paper waste, which is gathered from local Latvian sources. This stage accounts for all raw materials transported to Balticfloc facilities, where they are processed for manufacturing of Paper-hemp insulation material. For calculations, transport distances of all raw materials were included depending on the vehicle technology (see Annex 1).

The modelling for transport was carried out according to the Social Hotspot 2022 Category method w Normalization. Transport is calculated based on a scenario with the parameters described in the following table:

**Table 5.** Transportation parameters for 1 m<sup>2</sup> of Paper-hemp insulation material (by road).

PARAMETER	VALUE/DESCRIPTION
<b>Costs of transportation</b>	0.072 EUR/m <sup>2</sup> for hemp fiber 0.025 EUR/m <sup>2</sup> for paper waste 0.53 EUR/m <sup>2</sup> for Bico fiber 1.31 EUR/m <sup>2</sup> for fire retardant 0.12 EUR/m <sup>2</sup> for PE bags

➤ **A3, Manufacturing**

This module includes all activities related to the manufacturing of the Paper-hemp insulation material, specifically, the energy consumption and waste production. The manufacturing process includes the hemp, paper waste and Bico fiber grinding, mixing, forming, and cutting into desired size for later packaging. The inventory for this stage was collected from the available data from Paper-hemp insulation material production in 2023 and then normalized to the Declared Unit.

**3.3.3. A4-A5 Construction process**

The construction process is divided into 2 modules: transport to the building site (A4) and installation (A5).

➤ **A4, transport to the building site. Not Declared**

This module includes transport from the production gate to the building site.

➤ **A5, installation into the building. Not Declared**

The installation of product without the use of any additional material or energy expenditure.

**3.3.4. B1-B7 Use stage**

This stage includes any emissions to the environment of the used product (module B1) and technical operations on the product: maintenance, repair, replacement, and refurbishment (respectively module B2 to B5).

➤ **B1, use or application of the installed product. Not Declared**

The product does not produce any emissions to the environment during its use. Pollutant emissions to the environment during its use have been considered not relevant.

➤ **B2, maintenance; B3, repair; B4, replacement; B5, refurbishment. Not Declared**

The declared product performances assume a product working life that equals or exceeds the building lifetime. Once installation is complete, no actions or technical operations are required during the use stage until the end-of-life stage. Therefore, the Paper-hemp insulation material has no impact (excluding potential energy savings due to insulation properties not included in the scope of this study) on these modules.

➤ **B6, operational energy use; B7, operational water use. Not Declared**

The product is not related to any electricity or water use during the operation of the building.

**3.3.5. C1-C4 End-of-life**

This stage includes the different modules of end-of-life C1 to C4 detailed below. During the life cycle of the product any hazardous substance listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization” has not been used in a percentage higher than 0,1% of the weight of the product.

➤ **C1, de-construction, demolition. Not Declared**

The de-construction and/or dismantling of the entire building. The environmental impact is assumed to be the one corresponding to emissions from wall dismantling and the fuel required for the machinery to perform the demolition tasks.

➤ **C2, transport. Not Declared**

Transport to waste disposal site: 50 km are assumed.

➤ **C3, waste processing for reuse, recovery, and/or recycling. Not Declared**

The product is landfilled without reuse, recovery, or recycling.

- C4, disposal. **Not Declared**

The product is assumed to be 100% landfilled.

### **3.3.6. Benefits and loads beyond the system boundary**

In module D is declared the environmental benefits from reusable products, recyclable materials, or energy recovery.

### **3.3.7. Omissions of life cycle stages**

This is a cradle-to-gate. Stages A1-A3 have been included. The following flows are not included in the system boundaries:

- The construction of plants is excluded since the related flows are assumed to be negligible compared to the production of the building product when compared at these systems' lifetime levels.
- Manufacture of equipment used in production, buildings or any other capital goods;
- Transportation of personnel to the plant;
- Transportation of personnel within the plant;
- Research and development activities.
- Long-term emissions.

## **3.4. Quantification of energy and material inputs and outputs, considering how plant-level data is allocated to the declared products**

Quantifications for the social life cycle inventory inputs and outputs of energy and materials come from the S-LCA results of all the products belonging to the Paper-hemp insulation material available in the Social Hotspots Database.

### **3.4.1. Assumptions about relevant background data**

The data relating to background processes for raw materials, transport activities and energy expenditure in the production of Paper-hemp insulation material components are found or accordingly modified from the Social Hotspots Database unit processes.

## **3.5. Cut-off criteria for initial inclusion of inputs and outputs.**

### **3.5.1. Description of the application of cut-off criteria and boundaries to other product life cycles**

- All input and output flows in a unit process i.e., considering the value of all flows in the unit process and the corresponding LCI whenever available.
- Cut-off criterion of 1% on mass inputs and primary energy at the unit process level, and 5% at the information module level.
- No simplification of the LCI by additional exclusions of material flows.

All hazardous and toxic materials and substances are included in the inventory and the cut-off rules do not apply.

Following ISO 14025 standard<sup>1</sup> after development of Environmental LCA for the product, the pollutant pays principle has been followed also in S-LCA to make the two types of LCA consistent. Allocation of recycled material, also known as open loop recycling, is reported in the inventory as an input or output to the technosphere when such materials leave or enter the specific product system.

When a product is discarded, and its original function is lost, it can be processed further in a waste management system. Those parts of the initial product system that are utilized in a new product will be accounted for as material recycling in the LCI (as a flow to technosphere).

The exact boundary settings between the first and the next product systems are defined by the *willingness to pay* for the recycled material. This implies that from the moment the user of a secondary material pays for the material, this (secondary) product system will also be responsible for the environmental burden from that point on. This principle is referred to in the International EPD system as the *Polluter-Pay (PP) allocation method* and is followed also in the conducted S-LCA to maintain the same system boundary conditions in order to align the S-LCA results with the Environmental LCA developed for the same product.

Consequently, if there is an inflow of recycled material to the production system, the recycling process and the transportation from the recycling process to where the material is used shall be included. If there is an outflow of material to recycling, the transportation of the material to a sorting facility/recycling process shall be included. The material intended for recycling is then an outflow from the production system. This is achieved using the “Allocation at the Point of Substitution” system created by Social Hotspot Database for modeling the *Polluter-Pay (PP) allocation method*.

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<sup>1</sup> ISO 14025:2006 Environmental labels and declarations -- Type III environmental declarations  
-- Principles and procedures

## 4. LIFE CYCLE INVENTORY ANALYSIS

This chapter presents the sources of input data for Paper-hemp insulation materials product social life cycle as well as the main hypothesis.

### 4.1. Qualitative/quantitative description of unit processes necessary to model the social life cycle stages of the declared unit, considering the provisions of EN ISO 14025 regarding data confidentiality

#### 4.1.1. A1-A3 Product stage

Background processes data A1 to A3 from all the materials belonging to Paper-hemp insulation material were collected from the Social Hotspots Database (SHDB).

### 4.2. Sources of generic data or literature used to conduct the S-LCA

The social-economic data related to the production of components of the Paper-hemp insulation material, the energy consumption, transportation and waste management have been taken from the Social Hotspots Database (see Annex I for more details).

### 4.3. Validation of data, including:

#### 4.3.1. Data quality assessment

Data quality is an important aspect to evaluate the validity of any environmental impact assessment. In this study, a data quality rating (DQR) has been developed going along with the following criteria:

- Geographical representativeness (GeR): the specific data used on the process of manufacturing, transport, and installation of the analyzed product have been provided, so they are representative of the geographical area covered. For the other processes as far as possible, generic data representative of Europe have been used.
- Time representativeness (TiR): the quantity of materials used and transport distance, refers to 2023. Referred to generic data the Ecoinvent v3.8 database has been updated in the last year.
- Technological representativeness (TeR): the specific data reflect the physical reality of the declared product since they are based on data from the manufacturer.
- Precision (P): The data was overall measured, calculated, and internally verified.

The LCA model input data were based on technical information directly obtained from Balticfloc. The data quality was verified within the Balticfloc 2023 production data. A data quality score for each data quality criterion is given according to the rating scale presented as follows.

**Table 6.** Scoring scale for data quality rating (DQR)

Score for (TeR, GeR, TiR, P)	Data Quality Level
1	Excellent
2	Very good
3	Good
4	Fair
5	Poor

Based on the rating, a DQR for each inventory input is calculated as follows:

$$DQR = \frac{TeR + GeR + TiR + P}{4}$$

The DQR results are presented along with the life cycle inventory in Annex 1. Their overall evaluation for the data quality rating can be understood as:

**Table 7.** DQR rating

Overall data quality rating	Overall Data Quality Level
$DQR \leq 1.5$	Excellent quality
$1.5 < DQR \leq 2.0$	Very good quality
$2.0 < DQR \leq 3.0$	Good quality
$3.0 < DQR \leq 4.0$	Fair quality
$DQR > 4$	Poor quality

A data quality rating was performed with a rating system where 1 means excellent and 5 poor. An average for each criterion is presented as follows:

**Table 8.** Average DQR for this study LCI

Technological Representativeness, TER	Geographic representativeness, GER	Time Representativeness, TIR	Precision, P	Average DQR
1.55	1.8	2	1.25	1.65

#### 4.3.2. Treatment of missing data

To the best of the EPD's developers' knowledge, no missing data is found during this study.

#### 4.4. Allocation principles and procedures, including

##### 4.4.1. Documentation and justification of allocation procedures

Allocation among co-products has been avoided as only one product results from the operations considered within the scope. However, energy and material flows have been allocated to the declared unit following physical criteria.

##### 4.4.2. Uniform application of allocation procedures

Allocation among products and co-products has been avoided. Material and energy flows have been allocated to the main product following physical/mass criteria.

## 5. LIFE CYCLE IMPACT ASSESSMENT

### 5.1. LCIA procedures, calculations, and results of the study (reference to all characterization models, characterization factors and methods used, as defined in this European Standard)

#### 5.1.1. Parameters describing the social impacts

The main three components that are included in the Social Hotspot database is:

1. Global input-output model;
2. Model of working hours;
3. Data on social risks and opportunities.

The social impact is defined as hours worked by employees with a certain risk level of a certain risk indicator per process product in USD. Labor hours represent the labor intensity for each country-specific sector directly related to production.

S-LCA impact assessment is made by Social Hotspot 2022 Category method w Normalization in SimaPro 9.4 software and are evaluated as medium risk hours equivalent (mrheq). In Table 9 and Table 10 are social categories un subcategory list.

**Table 9.** Social impact categories and indicators

Damage category	Unit
Labor rights & decent work	mrheq
Health & safety	mrheq
Society	mrheq
Governance	mrheq
Community	mrheq

**Table 10.** Social impact subcategories and indicators

Impact category	Unit
Wage assessment	mrheq
Workers in poverty	mrheq
Child Labor	mrheq
Forced Labor	mrheq
Excessive WkTime	mrheq
Freedom of Assoc	mrheq
Migrant Labor	mrheq
Social Benefits	mrheq
Labor Laws/Convs	mrheq
Discrimination	mrheq
Unemployment	mrheq
Occ Tox & Haz	mrheq
Injuries & Fatalities	mrheq
Indigenous Rights	mrheq
Gender Equity	mrheq
High Conflict Zones	mrheq
Non-Communicable Diseases	mrheq
Communicable Diseases	mrheq
Poverty and inequality	mrheq
State of Env Sustainability	mrheq
Legal System	mrheq
Corruption	mrheq
Democracy & Freedom of Speech	mrheq
Access to Drinking Water	mrheq
Access to Sanitation	mrheq
Children out of School	mrheq
Access to Hospital Beds	mrheq
Smallholder v Commercial Farms	mrheq
Access to Electricity	mrheq
Property rights	mrheq

**5.2. A statement that the LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks**

According to Social Hotspot 2022 Category method with Normalization, the S-LCA results are expressions translating impacts to social themes such as Labor rights & decent work, Health & safety, Society, Governance and Community categories. In addition, the results do not provide information about the exceeding of thresholds, safety margins or risks.



## 6. SOCIAL LIFE CYCLE RESULTS AND INTERPRETATION

In this section the social welfare results for Paper-hemp insulation material are presented. The impact on the social of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material is shown in Table 11 and Table 12.

**Table 11.** The Social life cycle impact of 1 m<sup>2</sup> of Paper-hemp insulation material. Life cycle stages are grouped.

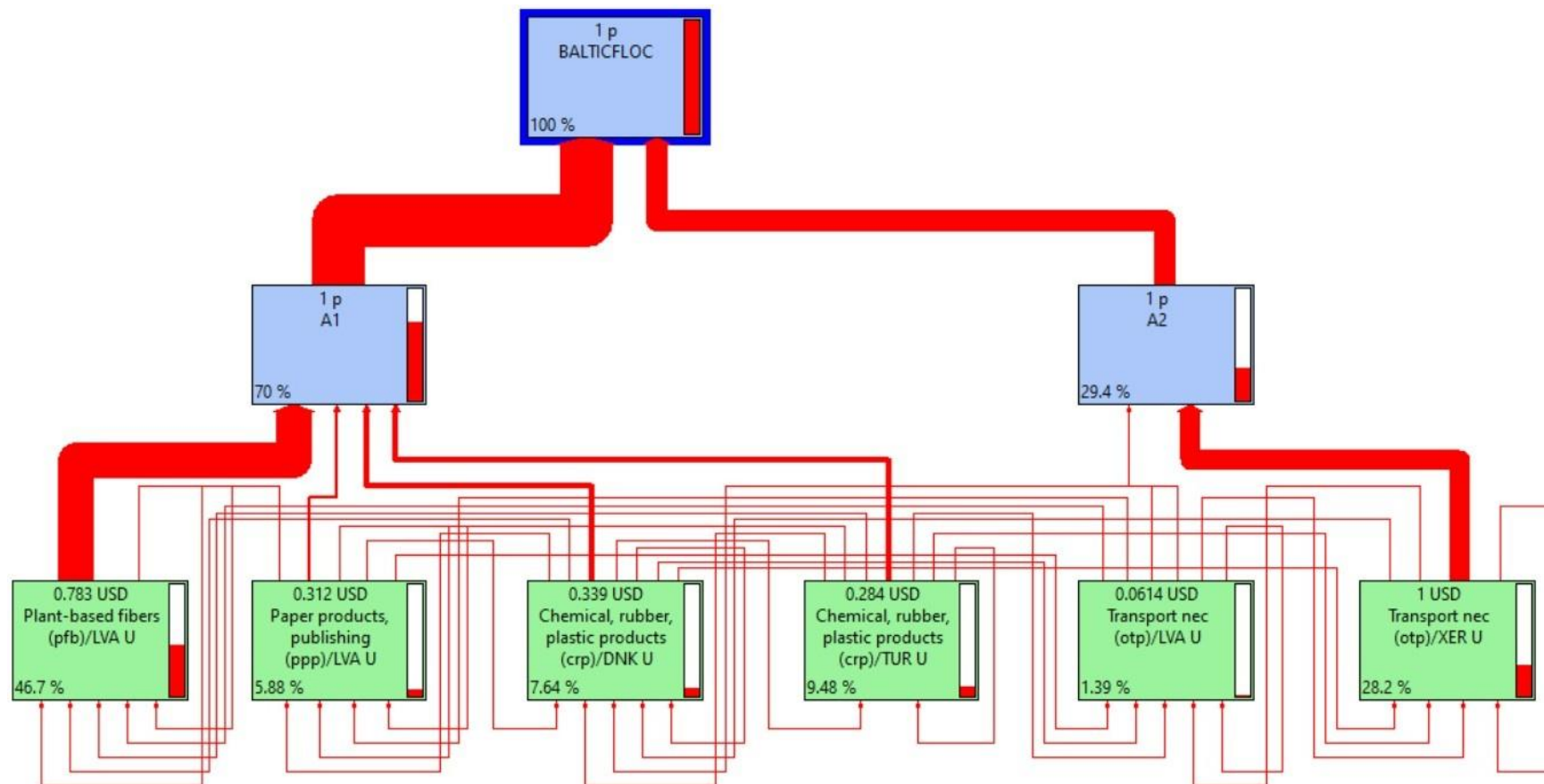
Category	Unit	Product Stage A1-A3
Labor rights & decent work	mrheq	5.64E-02
Health & safety	mrheq	9.95E-02
Society	mrheq	3.76E-02
Governance	mrheq	5.23E-02
Community	mrheq	2.84E-02

**Table 12.** The Social life cycle impact of 1 m<sup>2</sup> of Paper-hemp insulation material by life cycle stages, in percentage.

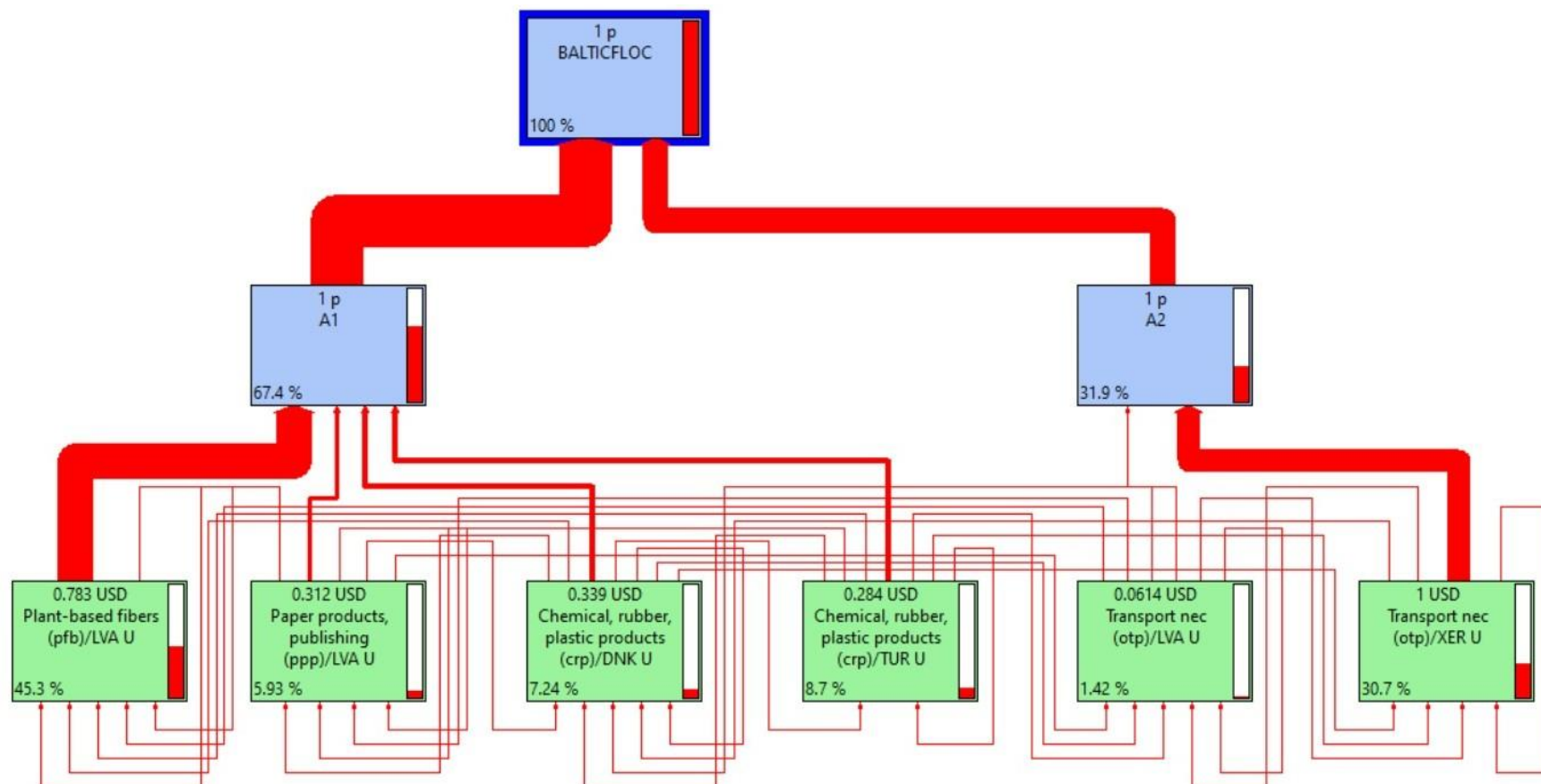
Category	Product Stage A1	Product Stage A2	Product Stage A3
Labor rights & decent work	70.0%	29.4%	0.6%
Health & safety	67.4%	31.9%	0.6%
Society	71.4%	28.0%	0.6%
Governance	58.1%	41.0%	0.9%
Community	67.7%	31.6%	0.6%

Figure 2 to Figure 6 show network flow diagrams for social impact categories. For all social impact categories, the main impact comes from plant based fiber sector in A1, followed by transportation sector within A2, except Governance category, where transportation sector within A2 has the highest social impacts.

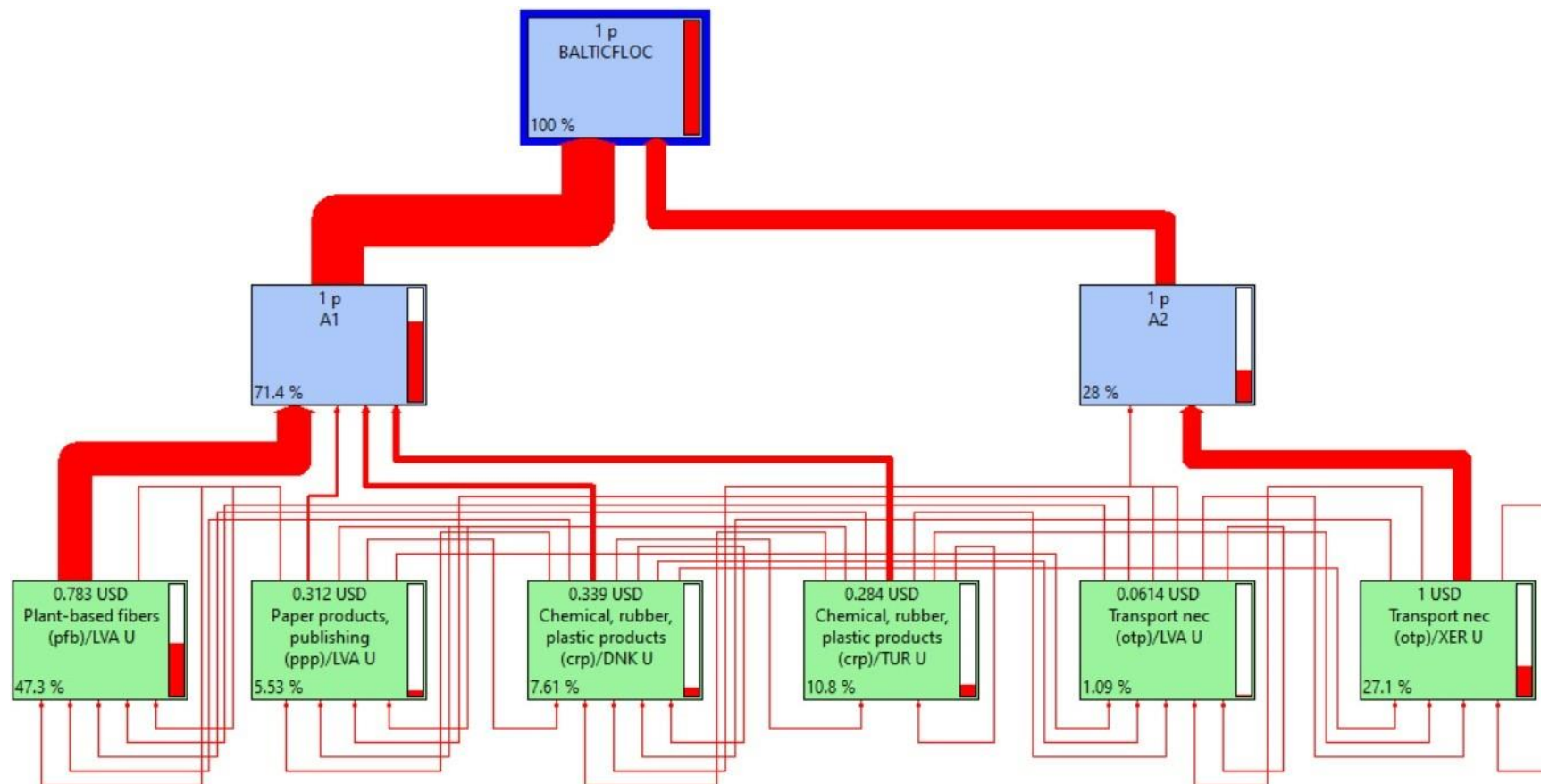
**Figure 2.** Tree network flow for Labor rights & decent work with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.



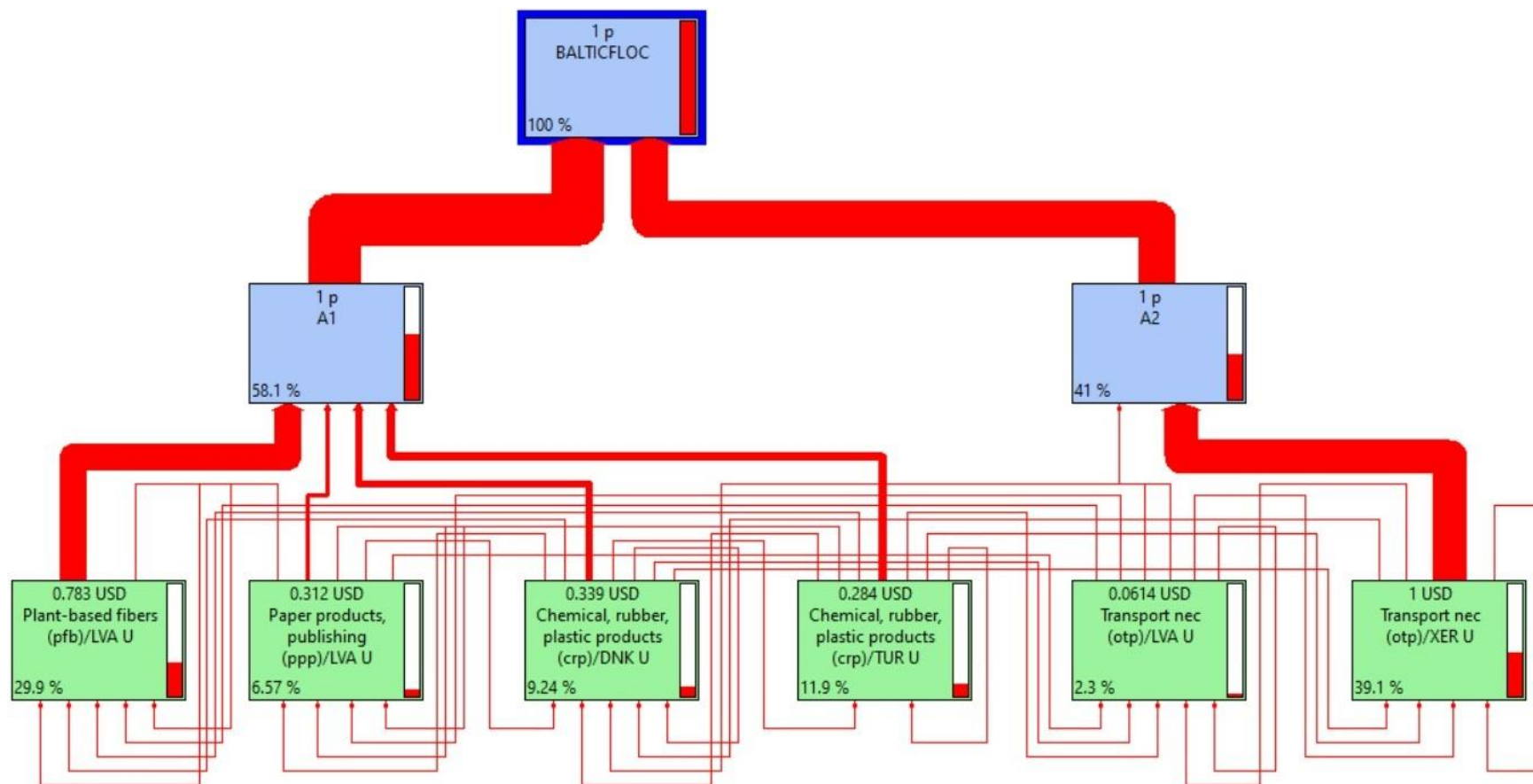
**Figure 3.** Tree network flow for Health & safety with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.



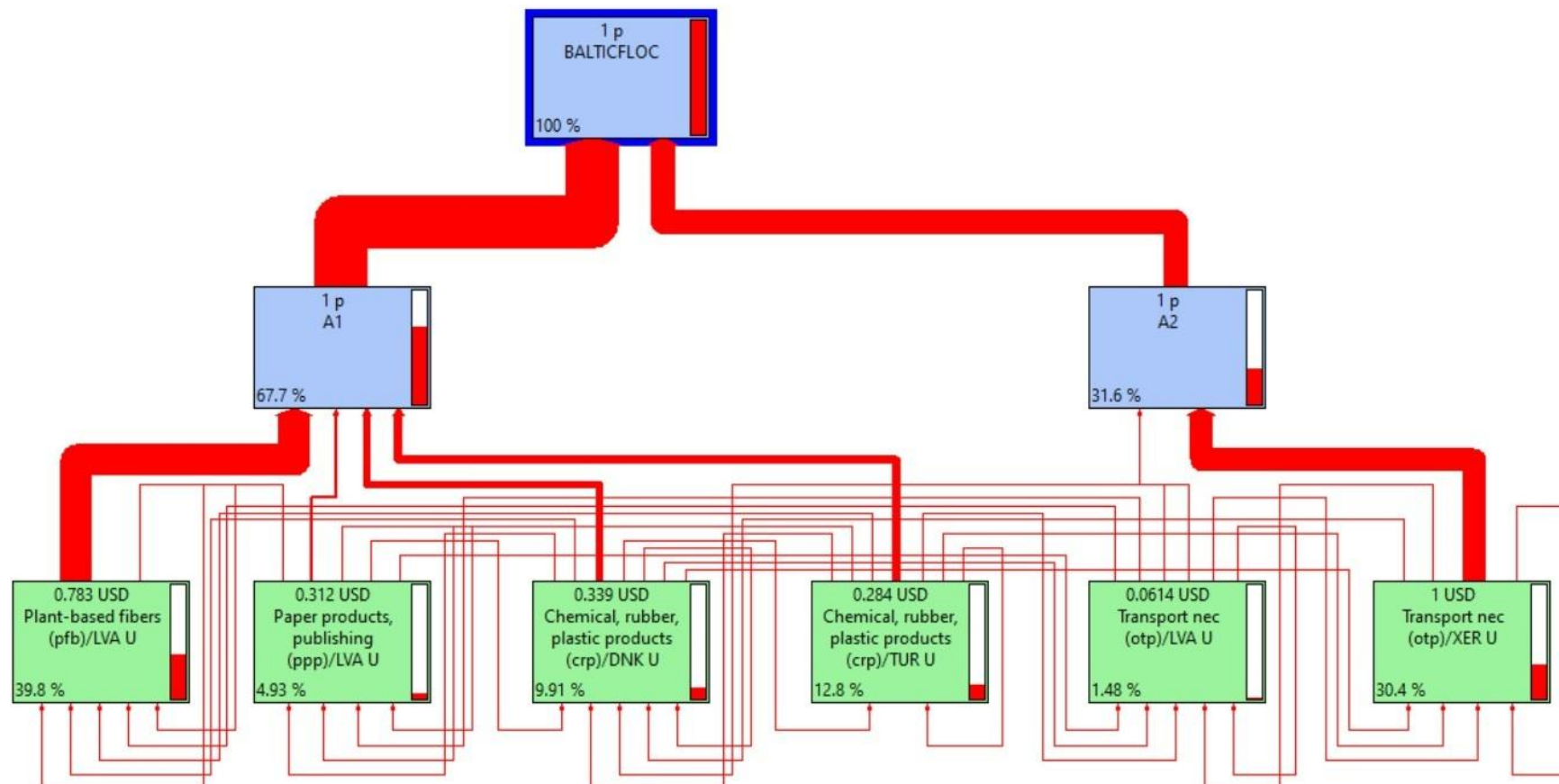
**Figure 4.** Tree network flow for Society with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.



**Figure 5.** Tree network flow for Governance with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.

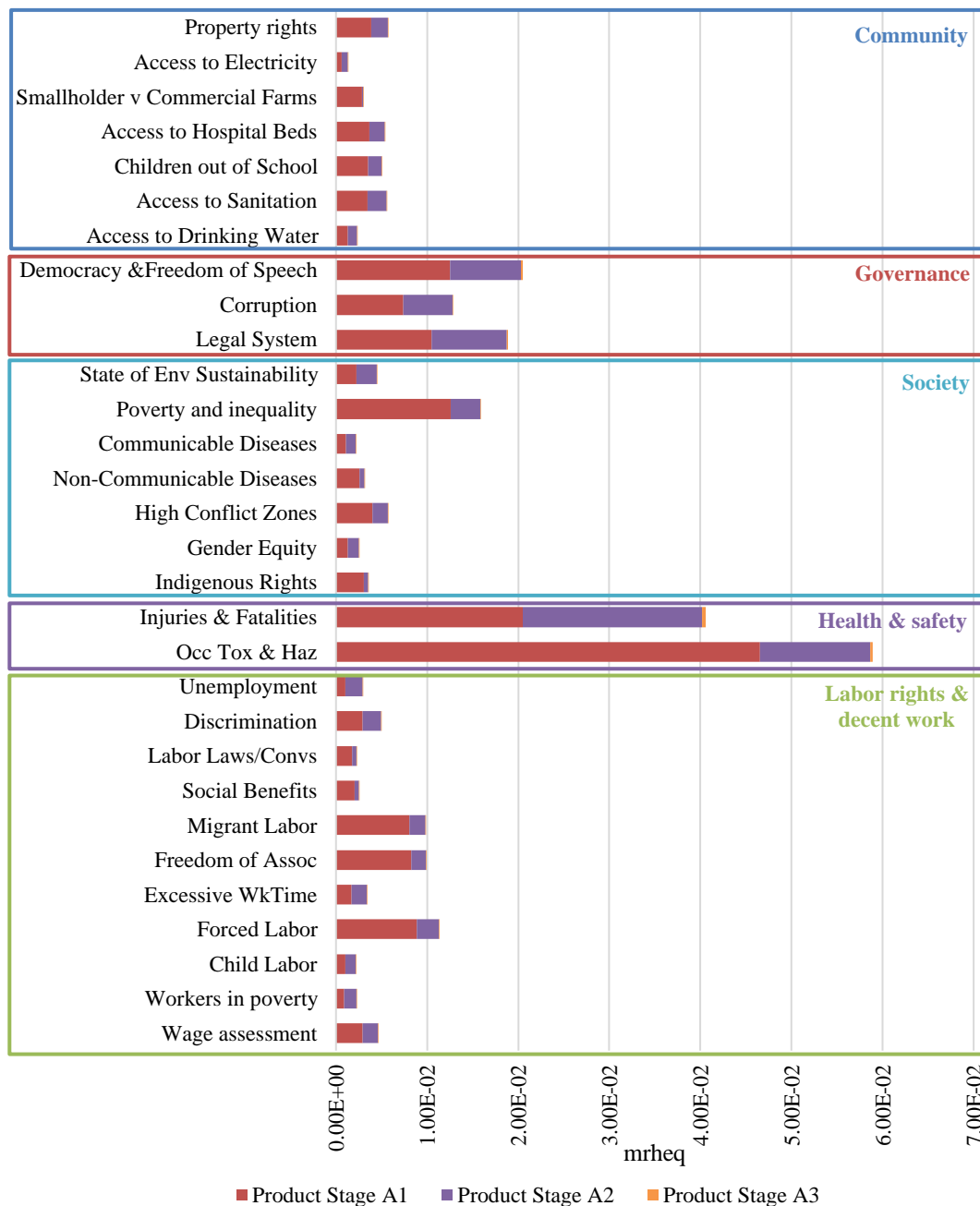


**Figure 6.** Tree network flow for Community with cut off 5% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.



In Figure 7 are results for social impact subcategories. Largest social impact is found in A1 and A2 life cycle stages for all of the categories and subcategories. At the same time, the social impacts in the manufacturing stage A3 are comparatively low. This is explained by the fact that the main processes in the production of the production of the 1 m<sup>2</sup> of Paper-hemp insulation material take place in resource extraction and their transportation to the manufacturing. The manufacturing itself is not energy, waste or labour intense and therefore does not add much of social burden to the lifecycle of the product.

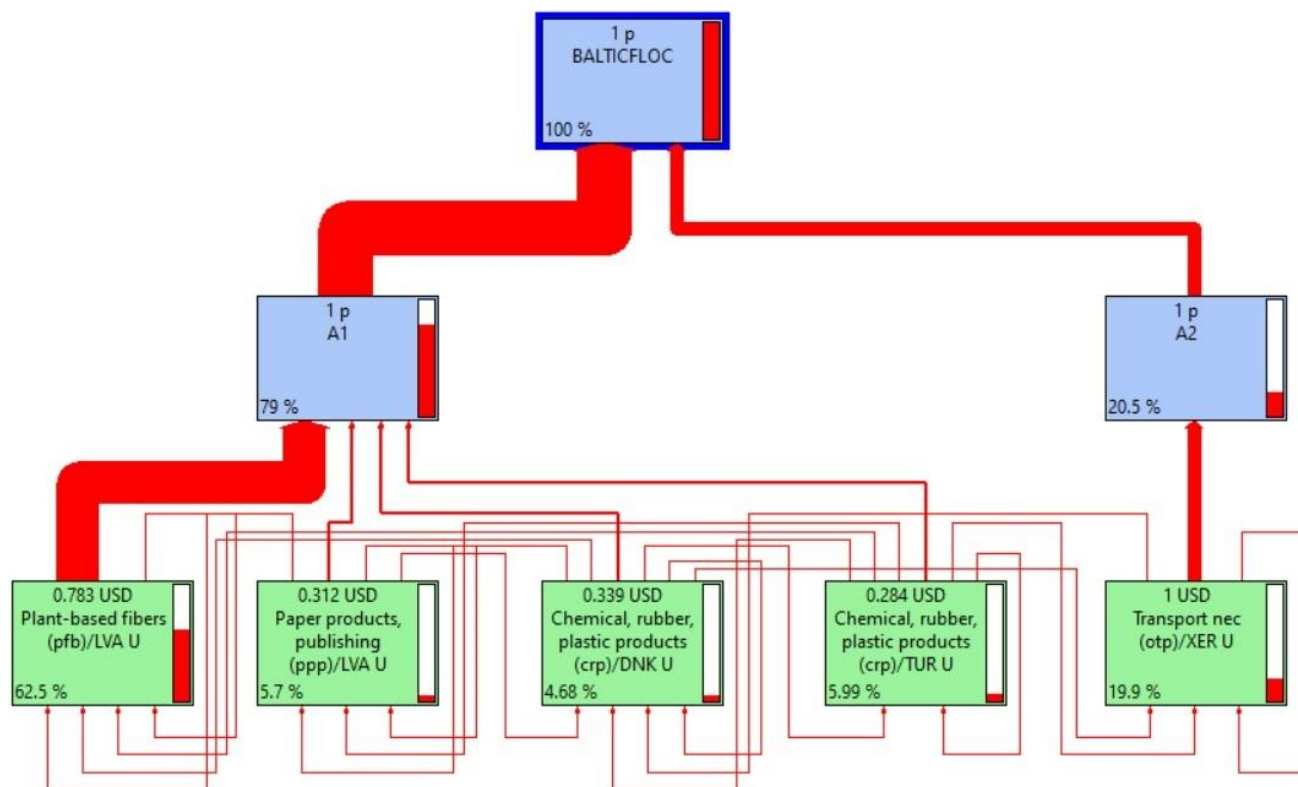
**Figure 7.** Social impact of the 1 m<sup>2</sup> of Paper-hemp insulation material life cycle, by subcategories.



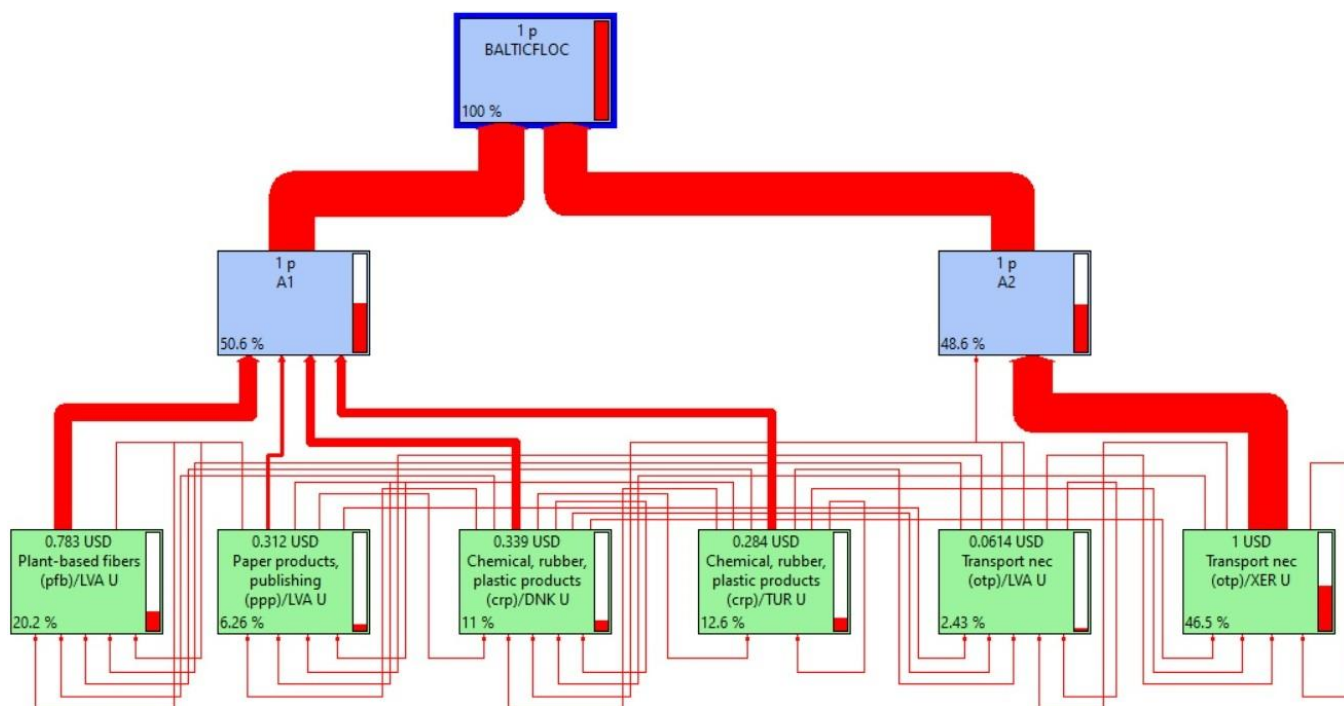
Largest social impact of the life cycle is from product stage A1 - raw material and followed by product stage A2 – transport, especially from transport XER, which is transport for rest of Europe. For the subcategories with largest social impact Occupational Toxicity & Hazzard (Occ Tox & Haz) and Injuries & Fatalities and in Figure 8 and Figure 9 are tree network flow diagrams.



**Figure 8.** Tree network flow for Occ Tox & Haz with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.



**Figure 9.** Tree network flow for Injuries & Fatalities with cut off 1% of the life cycle of 1 m<sup>2</sup> of Paper-hemp insulation material.

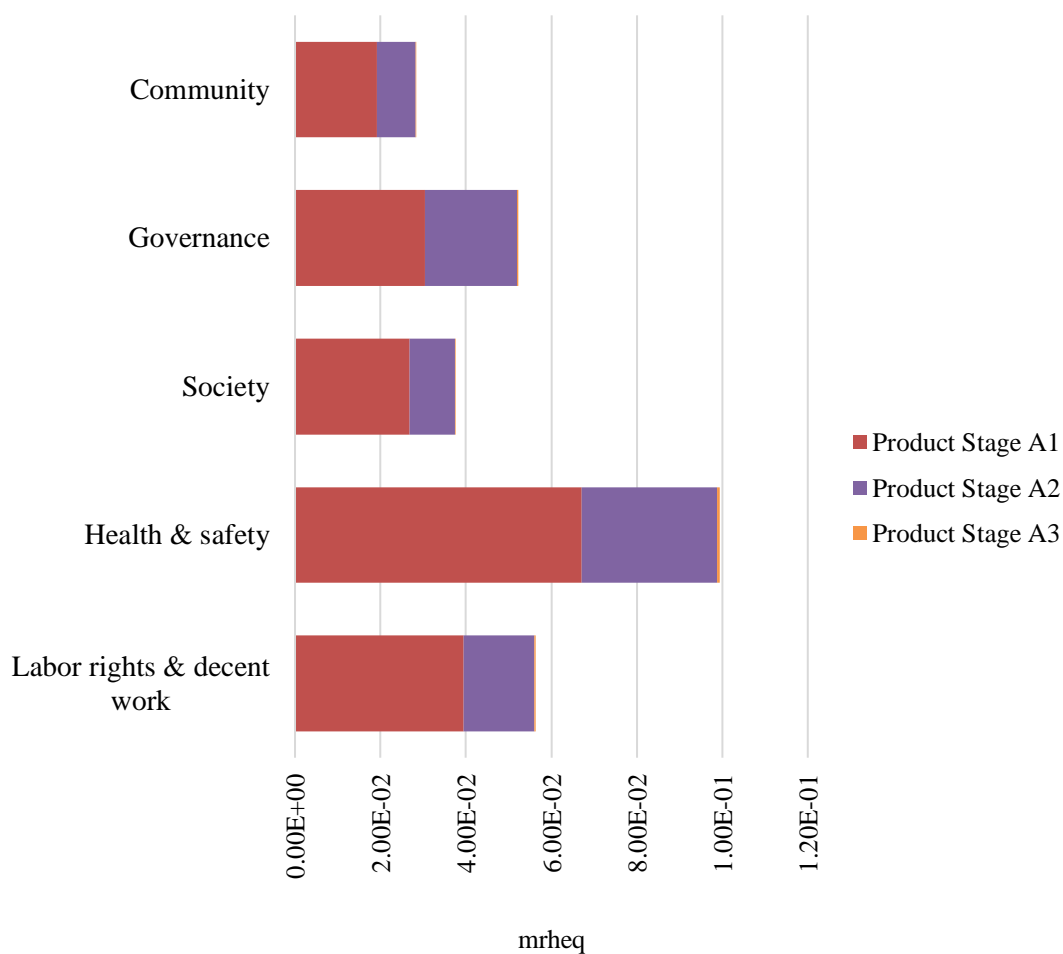




## 7. CONCLUSIONS

S-LCA study has been carried out for the Paper-hemp insulation material of Balticfloc. The document presents the results for 1 m<sup>2</sup> of Paper-hemp insulation material (declared unit). In Figure 10 are social impact category results per product stage. Largest social impact is from raw material extraction and preparation (A1) and transport (A2) stages. The least impact is from product stage A3 (manufacturing) and from total product impact A3 makes less than 1% social impact per impact category (Figure 10). In all product stages largest impact comes is to Health & safety category and followed by Labor rights & decent work category. Largest social impact comes from plant-based fibres and transport in Europe, as it appears in network flow diagrams.

**Figure 10.** Impact categories share by module for Paper-hemp insulation material.



The potential decrease of social impacts can be achieved by resource efficiency that allows to decrease the amount of resources used for production of the for 1 m<sup>2</sup> Paper-hemp insulation material and therefore decreases the related risk hours within the specific sector of concern. The resource use optimization should be evaluated together with the results of Environmental LCA.

## 8. BIBLIOGRAPHY

- ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006/Amd 2:2020 Environmental management. Life Cycle Assessment. Requirements and guidelines
- ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures.
- The Social Hotspots Database
- Guidelines for Social Life Cycle Assessment of Products and Organizations 2020

## Annex 1 - LCI for Paper-hemp insulation material

The collected data for Paper-hemp insulation material manufactured were in 2023 EUR values. However, input values in SimaPro for Social Hot Spots Database V5 (2022) are required as USD 2011 values, which are used as reference for construction of database. Consequently, calculations were made, and the value of 2023 EUR was converted to the value of 2011 EUR, where inflation was considered (1 EUR 2011 = 1.47 EUR 2023) and then converted to 2011 USD (average exchange rate in 2011 and it is 1USD = 0.719 EUR).

**Table 13.** Paper-hemp insulation material A1 – A3

Material/Process	Quantity per Declared unit, USD 2011	Quantity per Declared unit, EUR 2023	Item in database	DQR
<b>A1</b>				
Hemp fiber	0.783	1.60	Plant-based fibers (pfb)/LVA U	1.75
Paper waste	0.245	0.50	Paper products, publishing (ppp)/LVA U	1.5
Bico fiber	0.308	0.63	Chemical, rubber, plastic products (crp)/DNK U	1.75
Fire retardant	0.235	0.48	Chemical, rubber, plastic products (crp)/DNK U	2
Metal wires	0.0002	0.004	Metal products (fmp)/LVA U	2
PE bags	0.014	0.028	Chemical, rubber, plastic products (crp)/LTU U	1.5
<b>A3</b>				
Electricity	0.064	0.13	Electricity (ely)/LVA U	1.5
Gas for furnace	0.002	0.004	Gas manufacture, distribution (gdt)/LVA U	1.75
Metal wires	0.0002	0.0004	Business services nec (obs)/LVA U	1.75
PE bags	0.001	0.002	Business services nec (obs)/LVA U	1.5

**Table 14.** Paper-hemp insulation material LCI A2

Material/Process from database	Material transported	Quantity per Declared unit, USD 2011	Quantity per Declared unit, EUR 2023	DQR
<b>A2</b>				
Transport nec (otp)/LVA U	Hemp fiber	0.035	0.072	1.25
Transport nec (otp)/LVA U	Paper waste	0.012	0.025	1.25
Transport nec (otp)/XER U	Bico fiber	0.259	0.53	1.25
Transport nec (otp)/XER U	Fire retardant	0.641	1.31	1.25
Transport nec (otp)/XER U	PE bags	0.59	0.12	1.25