Ref. Ares(2018)1235135 - 06/03/2018

Project acronym: BECOOL

Project full title: Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels
Grant Agreement Number: 744821

Project start date: 01.06.2017

Deliverable 5.1

Title: **HARMONISED DATA AND METHODOLOGICAL APPROACHES**	
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Date:	2018/03/05

Dissemination Level: Public

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1 Introduction

The BECOOL project aims to develop innovative and sustainable value chains for producing advanced biofuels based on lignocellulosic biomass. An important element of this project is the development of biomass-to-advanced fuel value chains combining and integrating the different key research activities of the project into a consistent framework. An integrated sustainability and market framework assessment will help to flag opportunities for an optimization of the value chains regarding economic and environmental criteria and to identify the most promising value chains under current and future market conditions.

The development of sound and consistent value chains (including concepts for biomass logistics) and the assessment approach envisaged are based on comprehensive data from work packages 1 to 4. Thus, a coordinated approach for the collection of a consistent and harmonised database is necessary. The harmonisation of these data and the methods of the various tools and methodological approaches involved is crucial for WP 5 and its various interlinks to other WPs as well as for the discussion on methodological compatibilities with the partners from the Brazilian consortium.

The objective of this deliverable is therefore to define the process for data harmonisation and methodological approaches for integrated sustainability and market framework assessment in WP5.

Section 2 describes the motivation and the demand for data and method harmonisation and our approach to the general procedure. In Chapter 3, we highlight some main outcomes of the workshop that took place during the BECOOL project meeting in Athens (25-26 January 2018), which aimed to define and discuss initial value chains (from feedstock to advanced biofuel). Section 4 gives an overview the first value chains as a result of the workshops in Athens. Section 5 describes the proposed workflows for data collection and harmonisation.

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2 Motivation

What are the most promising value chains? - How to integrate the advanced biofuels investigated under BECOOL into the market? -Which value chains are the most competitive from an environmental, social and economic point of view?

These are the essentially scoping questions for the work in WP5. They will be answered by means of different assessment approaches, (i) market framework assessment in Task 5.3, and (ii) integrated sustainability assessment in Task 5.4. The latter will combine the assessment of the various value chains from: i) an attributional, and ii) a consequential LCA perspective. Prerequisite for such a comprehensive assessment is a solid and harmonised data collection and a harmonisation of the used methodological approaches. As Figure 1 shows, there are strong dependencies and connections within and across WPs 1-5 regarding the provision of the needed data.

With regard to method harmonisation, however, two different needs and approaches need to be addressed:

1. Assessment methods used in WP 5. Here, a coordination of the methods on the definition of the assessment criteria and a dedicated data collection sheet takes place. The selected procedure is described as a workflow in chapter 5.
2. Methods involved in various tools used in WP 1-4 for data provision. Appropriate assumptions and framework conditions should be defined via the data collection sheets.

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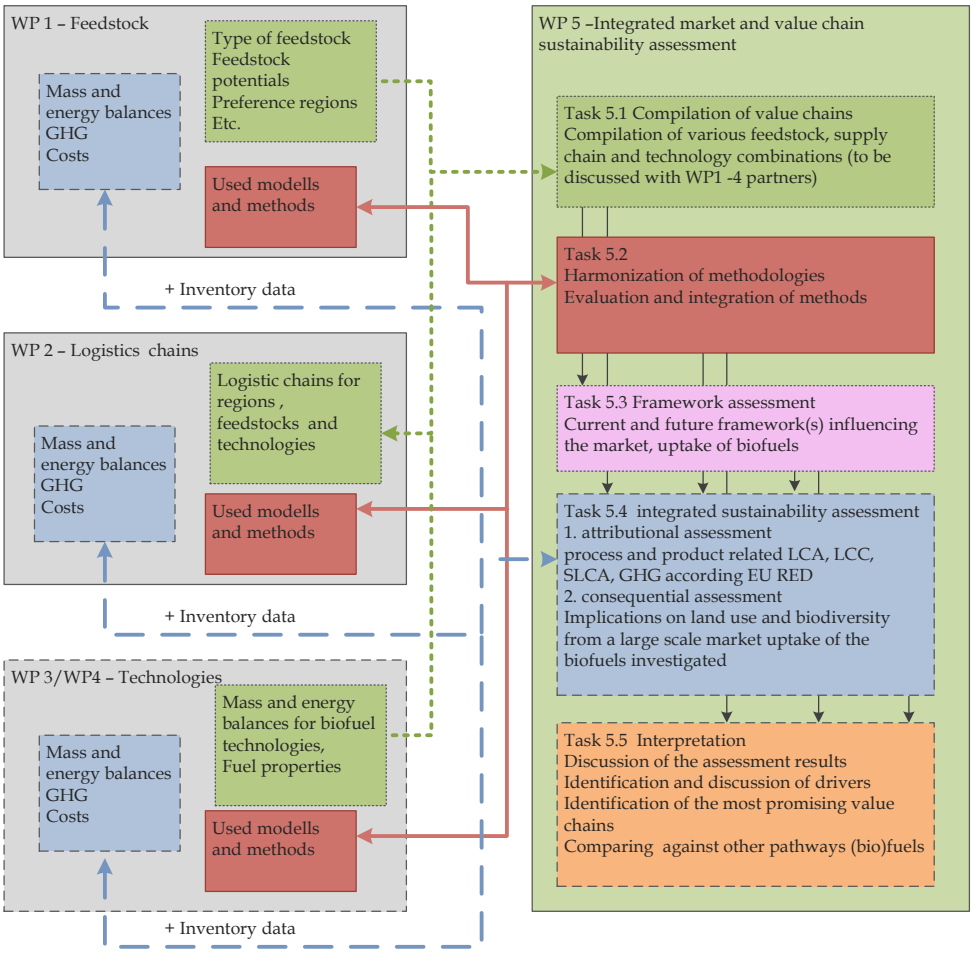

Figure 1 Structure and connections within the WPs 1-5

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3 Workshops

For the creation of the data collection sheets, it is necessary to define initial value chains (the term value chain comprises the entire process chain from biomass cultivation/provision to logistics to processing and end use) as the basis for further WP5 activities. Thus, the compilation of feasible i) giant reed ii) eucalyptus iii) sorghum and iv) lignin-rich value chain(s) was one of the goals of four workshops which took place as part of the second BECOOL consortium meeting in Athens (25-26 January 2018). For this purpose, the respective partners in charge have been asked to give brief presentations on the corresponding cultivation and conversion processes.

In preparation for the workshops, initial data collection sheets have been developed and sent out to the partners responsible for cultivation and conversion processes, with the request to qualitatively assess/evaluate the data collection sheet and to answer the questions regarding the ability to provide the requested data and if there any suggestions for amendments and comments.

Furthermore, questions have been defined in advance which should clarify existing dependencies regarding the exchange of data between the single process steps and which data is needed for the description and the assessment of the logistic chains in WP 2 (see Figure 2).

During the workshop lectures, the essential information was collected in parallel and the feasible value chains were mapped and discussed, according to a multi-actor approach, at the end of each workshop with all partners.

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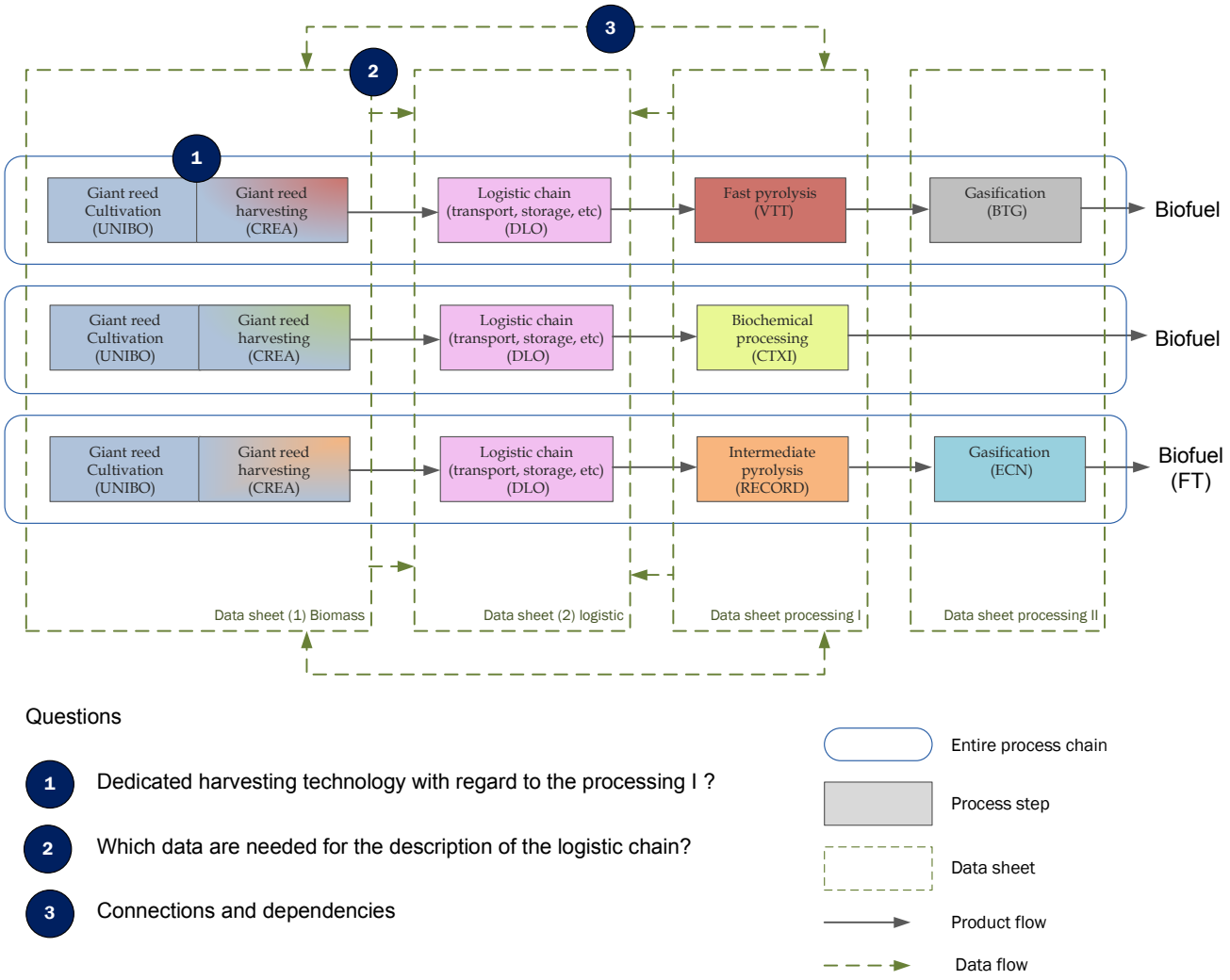

Figure 2 Structure and questions for data collection

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4 Initial value chains

The initial i) giant reed ii) eucalyptus iii) sorghum and iv) lignin-rich value chains compiled and discussed during dedicated workshops are shown in the following figures (Figure 3, Figure 4, Figure 5, Figure 6). The figures show very clearly the different possibilities and technologies of the individual process steps and the corresponding dependencies amongst each other, for example between harvesting technology and the processing process. They also show the data requirements for the description of the logistics chains, where feedstock characteristics and processing requirements will be matched.

Giant Reed

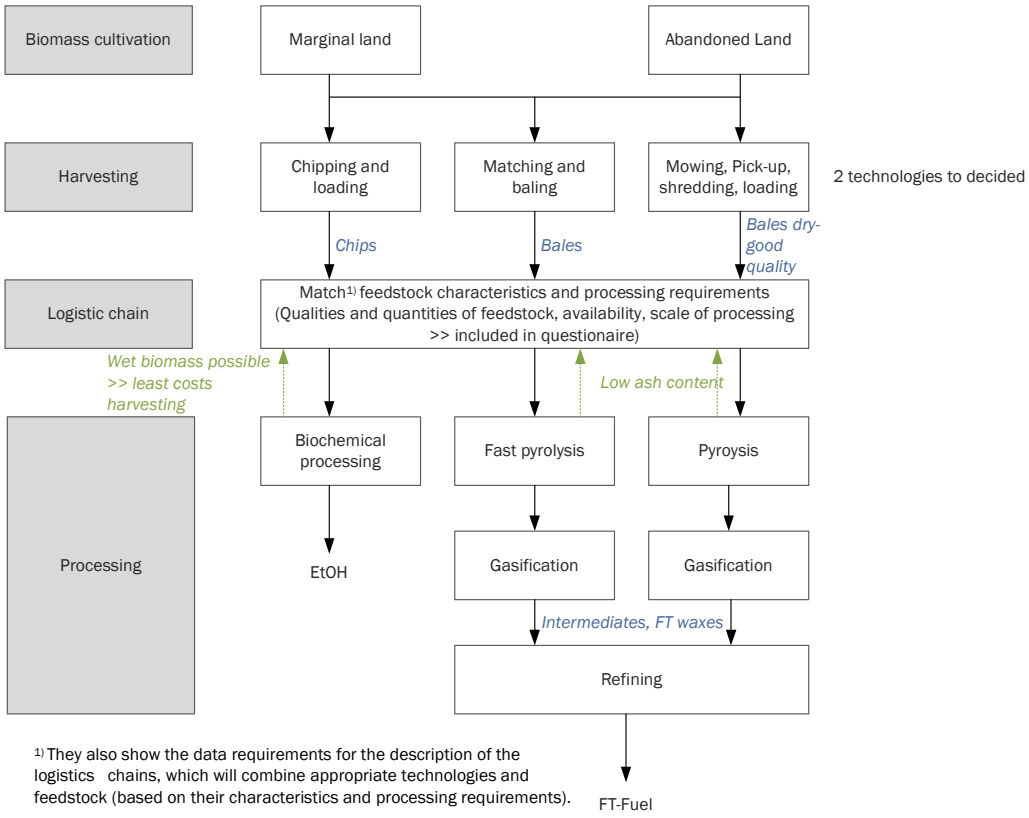

Figure 3 Initial giant reed value chain

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Eucalyptus

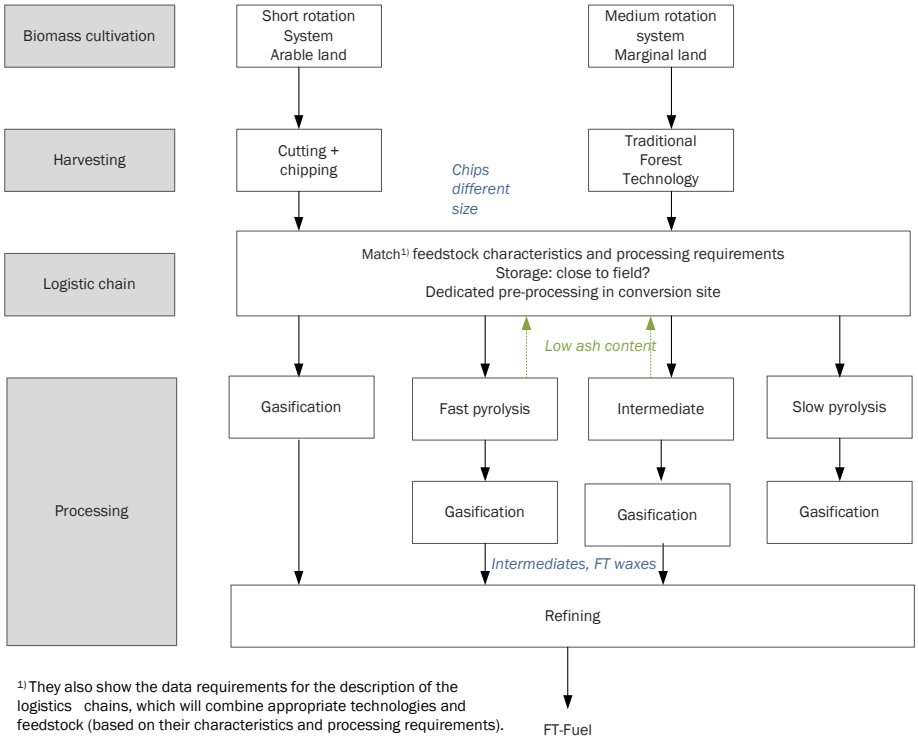

Figure 4 Initial eucalyptus value chain

Sorghum

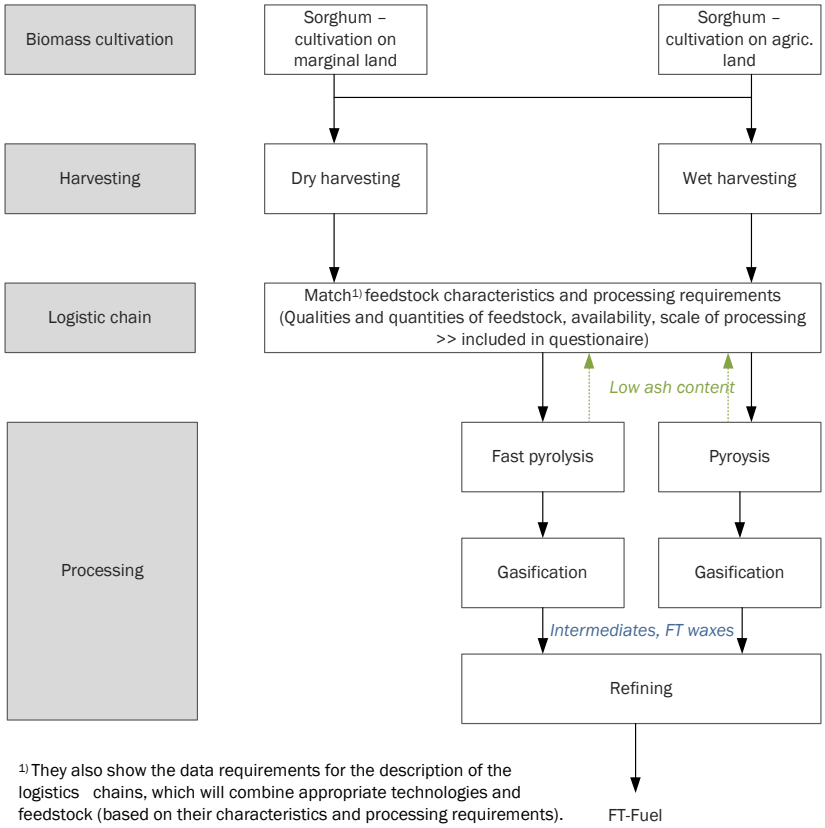

Figure 5 Initial sorghum value chains

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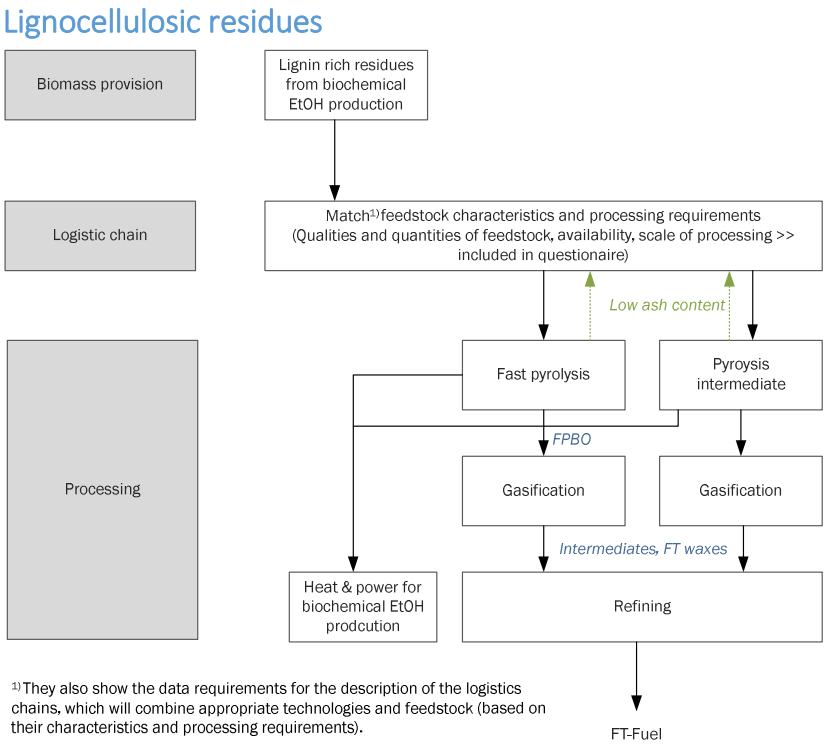

Figure 6 Initial lignin-rich value chain

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5 Proposed workflow for data collection and harmonisation

Based on the initial value chain concepts, compiled in the workshops, the identified connections and dependencies as well as the future data demand will be elaborated in close cooperation between DLO, IIASA, and DBFZ.

Adaptation of the data collection sheets

The data collection sheet, initially developed for the Athens workshops will be modified to allow for a more structured discussion of the necessary primary data (especially for the processes of cultivation and processing). The information generated with the help of this data collection sheet will be used for the description and assessment of the logistics chains in WP 2 and later in the project for the market framework and integrated sustainability assessment.

The data collection procedure is essentially based on the specifications of DIN ISO 14040 and 14044 (DIN ISO 14044; DIN ISO 14044). These two standards describe the procedure for conducting life cycle assessment (LCA), which will be a central component of the integrated sustainability assessment within BECOOL project. According to ISO 14040/14044, data collection includes all input and output for each process unit (cultivation, harvesting, processing, transport etc.) included within the system boundary (from biomass provision to biofuel end use). According to the standard, the process of data collection is an iterative process. That means, “As data are collected and more is learned about the system, new data requirements or limitations may be identified that require a change in the data collection procedures …” (DIN ISO 14040). Within the proposed workflow (see Figure 7) (i) the initial value chain concepts, compiled in the workshops, the identified connections and dependencies, (ii) the definition and description of the indicators for the assessment, (iii) the description of the logistic chains and data provision for logistics, (iv) the sub-selection of the value chains for the assessment and (v) the finalization of the data collection will influence the data collection procedure.

For the purpose of describing and assessing the logistic chains and the subsequent integrated sustainability assessment of the selected entire value chains the data collection will contain amongst others (i) qualitative and quantitative data (measured, calculated or estimated) for each process of the entire process chain to quantify the inputs and output of the processes (ii) general information about plant size and feedstock demand (iii) cost data and prices (iv) properties of feedstock, products and by-products (v) production and use of fuels, electricity and heat. As an example, the parameters for the data collection for feedstock cultivation are shown in the following Table 1.

The first steps after the workshops will be the adaptation of the data collection with regard to the identified information and data gaps, especially with regard to the description of the logistics chains (compare Figure 7). Furthermore, in close cooperation with colleagues from IIASA and DLO, the indicators for the assessments in WP 5 will be defined. This again can have a significant impact on data collection and will be particularly important for harmonise the information required for the different valuation methods used in WP 5.

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Table 1 data collection sheet for feedstock cultivation

Category	Description	Unit
Biomass characteristics		
Biomass type(s) available (name)	*pls. specify*	
Bulk density per biomass type		[kg dm/m³]
Higher heating value per biomass type		[GJ/ton dm]
Moisture content at roadside per biomass type		[kg moisture/ kg total]
Biomass availability		
Amount of biomass available per source location/grid cell (ton dm/year) (this should be as detailed as possible, e.g. nuts4 or nuts5 or even at parcel level, please add GIS file (shapefile) with locations)		[ton dm/ha] or [m³/ha] or [PJ/ha]
Description of form/shape (name) e.g. bales, chips, etc.	*pls. specify*	
Cost at roadside per biomasstype		[€/ton dm] or [€/m³] or [€/PJ]
Energy used for biomass production		[GJ/ton dm]
GHG emissions used for biomass production		[ton CO_2-Äq./ton dm]
Protected areas		
Location of any zone where the collection of biomass is more restricted (e.g., natural parks, nature reserves, Natura 2000…) or where the setup of production is prohibited. If you know the restriction level for the extraction of the biomass, this is very welcome!		
Biomass cultivation (till field borders)		
region	*pls. specify*	
soil type	*pls. specify*	
arable land size		[ha]
moisture/water content		[%]
amount of straw/residues remaining on the field		[kg/ha * a]
seed stock		[$kg_{seed\ stock}$/ha * a]
pesticide		[$kgp_{esticide}$/ha * a]
herbicide		[$kgh_{erbicide}$/ha * a]
fungicide		[$kgf_{ungicide}$/ha * a]
diesel use: cultivation		[l_{Diesel}/ha * a]
diesel use: harvesting		[l_{Diesel}/ha * a]
N fertiliser	*pls. specify*	[$kg_{fertiliser}$/ha * a]
P fertiliser	*pls. specify*	[$kg_{Dünger}$/ha * a]
K fertiliser	*pls. specify*	[$kg_{fertiliser}$/ha * a]
organic fertiliser	*pls. specify*	[$kg_{fertiliser}$/ha * a]
transport of the used pesticides and fertilisers from storage (3,5t lorry)		[km]

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Description of the logistic chains and selections of the value chains

The adapted data collection sheets will be sent to the partners of WP 1-3, with the request to provide the required data.

Based on this data a number of illustrative logistic chains for the supply of biomass to downstream pre-treatment and/or conversion processes will be developed and described. A logistic chain in this context is a specific transport route for biomass from field (edge) to conversion plant (gate) encompassing transport, storage, handling and pre-treatment. For that purpose data regarding different feedstocks, regions and conditions in Europe and different transport and pre-treatment organisation and technology forms (for instance large and small scale) are needed.

From the large amount of the illustrative logistic chains a sub-selection of logistical concepts will made based on defined criteria. The sub-selection will serve as input for the development and description of the entire value chains and to WP5 where an integrated sustainability assessment of these value chains is made.

Finalization of the data collection

According to the developed and described entire value chains the data collection for cultivation, harvesting, logistics and processing will be finalized. The responsible partners will be requested to revise the data collection once again. In case of data gaps, the missing data must be estimated and the methodologies for estimation should be reported. For that purpose the partners should give a comprehensive description of the process.

The information generated with these finalized data collection sheets will be used for (i) the market framework assessment, (ii) the sustainability assessment from an attributional and a (iii) consequential perspective.

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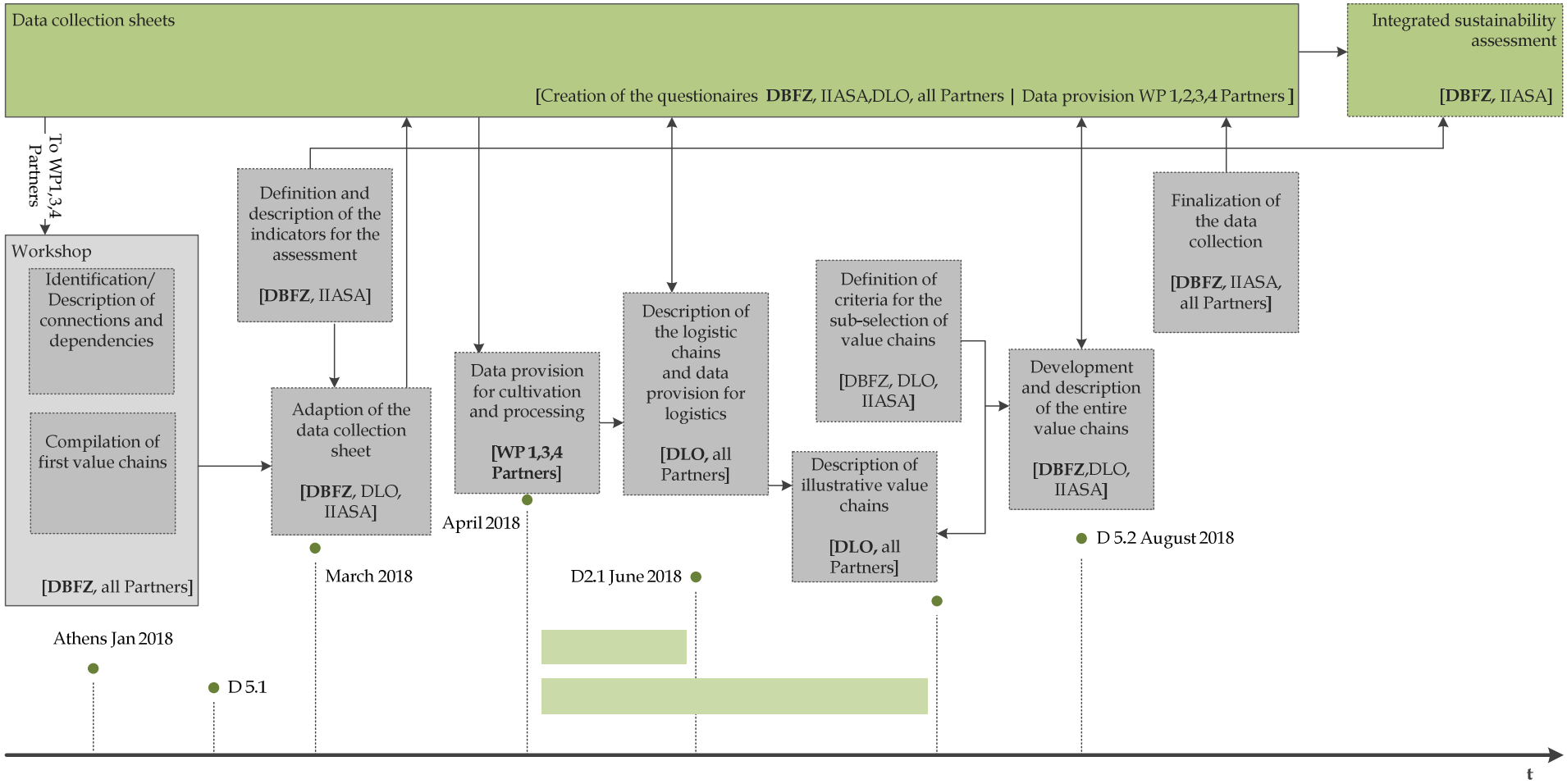

[1312, 007, R2D2, ...] - in the square brackets the partners involved, in bold the partners in charge

Figure 7 Workflow for data and method harmonisation

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6 Results

To develop biomass-to-advanced fuel value chains and to combine and integrate the different key research activities of the project into a consistent framework is an important element of this project. An integrated sustainability and market framework assessment will help to flag opportunities for an optimization of the value chains regarding economic and environmental criteria and to identify the most promising value chains under current and future market conditions.

The development of the entire value chains and the assessment approach envisaged are based on comprehensive data from work packages 1 to 4. Thus, a coordinated approach for the collection of a consistent and harmonised database is necessary. The harmonisation of these data and the methods of the various tools and methodological approaches involved is crucial for WP 5 and its various interlinks to other WPs as well as for the discussion on methodological compatibilities with the partners from the Brazilian consortium.

The objective of this deliverable was therefore to define the process for data harmonisation and methodological approaches for integrated sustainability and market framework assessment in WP5.

Starting from the Athens workshops and the compiled initial i) giant reed ii) eucalyptus iii) sorghum and iv) lignin-rich value chains. The identified connections and dependencies, a methodological approach for data collection, including data harmonisation has been developed. According to the specifications of the standards for conducting an LCA ISO 14040 and 14044 the workflow for an iterative data collection procedure has been defined.

This workflow describes iterative processes for the data collection from the definition and description of the indicators for the assessment, to the data provision for cultivation and conversion processes, the description of the logistic chains and data provision for logistics, to the finalization of the data collection. In addition to a specific schedule, the workflow also contains information on the partners involved and the respective partner in charge. This approach results in a coordinated approach with the appropriate partners for data collection and harmonisation.

7 References

DIN ISO 14040: Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006), Deutsche und Englische Fassung EN ISO 14040:2006, 10/2006.

DIN ISO 14044: Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006), German and English Version EN ISO 14044:2006, 10/2006.

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