CONTRIBUTION OF SOCIAL LIFE CYCLE ASSESSMENT TO THE EVALUATION OF MORE SUSTAINABLE SCENARIOS OF CEREAL USES IN WALLONIA (BELGIUM)

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Abstract

In Wallonia (Belgium), main cereals - wheat, barley, spelt, grain maize and forage maize - cover 66% of the Walloon arable cropped area (DGSIE, 2010). These cereals are mainly dedicated to animal feed industry. Biofuel industry valorising Walloon cereals is increasing up while food uses decrease notably due to the low prices obtained by the producers for food varieties. Transformation and added value are further located in Flanders. In this context of competition for cereal resources, the project “ALT-4-CER – Alternatives for Cereals” aims to compare environmental and socio-economic performances for current and potential scenarios of cereal uses in Wallonia. Thanks to the involvement of cereal chains stakeholders, four scenarios of cereal uses were defined based on cereal resources and uses for 2010, historic trends, estimates and contrasted hypothesis up to 2030: (1) “business-as-usual” scenario – extrapolating of past trends, (2) “strategic” scenario - optimization of current system, (3) “localisation” scenario - development of new conversion units in Wallonia and (4) “globalisation” scenario - Wallonia focuses on high added value production and exports other products. Beside Environmental Life Cycle Assessment (E-LCA), a Social Life Cycle Analysis (S-LCA) methodology is being elaborated in order to evaluate socio-economic performances of these scenarios. This implies the definition of a range of particular stakeholders (farmers, firms, workers and local communities) and workable indicators (number of work-related accidents, employment, training, qualification, etc.), specific to cereal production. Based on political priorities, a methodology evaluating wellness from both the economic and social dimensions is being developed, based respectively on added value and work time distribution. S-LCA depends on type and localization of actors so stakeholders are classified according to their characteristics. Methodology is based on interviews and specific database accounts because generic data are not accurate enough to depict Walloon cereal chains and simulate interactions between stakeholders.

Keywords: Cereals, life cycle assessment (LCA), ELCA, SLCA, decision making.

1. INTRODUCTION

In Wallonia (Belgium), more than 60% of the arable cropped area is dedicated to cereals. In the current context of non-renewable energy sources depletion and growing world population, competition for cereal resources requires the identification of the most sustainable scenarios for agricultural products and co-products use.

Nowadays most Walloon cereal chains are classically turned towards animal feed. Key opportunities for non-food uses are considered in a sustainable development perspective. But this can only be achieved through an exhaustive comparison of environmental and socio-economic impacts of existing and potential cereal chains.

Comparing current and potential cereal uses in Wallonia, the overall goal of the 3-year project “Alternatives for Cereals – ALT-4-CER”, started in March 2011, is to define and to evaluate alternative
scenarios for food and non-food uses of cereal resources in Wallonia with the support of involved stakeholders.

In order to depict comprehensively the Walloon cereal landscape the project firstly aimed at elaborating scenarios for food, feed, fuel and fibre uses of cereal resources in Wallonia (so-called “4F” scenarios). Scenarios definition was supported by the consultation of all involved actors in order to ensure a further scientific approach based on realistic existing and potential cases.

In parallel with Environmental Life Cycle Assessments (E-LCA) (see paper from Van Stappen et al. in this conference proceedings), a Social Life Cycle Analysis methodology (S-LCA) is being developed in order to grasp socio-economic impacts of defined scenarios. This method, complementary to E-LCA but not as well developed yet, requires more methodological adjustments.

Finally the relevance of the selected scenarios will be evaluated through multi-criteria analysis supported by the sector. Stakeholders will again be convened in order to help weighting sustainable indicators identified in the E-LCA and S-LCA processes.

2. WALLOON CEREAL CURRENT AND POTENTIAL USES

2.1 The Walloon agricultural context

Wallonia is divided into 10 agricultural regions, according to soil texture and landscape of the country [1]. The agricultural productions of Wallonia are closely related to the opportunities offered by the soil properties or the landscape. The Northern part of Wallonia (loam area, sandy-loam area, and clayed-loam area), with its particularly fertile and deep soils, is dedicated to large-scale crops, such as cereals, sugar beet and potato. The central part of Wallonia has poorer and less deep soils and is therefore dominated by forage crops (mainly forage maize). The Southern part, with a lower population density, is mostly covered by woods and forests, where agricultural lands are devoted to meadows and pastures. The Eastern Belgium area, with the highest a.s.l. elevations in Belgium, is dedicated to pastures and dairy productions; orchards and bocage are also found in this area.

Agricultural statistics show that more than 60% of the Agricultural Area Utilized for Farming (AAUF) is dedicated to cereals in Wallonia [2]. Main cereal crops are winter wheat (36%), forage maize (16%) and winter barley (10%). Thanks to its hardiness, spelt is also common in the Southern area with its less fertile soils, more cold and wet climate and steeper landscape.

Trends regarding main crops in Wallonia indicate that areas dedicated to wheat have been stable for the past 15 years, while barley and spelt areas are slowly decreasing. This can be related to climate becoming milder, allowing more productive wheat to overtake other cereals. Within the same period, grain maize areas have increased due to climate evolution and genetic selection. Forage and grain maize progressions seem to be made at the expense of sugar beet and temporary meadows.

The ALT-4-CER project team has therefore decided to focus on the following prevailing cereal crops in Wallonia: wheat (Triticum aestivum L.), barley (Hordeum vulgare L.), forage and grain maize (Zea mays L.), and spelt (Triticum aestivum subsp. spelta L.).

2.2 Current cereal uses in Wallonia

More than a half of the cereal chains are currently turned towards animal feed. Direct human food uses, i.e. milling and brewing, barely reach 10% of the grain production, mainly because of low prices paid for food varieties, less favourable climate conditions and scattered plots of land. Non-food uses are growing too, with 16% of the Walloon cereal production converted into bioethanol or biogas (Table 1).

![Table 1: Production and uses of Walloon cereal resources in 2010](https://example.com/table1.png)

<table>
<thead>
<tr>
<th>Use</th>
<th>Grain</th>
<th>Forage maize</th>
<th>Straw</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.10^t t FM&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.10^t t FM&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.10^t t FM&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.10^t t DM&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Food</td>
<td>125</td>
<td>0</td>
<td>0</td>
<td>108</td>
</tr>
<tr>
<td>Feed</td>
<td>724</td>
<td>2601</td>
<td>68</td>
<td>1544</td>
</tr>
<tr>
<td>Fuel (ethanol, biogas)</td>
<td>501</td>
<td>98</td>
<td>0</td>
<td>449</td>
</tr>
<tr>
<td>Fibre (animal litter)</td>
<td>0</td>
<td>547</td>
<td>89</td>
<td>465</td>
</tr>
<tr>
<td>Export</td>
<td>227</td>
<td>0</td>
<td>0</td>
<td>160</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1577</td>
<td>2654</td>
<td>616</td>
<td>2725</td>
</tr>
</tbody>
</table>

<sup>a</sup>FM = fresh matter  <sup>b</sup>DM = dry matter

2.3 Scenarios definition

The definition of “4F” scenarios is the basis for the subsequent steps of the project and was thus effectively supported by involved stakeholders.

Cereal flows (production, export, import, stock) have been evaluated thanks to expert consultation and available relevant data and literature. These flows, integrating historic trends and projections by
2030, helped defining the baseline scenario (2010) as well as future potential scenarios for cereal uses in Wallonia (2030).

Scenarios consider interactions between chains and their co-products, as well as potential impacts on the agricultural landscape and land occupation in Wallonia. They have been established with contrasting hypotheses: (1) “Business-as-usual” scenario: current trends are extrapolated from the past 15 years; (2) “Strategic” scenario: environmental, economic and social optimization of current system; (3) “Localisation” scenario: development of new cereal conversion units in Wallonia (added value relocated within the region) and increased autonomy; and (4) “Globalisation” scenario: world demand drives cereal resources outside Wallonia (massive export), and Wallonia focuses on high added-value products (biorefinery, bio-based chemistry).

Details on Walloon cereals flows and scenario definition will be available in an article to be submitted to Biotechnology, Agronomy, Society and Environment (Eds. Presses agronomiques de Gembloux).

3. **Socio-economic Life Cycle Assessment**

Beside E-LCA (see paper from Van Stappen et al. in this conference proceedings), a Social Life Cycle Analysis (S-LCA) methodology is being elaborated in order to evaluate socio-economic impacts of scenarios. S-LCA studies currently assess social performances and generally not proper social impacts [3]. Similarly to E-LCA, consequential LCA will be used in order to evaluate specific social impacts due to decision alternatives. In that case S-LCA assesses social impacts caused by choosing decision alternatives [4].

The ultimate goal of this study is to contribute to the drawing up of a S-LCA methodology for the Walloon cereal value chains. This S-LCA aims at answering the question: “What are the similarities, differences and future trends in terms of added value and working environment for cereal Walloon chains?” The scope includes the agricultural step down to the first conversion in Food, Feed, Fuel, Fibre sectors using Walloon cereals. At the cultivation level geographical differences will consider crop choice linked to territorial specificities.

S-LCA implies the definition of a range of particular stakeholders (farmers, firms, workers and local communities) and workable indicators (number of work-related accidents, employment, training, qualification, etc.) specific to cereal production. Farmers constitute a specific category because they have a particular status: they are at the same time consumers, sellers, workers and managers. With respect to current political development plans, a methodology evaluating wellness from both the economic and social dimensions is being developed, based respectively on added value and work time distribution. These two themes are foreseen to keep on being political priorities up to 2030.

Two impact categories are developed for this study: (i) distribution of added value along the agricultural chain and (ii) working environment. These impact categories aim at being as quantifiable as possible because results are focused on stakeholders of Walloon cereal chains directly concerned by cereal resources. Added value is evaluated thanks (i) to regional database of agricultural accounts and (ii) balance sheets freely available for the rest of the actors. Working environment will be evaluated through the “Bilan Travail” methodology [5] and thanks to several indicators and interviews.

“Bilan Travail” is dedicated to animal breeding and must therefore be adapted for cereal sectors. “Bilan Travail” estimates work hours through interviews with farmers and other farm workers, dedicated to (i) repetitive and postponed work, (ii) seasonal work and (iii) mutual aid work. Available time for administrative tasks, leisure time and others are calculated by the difference between legal working days and days occupied by works listed above.

Other indicators such as numbers of work accidents, employment by value chain or distribution of work contracts are used.

4. **Similarities and Differences Between ELCA and SLCA**

LCA methodology can be in principle used to evaluate socio-economic aspects even though it was primarily designed to assess environmental burdens associated with the life cycle of a given product, system or service. A major difference between ELCA and SLCA lies with social indicators often relating to a specific process or company. This also implies that stakeholders must be integrated from the beginning of data collection in SLCA. SLCA indicators are classified according to impact categories but may also differ according to stakeholders. SLCA is location sensitive and should be carried out for a specific site [6].

Furthermore data are more often qualitative in SLCA and therefore more subjective. Finally beneficial impacts are scarce in ELCA but can be either positive or negative in SLCA.
5. REFERENCES


