European Network for Rural Development

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# Bioeconomy case study

# Low-carbon transition in the EU sugarbeet sector – bioeconomy as a new business model[(1)]

This paper presents two examples of different approaches to innovative solutions on the climate change and low-carbon transition of agriculture in the EU sugarbeet sector, based on experiences of two cooperatives in Italy and in The Netherlands.

## Overview of the European sugarbeet sector

The European Union is the world´s leading producer of beet sugar, with around 50% of the total amount produced worldwide, corresponding to about 10% of world sugar production. In the EU, beet sugar is produced in Belgium, the Czech Republic, Denmark, Germany, Greece, Spain, Croatia, Italy, Lithuania, Hungary, the Netherlands, Austria, Poland, Romania, Slovakia, Finland and Sweden.

The 2006 reform of the Common Market Organization (CMO) of the EU sugar sector led to an immediate reduction in sugar quota production of around 6 million tons (-30%) and the abolition of the sugar quota regime as of 1 October 2017[(2)]. The consequences to the sector were drastic. The number of EU sugarbeet factories passed from 189 in marketing year 2005/06 to 107 in marketing year 2017/18. Therefore, from 300.000 beet producers in 2006, EU producers decreased to roughly 140.000 in 2018.[(3)] Today the EU produces around 18 million tonnes of sugar.[(4)] According to COPROB, Italy, which had been a significant producer of beet sugar in Europe with 19 factories until 2006, has only two operative factories since 2018/19.

The EU´s ambitious goals concerning climate change and the transition to a low-carbon, more competitive and resource-efficient economy have revamped both the economic and climatic role of the sugarbeet sector and provided a potential new source of income to the beet producers and processing industries[(5)]. Sugarbeet is a key part of the circular bioeconomy. Sugarbeet is one of the primary energy crops for biofuels production in Europe. In 2018, about 21% of bioethanol was produced from sugarbeet[(6)]. In the EU, there are

(1) Bianca Cavicchi for the ENRD Thematic Group on Bioeconomy and Climate Action in Rural Areas, with contribution from the International Confederation of European Beet Growers (CIBE).

(2) https://ec.europa.eu/commission/presscorner/detail/en/MEMO_17_3488

(3) Source: High-Level Goup on Sugar Market, 2019; https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/plants_and_plant_products/documents/final-report-high-level-group-meeting-sugar.pdf

(4) Source: AGRI G4 - Committee for the Common Organisation of Agricultural Markets, 2020 https://ec.europa.eu/transparency/regcomitology/index.cfm?do=search.dossierdetail&Dos_ID=18885&dos_year=2020&dc_id=

(5) Source: Scarlat, Dallemand, Monforti-Ferrario, & Nita, 2015

(6) Source: ePure, 2019

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around 20 factories producing bioethanol (mainly in France and Germany). Bioethanol is not the only way for sugarbeet valorisation. It is also used in the chemical industry for the production of bio-plastics, bio-resins for buildings or vehicles, organic polymers, detergents and food ingredients[7]. Experiments and pilot projects are been carried out in several EU countries, among which the Netherlands, through the support of the European Union research incentives (e.g. BBJ JU funding[8]). Therefore, sugarbeet aims to play a critical role in the low-carbon transition and as a model of sustainable practices[9] , not limited to its primary use in biofuel production, but also for other bioproducts, as the following cases demonstrate.

## The case of COPROB in Italy

The Italian sugarbeet sector went through a significant restructuration after the Common Agricultural Policy and Common Market Organisation reform between 2004-2006. The restructuration led to a sharp decrease in sugar production from 1.6 million tonnes in 2006 to 250 000 tonnes in 2019.

COPROB[10] is the last sugarbeet enterprise left in Italy since 2019. The cooperative was created in 1962 in Emilia Romagna region and has roughly 5 000 associated farmers cultivating a total of 33 000 hectares and a yearly production that ranges between 200 000 to 250 000 tonnes of beet sugar. COPROB farmers are mostly located in Emilia Romagna and Veneto, regions that provide the best climatic conditions for growing sugarbeet, i.e. a relatively constant humid climate throughout the growing and harvesting season, and to a lesser extent in Lombardia, Marche and Friuli Venezia Giulia. Additionally, most of the sugar processing factories were already located in these regions, and especially in Emilia Romagna, which makes the value chain in the region more cost efficient and competitive.COPROB believes that the entreprise's structure has helped it survive the changes in its environment. The cooperative structure has facilitated the adjustment to the challenges posed by the regulatory reform. This has been acheived by the relatively swift adaptation of production lines and the implementation of strategic measures to tackle market changes and uncertain climatic conditions. Given the number of associated farmers, the cooperative has a tight connection with the territory, in terms of resources, knowledge and goals. This strong territorial link has facilitated the dissemination of climate adaptation actions.

COPROB took two strategic actions to adapt to the challenges posed by climate change. The Italian enterprise invested in improving the quality and environmental footprint of its sugarbeet production and sugar products. It then set up a climate adaptation system centred on improving and disseminating farmers ´ knowledge and increasing farmers' collaboration. The strategies put in place to deal with regulatory, market and climatic challenges can be thought of in terms of product, process, practices and partnership innovations. To a lesser extent there have also been technological innovations. These innovations are often linked and mutually dependent.

A fundamental change in the production process has been the introduction of improved crop rotation, coupled with partnership innovation. COPROB signed an agreement with Barilla, the Italian multinational food company, to alternate the growing of sugarbeet and wheat (the latter to be supplied to Barilla) because scientific evidence proved that wheat would be of better quality if cultivated after sugarbeet.

Other key product innovations have been the production of raw beet sugar (otherwise only produced from sugar cane) and organic sugar. These changes follow market demand, although the production of organic sugar is also linked to the objective of reducing the environmental impact of sugar production. COPROB considers this a climate mitigation and ecosystem adaptation strategy. To date, the acreage used for organic sugar production is still low (roughly 1500 ha aiming to reach 3000 ha in the next few years). The cooperative also has three biogas plants (technological innovation) of 999 kWe each. The biomass mix includes energy crops (3300t), molasses (990t) and beet pulp (21000t). The electricity produced is then fed into the national grid (approx. 7500MW/year per plant). Biogas can, therefore, be considered to play a role in the low-carbon transition. Additionally, majority of the residues of the sugar extraction process (i.e. the remaining of the root, molasses) are used for animal feed[11].

Partnership innovations are linked to climate and market changes. COPROB has a network of "beet clubs" in place since 2010[12]. The beet clubs ´ main goal is to create an in-house ability to choose the best practices to adopt but also to use and diffuse new knowledge and advice without overly relying on external help. This means that the clubs oversee the channelling of new practices, research results and agronomic advice through the cooperative network, thus helping the other farmers to adjust to market and climate disturbances. For this reason, the clubs include those farmers who are better equipped to acquire new skills and have the means and authority to circulate the new knowledge effectively (i.e. the farmers with higher educational levels who are steeped in their agricultural traditions and with farms of a size lending them to innovation).

(7) Source: https://www.cibe-europe.eu/Bioeconomy

(8) https://www.bbi-europe.eu/

(9) http://www.sustainablesugar.eu/

(10) http://www.coprob.com/

(11) Source; http://www.coprob.com/filiera/

(12) http://www.coprob.com/club-della-bietola/

The other climate adaptation measure concerns the increase in the number of agronomists (from 14 to 24 following a deal made with the fertiliser company Timac[13]) who can swiftly intervene on site, for instance to advise on measures to adopt in case of unexpected climatic disturbances. This partnership innovation is critical to support the continuous adaptation of several aspects, such as the choice of seeds that are better suited to survive uncertain climatic conditions. The beet clubs help to disseminate the agronomists´ advice throughout the territory.

COPROB has used different funding sources to support the climate transition. For the training of farmers, the cooperative used regional funding. The farmers located in Emilia Romagna and Marche have also received RDP funding through Measure 11 (organic agriculture). The farmers who decided to join the organic production project received a funding of 180 to 320 euro/ha. Additionally, RDP funding through Measure 1.1 (Knowlegde Transfer and Advisory Services - Vocational training and skills acquisition actions) and Measures 16.1 and 16.2 (EIP Operational Groups; Pilot Projects) has been mobilised for two projects run by COPROB (BET BIO VENETO and BET BIO EMILIA ROMAGNA). The two projects' budgets together amount to slightly more than 700.000 euros. The projects aimed at testing measures to increase the yield from land under organic production while ensuring their sustainability. [14]

To conclude, the Italian case focused on increasing the value of traditional products while adapting to climate change rather than on product diversification. Also noteworthy are the interconnected adaptation measures implemented by the beet clubs and the number of on-site agronomists that accelerate farmers´ ability to adjust to new conditions. This approach is in line with the whole approach of Italian agriculture that tends to valorise existing products and production lines rather than invest in new activities or value chains.

## The case of Suiker Unie (Cosun) in the Netherlands

In 2007, Suiker Unie[15] became the only sugarbeet cooperative in the Netherlands. Suiker Unie is a member of Royal Cosun[16], a cooperative of more than 9 000 sugarbeet growers across the globe with a sugar production capacity of 1.42 million tonnes and a sugarbeet area of 90 000 ha.

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Suiker Unie aims to become 100% plant-based and circular by 2030 and is one of the greenest and most innovative stakeholders of the sugar/beet sector in the world. Suiker Unie's core values are those of cooperation and environmental sustainability, which translate in their investments in building new networks, green techniques and producing more sustainable products. In fact, the portfolio of bioproducts is rather diversified. Besides sugar production, the side streams and residual flows from sucrose production are processed into protein (green leaves), biofuels such as biogas and bioethanol (molasses and beet pulp), feed (cossettes resulting from sugar extraction), baking yeast-citric acid-yeast extracts (molasses) and household detergents-personal care products[17]. They also produce a fertilizer called Betacal, which is produced with a mix of carbonate of lime and organic residuals from the sugar beet.[18]

The cooperative's most innovative action concerns product innovation. All the side streams/residual flows from sucrose production are processed into animal feed, biogas or biobased products. Suiker Unie has developed several bio-based products, such as Betafib® (a natural thickener); Carboxyline® (a scale inhibitor for cleaning products); Quatin® (used as softener and conditioner); BetaBind® (multi-purpose moisturiser), and has put the circularity of the sugarbeet at the core of its business. Additionally, Suiker Unie's 2020 target is a 40% reduction of its $CO_2$ footprint compared to 1990[19]. This target has also led to investments in biogas and biomethane production, primarily used as fuel in tractors and trucks. In Germany Suiker Unie also produces bioethanol.

Suiker Unie also adopts innovative solutions in sugarbeet production, such as precision agriculture, remote sensing and satellite data to identify the best and more sustainable interventions and to prevent the excessive or unnecessary use of pesticides. Another form of process innovation consists of the reuse of steam produced during the beet boiling phase as a source of energy supply in the processing plant.

(13) http://www.timacagro.it/
(14) http://www.coprob.com/news/psr-veneto-betbio/
(15) https://www.suikerunie.com/
(16) https://www.cosun.com/
(17) https://www.suikerunie.com/products/
(18) https://www.suikerunie.com/products/betacal
(19) https://www.suikerunie.com/sustainability/facts-figures


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Concerning organisational innovation, Suiker Unie seeks to build networks and collaboration with other stakeholders. For instance, Suiker Unie recently signed a covenant with the local government to formalise the collaboration with Naturalis (a biodiversity centre) to increase the cooperative's engagement in environmentally friendly solutions such as circular agriculture and the greening of the living environment. At the same time, and similarly to the Italian case, Suiker Unie has set up an advisory system that provides tailor made advice to farmers and where the farmers with the most abundant yields help those with the smallest yields. Farmers receive a report, benchmarking them on how they perform regionally and nationally. They are advised on what seeds they should buy based on the history of the land, the type of soil and the types of diseases and climate, thus supporting both climate change mitigation and adaptation in addition to economic resilience.

Suiker Unie has used EU funding from the Bio-based Industries Joint Undertaking (BBJ JU)[20] on pilot projects such as the demonstration project "Pulp2Value"[21] for the valorisation of sugarbeet pulp (seven partners were involved from Belgium, Germany, the Netherlands and the UK). Another example is the new project on green proteins from sugar beat leaves (GreenProtein[22]). The BBI JU funds the project under the Horizon 2020 Framework Programme. The project developed a technology to make the protein profitable and marketable. It can be used as a food ingredient in new vegan and vegetarian products (milk-free yoghurt, vegan meat etc.), and has excellent properties for human nutrition in general.

A pilot plant was established in Dinterloord (NL) for the extraction and purification of the RuBisCo protein isolate[23]. The pilot plant has been operating since 2019. It has a vegetable residue processing capacity of 1 500 kg/hour, rendering 28 kg of dry RuBisCo[24]. The production method contributes to the global transition towards vegetable proteins and to the increased use of the sugarbeet biomass potential. The project will also help the Netherlands and the EU to achieve the Green Deal climate objectives and contribute to reducing the EU's dependence on protein from third countries.

## Lessons learned

Whereas the context and approaches to the low-carbon climate transition in the sugarbeet sector vary greatly between different EU countries, several lessons can be drawn from the two cases.

Firstly, we can see that each case has evolved according to the climate, the structural conditions of the sugarbeet sector and the approach to innovation in the agricultural sector. For instance, in the Italian case, the low-carbon transition in the sugarbeet sector has capitalised on tradition, the quality of local food products, and climate adaptation actions (e.g. strengthening farmers´ collaboration and knowledge dissemination), as is the case with the rest of Italian agriculture. Thus, COPROB´s innovations are anchored in low-tech forms of innovation and organisational innovations. An example of this is the production of organic sugar to answer consumer demand. In contrast, in the Suiker Unie case, the low-carbon transition is based on highly innovative solutions, particularly concerning product innovations. This can be explained by the national policy push to become a highly environmentally friendly country and increasethe share (or importance) of sugarbeet production in the agricultural sector.

Secondly, it is interesting to note that the sugarbeet farmers of COPROB benefited from RDP funding for the climate transition (measures 11, 1 and 16), while Suiker Unie mostly used H2020 funding, primarily through BBJ JU calls, in line with its strong innovative capacity. This difference could be linked to the differing approaches to innovation and goals of the two cases.

Third and lastly, as the two cases have demonstrated, it is crucial to invest in new knowledge production and knowledge sharing to tackle the unpredictable disturbances of climate change and become more resilient to its effects. Additionally, and in line with the previous point, interventions could focus on social inclusion. The Suiker Unie case demonstrates that the inclusion of different stakeholders (including organisations working on biodiversity and environmental sustainability) can help increase the fulfilment of environmental sustainability goals by capitalising on a diverse set of skills and networks.

(20) https://www.bbi-europe.eu/

(21) http://pulp2value.eu/

(22) http://greenproteinproject.eu/

(23) In December 2008, Suiker Unie aquired Green Protein B.V. based in Wageningen (NL). Green protein B.V developed a process to extract the protein RuBisCo from green leaves.

(24) http://greenproteinproject.eu/2019/10/03/greenprotein-general-assembly-demoplant-part1/





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