



LIFE Project Number

<LIFE16 ENV/IT/000225>

Final Report

Covering the project activities from 03/07/2017¹ to 30/06/2022

Reporting Date²

<30/09/2022>

LIFE PROJECT NAME or Acronym

LIFE The Tough Get Going

Data Project

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Project end date:	30/06/2021 Extension date: 30/06/2022
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(%) of eligible costs:	100%

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¹ Project start date

² Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

This table comprises an essential part of the report and should be filled in before submission

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Obligatory elements	✓ or N/A
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The correct latest template for the type of project (e.g., traditional) has been followed and all sections have been filled in, in English <i>In electronic version only</i>	✓
Index of deliverables with short description annexed, in English <i>In electronic version only</i>	✓
<u>Final report</u> : Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English <i>In electronic version only</i>	✓
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Consolidated Financial Statement with all 5 forms duly filled in and signed and dated <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)</i>	✓
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Amounts, names and other data (e.g., bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	✓
Beneficiary's certificate for Durable Goods included (if required, i.e., beneficiaries claiming 100% cost for durable goods) <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)</i>	N/A
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Instructions:

Please refer to the General Conditions annexed to your grant agreement for the contractual requirements concerning a Mid-term/Final Report.

Both Mid-term and Final Reports shall report on progress from the project start-date. The Final Report must be submitted to the CINEA no later than 3 months after the project end date.

Please follow the reporting instructions concerning your technical report, deliverables and financial report that are described in the document “Guidance on how to report on your LIFE 2014-2020 project”, available on the LIFE website at: http://ec.europa.eu/environment/life/toolkit/pmtools/life2014_2020/documents/how_to_report_on_your_lifeproject.pdf. Please check if you have the latest version of the guidance as it is regularly updated. Additional guidance concerning deliverables, including the layman’s report and after-LIFE plan, are given at the end of this reporting template.

Regarding the length of your report, try to adhere to the suggested number of pages while providing all the required information as described in the guidance per section within this template.

Table of contents

List of keywords and abbreviations.....	6
Executive summary	7
Introduction	9
Administrative part.....	11
Technical part.....	12
Technical progress, per action.....	12
Action B1 - Data collection and analysis	12
Action B2 - Development of the design tool for LCA and emission reduction initiatives ..	14
Action B3 - Communication Design Model for Packaging System Design	14
Action B4 - PEF reduction measures	16
Action B5 - Environmental Decision Support System (EDSS) software development...	17
Action B6 - Transfer of the results to other PDO	19
Action B7 - EDSS tests on French PDOs	20
Action C1 - Monitoring of the project impact.....	22
Action D1 - Consumers Engagement.....	22
Action D2 - Dissemination and awareness-raising to other stakeholders.....	23
Action D3 – Networking	24
Action E1 - Project management, monitoring, and contingencies plan	25
Action E2 – After LIFE plan.....	25
Main deviations, problems and corrective actions implemented	26
Evaluation of project implementation	27
Analysis of benefits	33
Environmental benefits	33
Economic benefits	36
Social benefits	36
Best Practice lessons	37
Innovation and demonstration value	38
Policy implications.....	38
Key Project-level Indicators.....	42
Comments on the financial report	44
Summary of Costs Incurred.....	44
Accounting system	44
Certificate on the financial statement.....	48
Estimation of person-days used per action.....	48
Annex	49

List of Tables

Table 1. Relevant and general activities implemented.....	24
Table 2. List of Consortia to be involved.....	26
Table 3. Action evaluations.....	27
Table 4. GHG emissions	Errore. Il segnalibro non è definito.
Table 5. Benefits at the end of the project.....	34
Table 6. Benefits beyond 3 years	34
Table 7. Benefits from raw milk production	35
Table 8. Improved water quality	35
Table 9: Key Project-level Indicators (KPIs)	42
Table 10: Project costs from 03/07/2017 to 30/06/2022	44
Table 11: Code identifying the project costs in the analytical accounting system.....	45
Table 12: budgeted person-days by group of actions.....	48
Table 13. List of annexes	49

Table of Figures

Figure 1. Login pages for Grana Padano and Comté consortia.....	7
Figure 2. Governance system	11
Figure 3. Computational structure.....	14
Figure 4. Final label, three proposals of text message	15
Figure 5. Environmental footprint reduction strategies for packaging	16
Figure 6. Ranking of all the PEFMRs	17
Figure 7. Login pages for Grana Padano and Comté consortia.....	18
Figure 8. Energy audit for Fruitière de Desnes	21
Figure 9. Solution for dairy plants	36
Figure 10. Economic benefits by the EDSS	36
Figure 11. Solutions for (a) farms, (b) dairies, and ripeners	37

List of keywords and abbreviations

AC: Administrative coordinator

C2M: Close to Market

CIGC: Comité Interprofessionnel de Gestion du Comté

CIP: Cleaning in Place

CTFGP: Consorzio Tutela del Formaggio Grana Padano

DE: Digestible Energy

DENG: Department of Energy

DES: Department of Design

DHW: Domestic Hot Water

DQR: Data Quality Requirement

CINEA: European Climate, Infrastructure and Environment Executive Agency

EC: European Commission

EF: Environmental Footprint

EDSS: Environmental Decision Support System

GHG: Green House Gas

GP: Grana Padano

ILCD: International reference Life Cycle Data System

KPI: Key Performance Indicator

LCA: Life Cycle Assessment

PEF: Product Environmental Footprint

PEFCR: Product Environmental Footprint Category Rules

POLIMI: Politecnico di Milano

PDO: Protected Designation of Origin

PGI: Protected Geographical Indication

OPC: Overall Project Coordinator

SC: Steering Committee

SMEs: Small and medium-sized enterprises

TAB: Technical Advisory Board

UCSC: Università Cattolica del Sacro Cuore

WTG: Working Technical Group

Executive summary

The project's main objective, i.e., the realization of software that operates as an Environmental Decision Support System (EDSS), was achieved. The software and the databases produced and used by the EDSS for the two Product Designation of Origin (PDO) cheeses, Grana Padano and Comté, were verified by an independent third party ([ecoinnovazione srl](#)) in conformity with the minimum entry-level requirements of the International Reference Life Cycle Data System (ILCD) data network. The Joint Research Centre (JRC) – European Commission will publish the datasets as soon as possible. Furthermore, the same software was validated by a second body ([CSQA Certificazioni srl](#)) in compliance with the requirements of the Product Environmental Footprint methodology promoted by the European Commission. As a final piece of evidence, we would like to point out that the model is being replicated from July 2022 on two other Italian entities, the [Consorzio del Prosciutto Crudo di Parma PDO](#) and the [Consorzio del Formaggio Asiago PDO](#). New contracts for replicating the calculation model on other realities will be signed in the coming years, thanks to the business model and the communication plan described in action E2.

Figure 1 shows the login pages created for the two main Consortia evaluated in the project. The login pages are easily accessible at the following web links, click here for [Grana Padano](#) and here for [Comté](#).



Figure 1. Login pages for Grana Padano and Comté consortia

The authors easily add to the outstanding result just described that the beneficiaries of the LIFE The Tough Get Going project (LIFE TTGG) concluded all the targets in terms of deliverables and milestones declared in the proposals. As proof, the technical part description and the Annex report all the deliverables and milestones foreseen during the project writing in 2016.

In conjunction, the authors state that the overall project coordination and administration started in July 2017 with the writing of the deliverable “Monitoring protocol and contingencies plan” worked as expected. The overall goal of the document was to provide efficient coordination and management for all actions planned in order to reach the set targets in terms of foreseen results and budget.

Deviations and problems encountered during project execution can be summarized as follows:

- delays related to the software implementation concerning what was budgeted in the tender phase can be attributed to the complication in carrying out the software house

selection call. This delay led to the request for a 1-year extension of the project. However, the activities were all completed as foreseen;

- delays related to the completion of the Life Cycle Inventory (LCI) dataset for the two PDO consortia are linked to the Covid pandemic that broke out in 2020, causing problems in collecting data in the field. Again, the activities were completed as foreseen;
- due to the Covid-19 pandemic, the action B7 was rescheduled. In the proposal stage, 1 or 2 Consortia and 3 manufacturers (dairy plants) were planned to visit and audited. By the communication from 23.10.2020, the activities were moved to Italy, involving 2 Consortia (Provolone Valpadana and Asiago) and 4 manufacturers (PLAC, Latterie Vicentine, Latterie Venete, and Caseificio casona di Pozzoleone). The choice of this rescheduling was justified by the entry of the Asiago consortium into the business model related to post-project activities (after LIFE plan), as previously mentioned.
- the Covid pandemic also created changes regarding actions B3 and D1 related to consumer involvement. Surveys under activity B3 were conducted online, while dissemination activities of the results in the D1 were conducted through a press campaign on social media and magazines instead of physical events (participation in trade fairs, etc.).

As a final point to be emphasized regarding the problems encountered, it should be noted that the Comté consortium (not a beneficiary of the project) in February 2022, after the presentation of the results obtained (analysis carried out by CNIEL partner), decided not to make the results public. Therefore, the dissemination activities foreseen in action B7 were partially completed. This decision resulted in lower budget expenditure for the CNIEL than that budgeted at the proposal stage (see the dedicated section). It is essential to underline that neither deliverables nor milestones were foreseen for the dissemination activity of the results in France. Still, the Key Performance Indicators (KPIs) declared concerning the achievement of stakeholders and consumers were all largely met. Thus, all the technical targets foreseen are however achieved.

Introduction

To limit global warming, in the coming decades, the reduction of Greenhouse Gas (GHG) emissions will have to be substantial and should cover all productive sectors. In this regard, the energy sector holds the main responsibility for direct global emissions, while the agricultural sector is responsible for 10-12% of total GHG emissions worldwide³. Based on actual population growth projections, food consumption will increase, and the GHG emissions from agricultural activities will rise without action⁴.

The European dairy sector represents one of the principal players globally in terms of importation and exportation. It is a crucial creator of wealth and jobs in the European Union. However, if we consider its environmental impacts, GHG emissions, water consumption, land use, etc., should not be underestimated⁵. In particular, the sector plays an essential role in GHG emissions; 37% of emissions of the agricultural footprint are caused by enteric fermentation⁶.

Solutions are needed to improve cheeses' supply chain efficiency and to analyze and reduce their environmental footprint. More sustainable production and consumption are achievable only by considering the whole supply chain of products, including waste management. According to the United Nations Environment Programme (UNEP), the waste of food products for human consumption touches very high percentages, and up to one-third of edible food produced is lost every year⁷. The European Commission sets aspiring targets to reduce GHG emissions and environmental degradation as a part of the European Green Deal. In line with the Farm to Fork strategy, the heart of the European Green Deal, the project LIFE 16 ENV/IT/000225 - LIFE The Tough Get Going (meaning "tough" the hard and semi-hard cheeses covered by the project) arises from the collaboration among universities, start-ups, manufacturing companies, Italian and French institutions, and research organizations. Through this synergy, the partners aim to improve the cheese production processes efficiency of Grana Padano and Comté, transfer the findings to Europe, reduce environmental impact, and thus achieve more sustainable

³ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

⁴ Tilman D., Clark M., 2014 - Global diets link environmental sustainability and human health. *Nature* volume 515, pages 518–522 (27 November 2014).

⁵ Fantin, Valentina & Buttol, Patrizia & Pergreffi, Roberto & Masoni, Paolo. (2012). Life cycle assessment of Italian high quality milk production. A comparison with an EPD study. *Journal of Cleaner Production*. 28. 150-159. 10.1016/j.jclepro.2011.10.017.

⁶ Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G. 2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome.

⁷ UNEP, 2022. Worldwide food waste [WWW Document]. URL <https://www.unep.org/thinkeatsave/get-informed/worldwide-food-waste#:~:text=Roughly one-third of the,tonnes - gets lost or wasted>.

production and consumption. Italy and France are significant European cheese producers (France takes second place after Germany, and Italy takes sixth place after Germany, France, the UK, Poland, and the Netherlands). In this context, Grana Padano and Comté undoubtedly are vital representatives of the two countries concerning Protected Designation of Origin (PDO) productions.

As well-known, Life cycle assessment (LCA) is increasingly required representing one of the reference methods for the European environmental policies and helps in analyzing supply chains to achieve environmental sustainability objectives. It consists of a comprehensive analysis that accounts for the material and energy inputs and emissions associated with each stage of a product life cycle, from resource extraction through processing to final use and disposal, to assess the environmental load quantified on specific impact categories. The European Commission, since 2013, has developed its LCA method called Environmental Footprint.

The authors in this project proposed a tangible tool (an Environmental Decision Support System software - EDSS) that will allow: i) the calculation of the environmental footprint; ii) comparison with an average performance at the Consortium level (benchmark); iii) the management of activity and environmental data at the consortium level, allowing data processing and monitoring over time, and they also propose solutions for the efficiency of the supply chain. Two different third party entities validated the EDSS software and thus can be declared PEF compliant. The EDSS software is the only software on the market that aggregates and interconnects the various production phases of PDO and PGI products, assesses the environmental profile according to the European PEF method, proposes supply chain efficiency solutions, and allows the comparison of one's own business reality with a dynamic benchmark (which updates over time) representative of one's own consortium. The software results from extensive data collection and processing through dedicated instrumentation on a representative sample of companies belonging to the Grana Padano and Comté cheese production chain.

During the five years of the project, the LIFE TTGG consortium contributed to:

- establishing resource efficiency practices in Small and Medium Enterprises;
- testing and developing solutions to apply the EF methodology to PDO products;
- developing Life Cycle Inventories focus on Grana Padano and Comté that contributes to “data availability, quality, and traceability”;
- an EDSS software that will simplify PEF methodologies calculation;
- the EDSS contributes to implementing the best available techniques in farms, dairies, and packers, providing specific solutions at the consortium level.

Administrative part

As described in the deliverable E1.1 (Monitoring protocol and contingencies plan), the project was managed both by Prof. Mario Motta (as an overall project coordinator - OPC) and Andrea Papoff (as administrative coordinator – AC) from Polimi. Two bodies compose the governance system of the project: the Steering Committee (SC) and the Working Technical Group (WTG). Figure 2 shows how the governance system work.

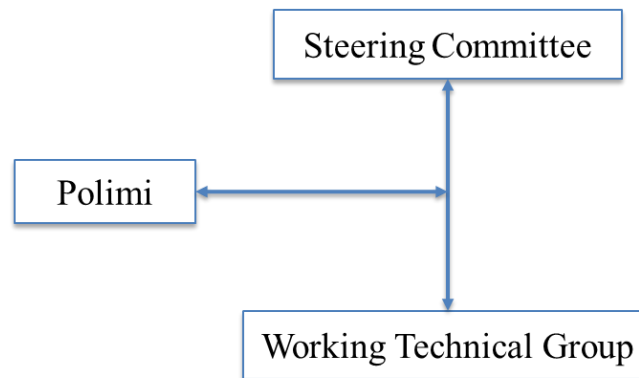


Figure 2. Governance system

SC is composed of members representing the partners of the project. WTG is formed by the OPC (or his delegate) and at least a technical expert of each partner.

The WTG met mainly via IT platforms (i.e., Microsoft Teams, Skype, and Zoom) for Covid pandemic reasons.

Concerning the communications with the Agency and the Monitoring team, it is essential to emphasize that a brief update on the project was provided by Polimi monthly to the Monitoring team (Ms Chiara Spotorno and Eng. Lorenzo Mengali).

As stated in the Grant Agreement, the beneficiary coordinator also offered official communications for the progress and mid-term submissions to the Agency. In particular, Polimi provided:

- the grant agreement signed on the 9 June 2017;
- three progress reports on 20 December 2018, .05 March 2021, and 01 March 2022;
- the Mid-term report on the 24 June 2019.

In addition, the annual monitoring visits were carried out as detailed below.

- 18 February 2018;
- 19 and 20 February 2019;
- 25 June 2020;
- 19 and 20 May 2021;
- 15 and 16 June 2022.

On the 11 March 2021 was submitted an amendment request for an extension of the project duration of 12 months was necessary to allow the completion of the planned activities. The request was justified and accepted by CINEA due to delays in some activities caused by the Covid-19 pandemic. The activities affected by delays were actions B1, B7, B2, and B5.

Technical part

This section describes the technical part of the project indicating the actions implemented, main deviations, problems, and corrective actions applied, the final evaluation of the project, and the analysis of benefits.

Technical progress, per action

The project area consists of 13 project sub-areas (actions). Below is a short description of them and the activities undertaken during project implementation.

Action B1 - Data collection and analysis

Foreseen start date: III/2017

Actual start date: July 2017

Foreseen end date: II/2019

Actual end date: June 2022

Action B1 was one of the most significant actions of the project. The data collection along the production chain of Grana Padano allows Polimi and UCSC to define the average benchmark. The data collection was divided into 3 phases and involved the following number of companies:

- 67 dairy farms;
- 20 dairies and ripeners;
- and 18 packagers.

The data sampling and the data collection complied with the Product Environmental Footprint Category Rules for dairy products elaborated by the European dairy Association (EDA) during the Product Environmental Footprint (PEF) programme. The activity produced 8 datasets:

- cow milk for Grana Padano PDO cheese-making, average milk production, at farm; per kg FPCM;
- cow milk for Trentingrana PDO cheese-making, average milk production, at farm; per kg FPCM;
- cow milk in the Grana Padano PDO cheese-making area, average milk production, at farm; per kg FPCM;
- raw milk transformation and cheese ripening (9 months) for Grana Padano PDO in high production dairy; average dairy processing, at plant; per kg;
- raw milk transformation and cheese ripening (9 months) for Grana Padano PDO in low production dairy; average dairy processing, at plant; per kg;
- raw milk transformation and cheese ripening (9 months) for Grana Padano PDO in average production dairy; average dairy processing, at plant; per kg;
- cheese packaging for Grana Padano PDO; average packaging process, at plant; per kg;
- the life cycle of Grana Padano PDO cheese in average production dairy plant and in average primary packaging typology, in supply chain; per kg.

The datasets were validated in compliance with the entry-level requirements of the ILCD data network by an independent external reviewer (Alessandra Zamagni, Ecoinnovazione Srl).

ILCD datasets were created to ensure broad compatibility and enable comprehensive datasets documentation. The publication of data inventories requires detailed metadata following minimum requirements for their realization. The guidelines on the website were used to carry out this task ([click here](#)).

The procedure for creating the System (S) file in SimaPro was carried out, proceeding to the extraction of the dataset realized utilizing a special mapping file. This procedure was done for the eight inventories produced within the LIFE TTGG project. The realization of the metadata file for the dataset that was exported reports errors linked to flows and, in particular, to two indicators: water scarcity and land use. These errors occur when reading the inventory metadata file created with the software made available by the Joint Research Centre (JRC) - European Commission: look@. To overcome these errors, the manual for creating mapping files was used: *How to Export from SimaPro to ILCD packages. A Guide for SimaPro 9*. These guidelines provide the correct instructions for downloading and using special software, “Notepad++”, to replace streams that are not visible or contain read errors. Errors can be defined in two types:

- occasional error streams, i.e., they must be corrected manually (less than 10);
- systematic error streams, i.e., affecting the water scarcity indicator for all stages of the supply chain. At the same time, the land use indicator for the milk production stage (these errors accounted higher than 100).

A special tool (ILCD format validation Soda4LCA) was used for occasional error streams to replace erroneous UUIDs concerning the reference mapping file.

For systematic error flows, the JRC was contacted. In particular, there were exchanges of e-mails with Simone Fazio to develop a special software capable of solving this problem. The errors have not yet been resolved, so it is currently impossible to view the datasets via the look@ software.

Deliverable #1 contains the eight review reports validated by Ecoinnovazione S.r.l., while Annex – “Results concerning the 8 datasets” shows the eight datasets' characterized and weighted environmental impacts.

Linked with the action were two deliverables and two milestones:

- Deliverable #1. LCI database. The LCI will produce primary data to be implemented in ILCD Data Network following the Compliance rules and entry-level requirements;
- Deliverable #2. Guidelines on LCI database adaptation;
- Milestone #1. Development of the LCI database that will be implemented in the software;
- Milestone #2. LCI database completion.

Additional/information: see the Annex.

Delays: delays related to the completion of the Life Cycle Inventory (LCI) dataset are linked to the Covid pandemic that broke out in 2020, causing problems in collecting data in the field. The activities were completed as foreseen.

Action B2 - Development of the design tool for LCA and emission reduction initiatives

Foreseen start date: II/2018

Actual start date: April 2018

Foreseen end date: IV/2020

Actual end date: March 2022

The aims of the action were: i) identify different processes of EU PDO hard and semi-hard cheeses production and their possible alternative solutions, ii) computerize a checklist encompassing each phase; and iii) create the technology and biosphere matrix as indicated by Heijungs, R., Suh, S., 2002 in the Computational Structure of Life Cycle Assessment. Springer-Science + Business Media, B.V..

Based on the data collected in Actions B.1 and B.7, were identified and listed the main processes involved in the production of hard and semi-hard cheeses. The processes were schematized in unit processes and linked with corresponding commercial datasets.

In the deliverable B2.1, "Life Cycle Impact Assessment (LCIA)", the computational structure for farms, milk processing, and packaging was provided. Figure 3 shows the computational structure adopted.

Life Cycle Assessment (LCA) model

$$\begin{array}{c}
 \text{Impacts} \begin{bmatrix} \vdots \\ \vdots \end{bmatrix} = \text{Impact categories} \begin{bmatrix} \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \end{bmatrix} * \text{Env. flows} \begin{bmatrix} \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \end{bmatrix} * \text{Activities} \begin{bmatrix} \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \\ \vdots & \dots & \vdots \end{bmatrix} * \text{Products} \begin{bmatrix} \vdots & \dots & \vdots & \dots \\ \vdots & \dots & \vdots & \dots \\ \vdots & \dots & \vdots & \dots \\ \vdots & \dots & \vdots & \dots \end{bmatrix}^{-1} * \text{Products} \begin{bmatrix} \vdots \\ \vdots \\ \vdots \end{bmatrix} \\
 \text{Scores (h)} \quad \text{Characterization (C)} \quad \text{Biosphere (B)} \quad \text{Technosphere (A}^{-1}\text{)} \quad \text{Demand (f)}
 \end{array}$$

Figure 3. Computational structure

In deliverable B2.2, called "Report on the LCIA tool and Life Cycle Impact Assessment (LCIA) description" the Template sheets representing the sheet used by the user to insert the data collected according to the specific life cycle phase were explained together with the presentation of the results (tables, charts, etc.).

Additional/information: see the Annex.

Variation: none.

Action B3 - Communication Design Model for Packaging System Design

Foreseen start date: I/2019

Actual start date: March 2018

Foreseen end date: IV/2020

Actual end date: August 2020

The research activity focuses on translating and transferring the Product Environmental Footprint index on the packaging. The focus is on the communication role of packaging in designing a cross-communication system.

Starting from September 2018, the activity was articulated in the following points: desk research and communicative potential to identify the definition of the architecture of the communicative system (i.e., objectives, tools, contents, and communicative strategies). Thanks to the outcomes of these two tasks, the visual identity was created, proposing three hypotheses for labeling. Figure 4 shows the final label developed, where three different text messages are displayed.



Figure 4. Final label, three proposals of text message

The label created was tested on Grana Padano packaging, developing a maquette, mock-up, and aesthetic prototype. Finally, a report on packaging communication system design was realized. In order to write the report, a workshop and a pool survey online were organized.

Based on the results of Action B1, it was possible to identify the most important improvement actions to reduce the environmental footprint through packaging. The PEF Reduction Measures (EDSS Sheets) were then made available through the EDSS software. Figure 5 shows the strategies for reducing the environmental footprint, with respect to the type of intervention (product or communication) and the subject involved (packager or consumer).

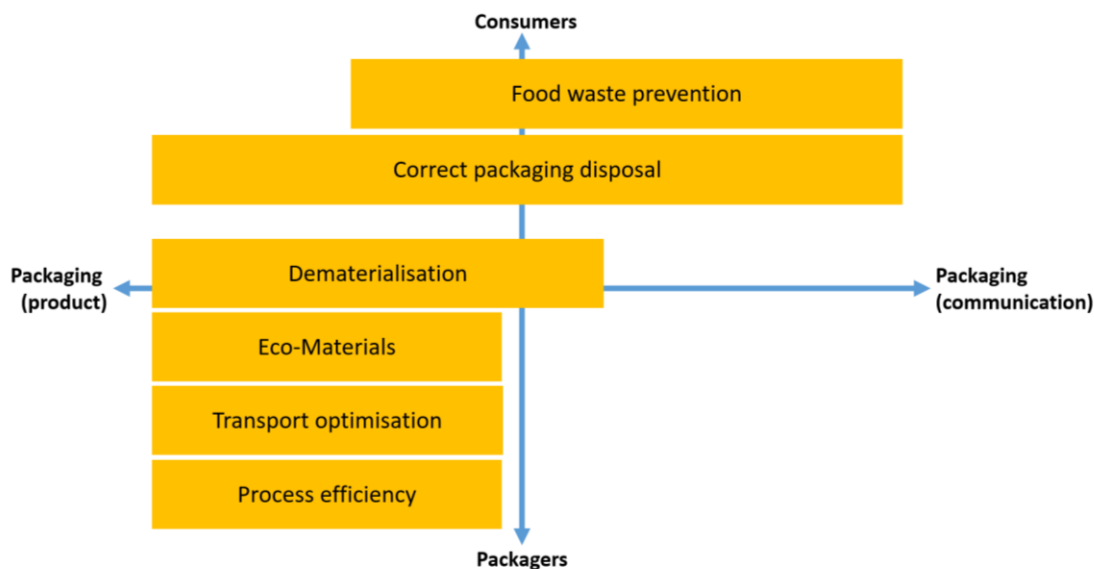


Figure 5. Environmental footprint reduction strategies for packaging

Linked with the action were five deliverables and one milestone:

- Deliverable #1. Dossier with visual maps;
- Deliverable #2. Maps and Moodboards;
- Deliverable #3. Signs and rules for the PEF identity;
- Deliverable #4. Maquette, mock-up, aesthetic prototype;
- Deliverable #5. Report Packaging communication system design.
- Milestone #1. EDSS sheets.

Additional/information: see the Annex.

Variation: the deliverable “PEF reduction measures: EDSS sheets” had the same name as the Deliverable of Action B4. This was a mistake in the action sheet drafting. Thus, we change the deliverable name in “signs and rules for the PEF identity” to have greater consistency with the associated activities. The Covid pandemic also created changes regarding actions B3 related to consumer involvement. Surveys under activity B3 were conducted online.

Action B4 - PEF reduction measures

Foreseen start date: I/2018

Actual start date: September 2017

Foreseen end date: II/2020

Actual end date: December 2021

Action B4 was a significant action of the project. The B4 aimed to define solutions for improving the PDO cheese supply chains and integrate them into the EDSS software.

The first task was to conduct site visits to define the main contributors to the environmental impact of farms, dairies, and ripeners. After determining the main contributors, the reduction measures were listed and classified qualitatively. After the classification, each Product Environmental Footprint Reduction Measure (PEFRM) was associated with a quantitative description. Figure 6 shows how all the PEFRMs were ranked quantitatively, compared between their potential environmental profile reduction and ease of

implementation. The ranking described in the figure was adopted in the EDSS in order to propose each solution to the final user.

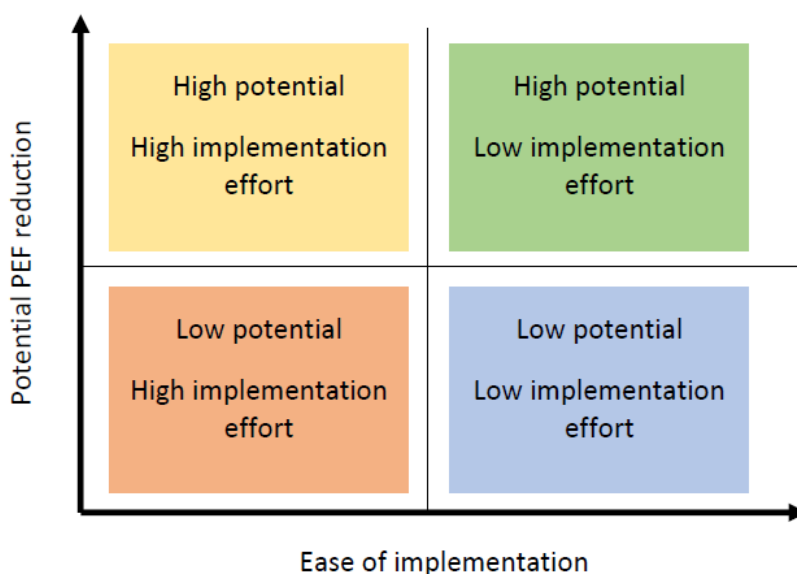


Figure 6. Ranking of all the PEFMRs

The main results of the activity were summarized in a document translated into four languages (Italian, English, French, and Spanish) shared during the workshops organized by the project team to stakeholders and policymakers.

All the activities described are reported in four deliverables, called:

- Audit description and results;
- PEF reduction measures: description;
- PEF reduction measures: EDSS sheets;
- Summary report "PEF reduction measures: description".

The only milestone of the action was also reached; all the companies declared in the proposal were audited. In total, 67 farms, 20 dairies of Grana Padano, and 8 dairies abroad (4 in France - Abondance and Beaufort consortia, 2 in Spain – Mahón Menorca consortium, and 2 in the UK - Stilton cheese consortium). The feasibility of the measured proposed can be reconducted with the positive feedback from 4 companies that decided to implement some actions, as described in the section “Environmental benefits”.

Additional/information: see the Annex.

Variation: none.

Action B5 - Environmental Decision Support System (EDSS) software development

Foreseen start date: I/2019

Actual start date: January 2019

Foreseen end date: I/2021

Actual end date: June 2022

This action was entirely dedicated to developing an “Environmental Decision Support System (EDSS) software”. Action B5 represents the most important action of the project,

in which results achieved in actions B1, B2, B4, and B7 are combined to create the most relevant project output. The activities were conducted following the steps reported here:

- defining the functionalities of the EDSS software;
- describing the wireframe used to plan the mock-up of the software;
- software implementation;
- testing of the software by sharing functionalities with industry technicians;
- software modification by the feedback of the previous point and realization of the final version;
- validation by a third independent entity in compliance with the requirements of the Product Environmental Footprint methodology promoted by the European Commission;
- release of software user manual and technical documentation.

Figure 7 shows the login pages created for the two main Consortia evaluated in the project. The login pages are easily accessible at the following web links, click here for [Grana Padano](#) and [Comté](#).



Figure 7. Login pages for Grana Padano and Comté consortia

The action involved 5 external experts/companies. The external assistances were carried out concerning the development of the frontend (graphic interface and definition of functionalities), the definition of the backend and its implementation, support in the development of the backend, and validation.

Linked with the action were five deliverables and one milestone:

- Deliverable #1. Requirements specification document;
- Deliverable #2. Software design documentation;
- Deliverable #3. Release alpha version of the software;
- Deliverable #4. Release beta version of the software;
- Deliverable #5. Release final version of the software;
- Deliverable #6. Release of software user manual and technical documentation.
- Milestone #1. Alpha version of the software;
- Milestone #2. Software package.

The frontend of the software was tested involving three technicians from three different companies involved in the supply chain of Grana Padano: i) Santangiolina (for the farm phase), ii) Soresina (for the milk processing phase), and iii) Ferrari (for the packaging phase).

Additional/information: see the Annex.

Delays: delays related to the software implementation concerning what was budgeted in the tender phase can be attributed to the complication in carrying out the software house selection call. This delay led to the request for a 1-year extension of the project. However, the activities were all completed as foreseen.

Action B6 - Transfer of the results to other PDO

Foreseen start date: IV/2017

Actual start date: October 2017

Foreseen end date: II/2021

Actual end date: June 2022

The action foresaw two tasks, the first finalized at the end of 2018 and the second implemented between 2020 to 2022. During the first task, technical visits were carried out on four PDO consortia and eight dairies selected. In summary:

- France – Beaufort PDO. Cooperative laitiere de Haute Maurienne Vanoise and Cooperative latiere del a region de Moutiers;
- France – Abondance PDO. Fromagerie Chabert and Fromagerie Les Chenevifs;
- Spain - Mahón-Menorca PDO. Dalrit and Coinga;
- UK – Stilton PDO. Cropweel Bishop Creamery and Long Clawson Dairy.

The site visits were also an opportunity to present the project to the concerned Geographical Indication (GI) Groups, respectively: in France with “Association des Fromages Traditionnels des Alpes Savoyardes” (AFTA) which gathers seven PDO-PGI cheeses from Savoie region (Abondance, Beaufort, Chevrotin, Emmental de Savoie, Reblochon, Tome des Bauges, Tomme de Savoie); in Spain with “Consejo Regulador DO Mahón-Menorca”, in the UK with the Stilton cheese Makers Association and the UK Food Protected Names Association. An additional meeting to present the LIFE TTGG project took place in Sigriswil (Thun), Switzerland, with the representatives of Swiss PDO cheeses, who learned about the project through origIn and expressed interest in the project outcomes.

The second task of the project was implemented in 2020-2022. It consisted in organizing meetings with GI groups and relevant stakeholders of targeted countries (with an estimated average of 20 PDO representatives per meeting):

- 1 meeting in France;
- 1 meeting in Spain;
- 1 meeting in the United Kingdom (replacing The Netherlands);
- 2 meetings in Italy.

The scope of those meetings was to present the project outcomes and, in particular, to present the software developed to the EU PDO cheese producers not involved directly in the project, to ensure the replicability and transferability of project results beyond the PDO Grana Padano and increase the sustainability of the project itself by creating interest in the software.

We managed to overcome the impediments of the COVID-19 pandemic by using virtual platforms, mainly Zoom, and organized online events replacing physical meetings. It allowed the participation of a larger audience and reached a larger number of GI groups and relevant stakeholders to promote the software. Out of five events, four took place

online, and more than 400 representatives of GI groups, institutions dealing with GIs, and experts from all around the world were involved. In Italy, one of the two meetings foreseen was managed in person. It was organized in the framework of the international food fair CIBUS with the participation of some 50 GI group representatives. For more information, see Deliverable B.6.2.

Deliverables and milestones of the action:

- Deliverable #1. EU PDO Datasheets (collection of PDO products information and best practices);
- Deliverable #2. Transferability plan;
- Deliverable #3. Workshop material (Speakers' presentations, studies, etc.);
- Milestone #1. Data collection on the production processes;
- Milestone #2. Transferability plan;
- Milestone #3. Transfer of the project results to other PDOs at the EU level.

Variation: we experienced difficulties in finding 2 dairies available for the analysis of a Dutch PDO as initially indicated in the project proposal. Therefore, we could not include The Netherlands in the project. However, we identified 2 dairies of the PDO Stilton (United Kingdom). This change was communicated to and accepted by CINEA in 2018.

Unfortunately, in January 2020, the COVID-19 global outbreak exploded and strongly impacted the activities planned due to the stop to traveling and social distancing. We had to confront the impossibility of traveling and hosting events in person. The unprecedented situation forced us to rethink work and find new possibilities to bring the LIFE TTGG project activities forward, keeping visibility and impact on achieving the planned objectives. We managed to overcome the impediments of the COVID-19 pandemic by using virtual platforms, mainly Zoom, and organized online events replacing physical meetings.

Additional/information: see the Annex.

Action B7 - EDSS tests on French PDOs

Foreseen start date: III/2018

Actual start date: July 2018

Foreseen end date: II/2021

Actual end date: June 2022

The data collection along the production chain of the Comté consortium selected by CNIEL allows the project team to define the average benchmark and test the replication of the model developed for Grana Padano in other realities. The data collection was divided into 3 phases and involved the following number of companies:

- 29 dairy farms;
- 19 dairies;
- and 5 refiners.

6 of the 19 dairies were energy audited. Shows some pictures taken during the energy audit of the company "Fruitière de Desnes":



Figure 8. Energy audit for Fruitière de Desnes

The data sampling and the data collection complied with the Product Environmental Footprint Category Rules for dairy products elaborated by the European dairy Association (EDA) during the Product Environmental Footprint (PEF) programme. The activity produced 3 datasets:

- cow milk for Comté PDO cheese-making, average milk production, at farm; per kg FPCM (Fat Protein Corrected Milk);
- raw milk transformation for Comté PDO; average dairy processing, at plant; per kg;
- average cheese ripening for Comté PDO; average comté ripening, at plant; per kg.

The datasets were validated in compliance with the entry-level requirements of the ILCD data network by an independent external reviewer (Alessandra Zamagni, Ecoinnovazione Srl). ILCD datasets were created to ensure broad compatibility and enable comprehensive datasets documentation. The publication of data inventories requires detailed metadata following minimum requirements for their realization. The guidelines on the website were used to carry out this task ([click here](#)).

Two other tasks were developed thanks to activity B7. A test of the EDSS on other companies beyond the Grana Padano and Comté consortium was conducted. In this regard, three Italian dairies belonging to the Asiago PDO Consortium and one dairy of the Provolone Valpadana PDO consortium were audited to analyze the scalability of the EDSS. Using the data collected in action B6, the EDSS was also tested for the 8 dairies belonging to Abondance, Beaufort, Mahon Menorca, and Stilton. Finally, a report on the use of EDSS on other PDOs and guidelines for the supervisor activity for BM development were written.

Linked with the action were two deliverables and two milestones:

- Deliverable #1. LCI database. The LCI will produce primary data to be implemented in ILCD Data Network following the Compliance rules and entry-level requirements;
- Deliverable #2. EDSS test on other companies;
- Deliverable #3. Report on the use of EDSS on other PDOs (besides Grana Padano) and guidelines for the supervisor activity for BM development.
- Milestone #1. Report on the use of EDSS on other PDOs (besides Grana Padano) and guidelines for the supervisor activity for BM development.

Additional/information: see the Annex.

Delays: delays related to the completion of the Life Cycle Inventory (LCI) dataset are linked to the Covid pandemic that broke out in 2020, causing problems in collecting data in the field. The activities were completed as foreseen.

Variation: still, the Key Performance Indicators (KPIs) declared concerning the achievement of stakeholders and consumers were all largely met. Thus, all the technical targets foreseen are however achieved. Due to the Covid-19 pandemic, the action B7 was rescheduled. In the proposal stage, 1 or 2 Consortia and 3 manufacturers (dairy plants) were planned to visit and audited. By the communication from 23.10.2020, the activities were moved to Italy, involving 2 Consortia (Provolone Valpadana and Asiago) and 4 manufacturers (PLAC, Latterie Vicentine, Latterie Venete, and Caseificio casona di Pozzoleone). The choice of this rescheduling was justified by the entry of the Asiago consortium into the business model related to post-project activities (after LIFE plan), as previously mentioned.

Action C1 - Monitoring of the project impact

Foreseen start date: III/2017

Actual start date: July 2017

Foreseen end date: II/2021

Actual end date: June 2022

Monitoring activities were carried out periodically, every 6 months approximately. Eight deliverables were drafted and submitted in detail:

- Deliverable #1. Monitoring Protocol. It will include a description of the monitoring procedure and the monitoring indicators.
- Deliverable #2. Monitor Report released after one year from the beginning of the project.
- Deliverable #3, #4, and #5. Report on progress on performance indicators. At the time of the project, formal reporting: Progress report.
- Deliverable #6. Report on progress on performance indicators. At the time of the project, formal reporting: Mid-term report.
- Deliverable #7. Report on progress on performance indicators. At the time of the project, formal reporting: Final report.
- Deliverable #8. Extensive Monitoring Report: socio-economic and environmental impacts of the project.

Additional/information: see the Annex.

Action D1 - Consumers Engagement

Foreseen start date: III/2017

Actual start date: July 2017

Foreseen end date: II/2021

Actual (or anticipated) end date: June 2021

The activities engaged 1 407 106 consumers thanks to the following tasks implemented during the project:

- a specific website for the project was created (www.lifettgg.eu);
- a definition of a consumer engagement plan concerning communication strategy and program, working method, and a calendar for the consumer engagement activities;
- videos and TV appearances. In detail, three videos were produced, plus the project was presented during the TV program Slow Tour conducted by Patrizio Roversi on Rete 4 (one of the main TV channels of Italy);

- brochures. 4 400 brochures were designed and printed in three languages (ITA-ENG and FR-ENG). Digital versions of the brochures were also produced in four languages ITA-ENG, SP-ENG, and FR-ENG;
- web communication was created through the Grana Padano Protection Consortium website and on other selected websites;
- between 2021 and 2022, 31 articles were published in the main Italian magazines to disseminate the project results. Here below are listed the number of articles published per magazine. Besides, communication within other newspapers and magazines was implemented, such as: Terra&Vita, La Gazzetta di Mantova, Grana Padano Inseme, La Cucina Italiana; Giornale di Brescia. Unreported activities on the project but still had an impact on the final consumer.

Linked with the action were seven deliverables and one milestone:

- Deliverable #1. Project website;
- Deliverable #2. Video and brochure;
- Deliverable #3. Guidelines on consumers' engagement;
- Deliverable #4. Packaging test report and TV;
- Deliverable #5. Articles for magazines;
- Deliverable #6. Layman's report;
- Deliverable #7. Notice boards;
- Milestone #1. Lesson learned on consumers' engagement.

Additional/information: see the Annex.

Variation: the Covid pandemic also created changes regarding action D1 related to consumer involvement. Dissemination activities of the results were conducted through a press campaign on social media and magazines instead of physical events (participation in trade fairs, etc.).

Action D2 - Dissemination and awareness-raising to other stakeholders

Foreseen start date: I/2020

Actual start date: January 2017

Foreseen end date: II/2021

Actual end date: June 2022

The action focused on disseminating and raising stakeholders' awareness of the project's outcomes. The activity was implemented following the steps listed below:

- selection of the stakeholders and implementation of the stakeholders' contact database;
- preparation of the dissemination and communication plan;
- development of the dissemination tools, contents, and materials;
- implementation of the dissemination and communication campaign.

The stakeholders' contact database was implemented by Qualivita Foundation, the leader of the action, using its contact networks in Italy and abroad. The stakeholders entered in the database are divided into different categories of recipients, aiming to ensure the effectiveness of the dissemination activities and communication materials. A dissemination and communication plan was also developed to reach the maximum number of entities via: i) the project website, ii) social media campaign on Twitter, LinkedIn, and Facebook, iii)

Partner Websites and social media channels, iv) newsletters, v) press releases, vi) articles in specialized journals, vii) network activities, viii) workshop, ix) sector Events and Public Relations, x) telematic information desk, xi) brochures, and xii) Roll Up-banners and shopping bags.

On 28 June 2022, the project's final workshop was organized on the web platform Zoom. 143 people from 41 countries participated in the online event. During the event, the project was presented by showing the EDSS software developed.

Deliverables of the action:

- Deliverable #1. Dissemination & Communication Plan;
- Deliverable #2. Stakeholders contacts database;
- Deliverable #3. Designing of template and layout for the dissemination & communication materials;
- Deliverable #4. Implementation of the following dissemination & communication materials.

Additional/information: see the Annex.

Variation: the Covid pandemic also created changes regarding action D2. The workshop, initially conceived in Brussels, was organized online.

Action D3 – Networking

Foreseen start date: III/2017

Actual start date: July 2017

Foreseen end date: II/2021

Actual end date: April 2022

The goal of the action can be summarized as follows:

- to make a comparison of technical aspects to reach a better quality in the results;
- to verify the consistency between consumer communication messages and information on similar topics;
- to increase the effectiveness of the information campaign (more persons involved with optimization of efforts and resources);
- to share the results obtained from the LIFE TTGG project even after the end of the activities.

The networking strategy consisted in: i) 7 joint disclosure initiatives (e.g., seminars, stands); ii) 2 discloser initiatives as a guest; iii) 10 internal meetings (physical or by conference call) to compare relevant technical aspects and approaches, iv) 13 digital communications about information between projects. Table 1 provides an overview of the activities implemented during the project.

Table 1. Relevant and general activities implemented

Task	Name of the project and n. of activities implemented	Implemented
Common disclosure initiative	LIFE DOP (3), PEFMED (1), QSOST (1), REINWASTE (1), LIFE DOP and FORAGE 4 CLIMATE (1)	7
Disclosure initiative as a guest	Climate-neutral food and wood (1), LIFE RENDER (1).	2
Internal meetings	LIFE DOP (4), LIFE EFFIGE (2), PEFMED (3), and LIFE ECOLAC (1)	10

Additional/information: see the Annex.

Variation: none.

Action E1 - Project management, monitoring, and contingencies plan

Foreseen start date: III/2017

Actual start date: July 2017

Foreseen end date: II/2021

Actual end date: June 2022

The description of the activities implemented for the action was provided in the “Administrative part” section. In this paragraph were provided the list of deliverables and milestones:

- Deliverable #1. Monitoring protocol and contingencies plan;
- Deliverable #2. Progress report (activities from 03 July 2017 to 31 October 2018);
- Deliverable #3. Mid-term report (activities from 03 July 2017 to 30 September 2019);
- Deliverable #4. Progress report (activities from 03 July 2017 to 31 December 2020);
- Deliverable #5. Progress report (activities from 03 July 2017 to 31 December 2021);
- Deliverable #6. Final report (activities from 03 July 2017 to 30 June 2022);
- Milestone #1. Kick-off meeting of the project;
- Milestone #2. Partnership agreement.

Additional/information: see the Annex.

Variation: on the 11th of March 2021 was submitted an amendment request for an extension of the project duration of 12 months was necessary to allow the completion of the planned activities. The request was justified and accepted by CINEA due to delays in some activities caused by the Covid-19 pandemic. The activities affected by delays were actions B1, B7, B2, and B5.

Action E2 – After LIFE plan

Foreseen start date: III/2019

Actual start date: July 2019

Foreseen end date: II/2021

Actual end date: June 2022

This action aims to provide effective means for the long-term sustainability of the project outcomes and results, mainly the widespread use, the continuous adaptation to new products, and the updates of the EDSS software.

To ensure economic stability for the project downstream of the European funding was carried out with the help of external consultants: i) an exploitation plan, ii) a business model, iii) a business plan, and iv) a communication plan.

In 2021 the LIFE TTGG was selected as a Close to Market (C2M) project. In this regard, three meetings were organized with the monitoring team and Ernest & Young (selected by CINEA as expert consultants for these activities). Two meetings were held in 2020 and one

in 2021. Based on the suggestions provided by Ernest and Young, the business model was optimized and adapted to the needs of the consortium created in the last months of the project (composed of Polimi, UCSC, and Enersem - partners holding the intellectual property of EDSS).

As a final piece of evidence, as already stated in the “executive summary” we would like to point out that the model is being replicated from July 2022 on two other Italian entities, the Consorzio del Prosciutto Crudo di Parma PDO and the Consorzio del Formaggio Asiago PDO. The list of further Consortia to be involved is presented in Table 2. A preliminary contact with the Italian Consortia: i) Pecorino Romano, ii) Quartirolo Lombardo, iii) Piave, iv) Salva Cremasco, v) Prosciutto San Daniele, and vi) Arancia Rossa di Sicilia IGP was did by Enersem in the first part of the 2022.

Table 2. List of Consortia to be involved

Italy	Abroad
Mozzarella di Bufala Campana	Fromage Cantal
Pecorino Romano	Fromage Saint Nectaire
Pecorino Sardo	Gruyère français,
Pecorino Toscano	Emmental français
Quartirolo Lombardo	Other Spanish and Swithzerland cheeses
Piave	Fromage Cantal
Stelvio o Stilfser	Jabugo (Spain)
Toma Piemontese	Fromage Cantal
Salva Cremasco	-
Speck Alto Adige IGP	-
Prosciutto San Daniele	-
Prosciutto Toscano	-
Mortadella di Bologna	-
Arancia Rossa di Sicilia IGP	-

Deliverables and milestones of the action:

- Deliverable #1. Business model and business plan;
- Deliverable #2. Communication plan;
- Deliverable #3. Business model and business plan reviewed;
- Milestone #1. Creation of the consortium/body.

Additional/information: see the Annex.

Variation: none.

Main deviations, problems and corrective actions implemented

Action B3

The deliverable “PEF reduction measures: EDSS sheets” had the same name as the Deliverable of Action B4. This was a mistake in the action sheet drafting. Thus, we changed the deliverable name in “signs and rules for the PEF identity” to have greater consistency with the associated activities. The Covid pandemic also created changes regarding actions

B3 related to consumer involvement. Surveys under activity B3 were conducted online. The targets listed in the Key Performance Indicators were largely achieved.

Action B6

We experienced difficulties in finding 2 dairies available for the analysis of a Dutch PDO as initially indicated in the project proposal. Therefore, we could not include a Dutch consortium PDO in the project. However, we identified 2 dairies of the PDO Stilton (United Kingdom). This change was communicated to and accepted by CINEA in 2018. Unfortunately, in January 2020, the COVID-19 global outbreak exploded and strongly impacted the activities planned due to the stop to traveling and social distancing. We had to confront the impossibility of traveling and hosting events in person. The unprecedented situation forced us to rethink work and find new possibilities to bring the LIFE TTGG project activities forward, keeping visibility and impact on achieving the planned objectives. We managed to overcome the impediments of the COVID-19 pandemic by using virtual platforms, mainly Zoom, and organized online events replacing physical meetings.

Action B7

It should be noted that the Comté consortium (not a beneficiary of the project) in February 2022, after the presentation of the results obtained (carried out by the CNIEL), decided not to make the results public. Therefore, the dissemination activities foreseen in action B7 were partially completed. This decision resulted in lower budget expenditure for the CNIEL than that budgeted at the proposal stage (see the dedicated section). It is essential to underline that neither deliverables nor milestones were foreseen for the dissemination activity of the results in France. Still, the Key Performance Indicators (KPIs) declared concerning the achievement of stakeholders and consumers were all largely met. Thus, all the technical targets foreseen are however achieved. Due to the Covid-19 pandemic, the action B7 was rescheduled. In the proposal stage, 1 or 2 Consortia and 3 manufacturers (dairy plants) were planned to visit and audited. By the communication from 23 October 2020, the activities were moved to Italy, involving 2 Consortia (Provolone Valpadana and Asiago) and 4 manufacturers (PLAC, Latterie Vicentine, Latterie Venete, and Caseificio casona di Pozzoleone).

Action D1

The Covid pandemic also created changes regarding action D1 related to consumer involvement. Dissemination activities of the results were conducted through a press campaign on social media and magazines instead of physical events (participation in trade fairs, etc.). Still, in this case, the targets foreseen were largely met.

Evaluation of project implementation

Table 3 shows the evaluation of the actions. It provides the objectives, the final results according to the proposal, the achieved results, and a short conclusion for each of the 13 activities listed for the project.

Table 3. Action evaluations

B1 - Data collection and analysis
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<i>Objectives</i>
Development of a Life Cycle Inventory (LCI) database to be implemented in the software tool. The LCI reduces the time and effort needed to assess the PEF of PDO hard and semi-hard cheeses producers.
<i>Final results according to project proposal</i>
LCI database was developed and implemented in the European International Reference Life Cycle Data System (ILCD) Data Network, following the entry-level requirements. The LCI is based on 67 farms, 18 diaries, and packers. Three datasets in total: raw milk, milk processing, and packaging phase.
<i>Achieved Results</i>
Developing an LCI database and implementing in the European International Reference Life Cycle Data System (ILCD) Data Network, following the entry-level requirements. The LCI is based on 65 farms, 20 diaries, and 18 packers. Eight datasets in total: three types of raw milk, three types of milk processing, packaging processing, and pulsa a supply chain dataset.
<i>Evaluation</i>
The action was successful. It was implemented to a larger extend more than declared in the proposal.
B2 - Development of the design tool for LCA and emission reduction initiatives
<i>Objectives</i>
Identify different processes of EU PDO hard and semi-hard cheeses production (focused on farm and dairy phase) and their possible alternative solutions for environmental emissions reduction. Development of a computerized checklist encompassing each stage detailed in unit processes for EU PDO cheeses.
<i>Final results according to project proposal</i>
<ul style="list-style-type: none"> • Graphic interface to provide easy use; • hypertext user guide in multiple languages, which will assist the user in all the phases from LCI preparation, to process analysis and LCA (relevant data, sampling rules, allocations, etc.); • opportunity to import new LCIs or updates directly.
<i>Achieved Results</i>
All the three bullet points described above were developed. As evidence of the work done, see the deliverables B2.1, B2.2, B5.1, B5.2, and B5.3.
<i>Evaluation</i>
All the targets foreseen in the proposal were achieved.
B3 - Communication Design Model for Packaging System Design
<i>Objectives</i>
The research activity focuses on translating and transferring the Product Environmental Footprint index on the packaging. The focus is on the communication role of packaging in designing a cross-communication system. The action is finalized: to create a virtuous circle; to increase the consumer's awareness and responsibility during his choice of buying and using the product to improve positive behavior.
<i>Final results according to project proposal</i>
The project proposal reports the following results of the action: <ul style="list-style-type: none"> • data, standards, symbols, and case studies to be collected and systematized for the project; • identification of PEF communicative potentialities; • definition of contents and their architecture structure (contents hierarchy); • definition of communicative functions and rhetoric strategies;

<ul style="list-style-type: none"> • definition of tool communication system to create a storytelling and valorize the PEF index; • communication design model for Grana Padano Packaging system.
<i>Achieved Results</i>
<p>The activity was articulated in the following points: desk research and communicative potential to identify the definition of the architecture of the communicative system (i.e., objectives, tools, contents, and communicative strategies). Thanks to the outcomes of these two tasks, the visual identity was created, proposing three hypotheses for labeling. The label created was tested on Grana Padano packaging, developing a maquette, mock-up, and aesthetic prototype. A report on packaging communication system design was realized. A workshop and a poll survey online were organized to write the report. Finally, an EDSS sheet was developed to propose solutions for improving the environmental profile of the packaging by the software.</p>
<i>Evaluation</i>
<p>The action was specifically useful to set up a proper communication system on the Grana Padano packaging. In this context, a new labeling system was created and tested by a workshop and a poll survey specifically organized. The solutions to mitigate the footprint of the packaging and food waste and food wastage are promptly proposed within the EDSS; the solutions were also presented during the workshops organized in activities B6 and D2 of the project. All the targets foreseen in the proposal were achieved.</p>
B4 - PEF reduction measures
<i>Objectives</i>
<p>The action aims to calculate the PEF reduction measures to be included in the EDSS.</p>
<i>Final results according to project proposal</i>
<p>The final results, according to the project proposal, were:</p> <ul style="list-style-type: none"> • identification and description of the different processes of EU PDO hard and semi-hard cheese production; • assessment of the energy and resources consumptions of the cheese production phase; • identification of effective energy and resource efficiency measures; • processes modeling for PEF reduction measures simulation to produce all the input for the EDSS mitigation section; • engagement with policymakers regarding evaluation and reduction of environmental impacts from the dairy sector. <p>For the action, we declared that the companies to be audited were: farms (number not declared) and 26 dairies.</p>
<i>Achieved Results</i>
<p>All the results listed in the previous box were described in the deliverables associated with action B4 (see section 4.1). In particular, it is important to underline that the number of companies audited was more than declared, in summary: 65 farms, 20 dairies of Grana Padano, 8 dairies abroad (4 in France, 2 in Spain, and 2 in the UK), and 4 in Italy (beyond Grana Padano).</p>
<i>Evaluation</i>
<p>The action was successful. It was implemented more than declared in the proposal.</p>
B5 - Environmental Decision Support System (EDSS) software development
<i>Objectives</i>
<p>This action is dedicated to developing an “Environmental Decision Support System (EDSS) software”, based on the LCA tool developed in action B2. The usefulness of this instrument is mainly threefold:</p>

<ul style="list-style-type: none"> • helps the user to focus on the critical factors which are more relevant for the sustainability indicators; • makes the choices of the decision maker a process more transparent and straightforward; • helps the user to manage simply the complex task of making a decision that could affect many aspects of the production process.
<i>Final results according to project proposal</i>
The final results according to the project proposal can be summarized as follows: EDSS software for the PDOs Grana Padano and Comté; Validation of the software by a third independent entity.
<i>Achieved Results</i>
The EDSS was implemented for Grana Padano and Comté, and it was validated by CSQA Certificazioni srl. The EDSS developed has the following features: <ul style="list-style-type: none"> • representation of the production processes associated with each alternative object of the analysis; • visualization of the values of the indicators for the whole process; • visualization of several types of charts for the representation of variables selected by the user; • the highlight of the most critical process, considering all the indicators.
<i>Evaluation</i>
All the targets foreseen in the proposal were achieved.
B6 - Transfer of the results to other PDO
<i>Objectives</i>
The action document summarizes the activities planned to transfer the results to other PDOs and disseminate and raise awareness of the project outcomes at the EU level.
<i>Final results according to project proposal</i>
The final results, according to the project proposal, were: <ul style="list-style-type: none"> • selection of 4 PDOs to be involved in the transfer activities; • elaboration of a transferability plan defining objectives, strategy, and the schedule for the implementation of the transfer activities; • technical visits to PDOs to collect data and inform producers about the software; • organization of 3 meetings one in France, one in the Netherlands, and one in Spain; • organization of 2 workshops in Italy.
<i>Achieved Results</i>
During the first task, technical visits were carried out on four PDO consortia (2 in France, 1 in Spain, and 1 in the UK) and eight dairies selected. The site visits were also an opportunity to present the project to the concerned GI groups. The second task consisted in organizing meetings with GI groups and relevant stakeholders. We managed to overcome the impediments of the COVID-19 pandemic by using virtual platforms, mainly Zoom, and organized online events replacing physical meetings. It allowed the participation of a larger audience and reached a larger number of GI groups and relevant stakeholders to promote the software. Four of five events took place online, and more than 400 representatives of GI groups, institutions dealing with GIs, and experts from around the world were involved. In Italy, one of the two meetings foreseen was managed in person. It was organized in the framework of the international food fair CIBUS with the participation of some 50 GI group representatives. For more information, see Deliverable B.6.2.
<i>Evaluation</i>
All the targets foreseen in the proposal were achieved even if two variations were implemented for this action. We experienced difficulties finding 2 dairies available to

analyze a Dutch PDO. Thus, the Netherland was replaced by the UK. Unfortunately, in January 2020, the COVID-19 global outbreak exploded and strongly impacted the activities planned due to the stop to traveling and social distancing. We managed to overcome the impediments of the COVID-19 pandemic by using virtual platforms and organizing online events replacing physical meetings.
B7 - EDSS tests on French PDOs
<i>Objectives</i>
The action is focused on testing the EDSS on a French PDO Consortia (Comté). The test of the EDSS on other EU semi-hard and hard cheese PDOs (besides Grana Padano); fine-tuning its contents, utilities, and user interface. The activity aims to demonstrate that the EDSS is not a “single product tool” but can be used on different products.
<i>Final results according to project proposal</i>
The final results, according to the project proposal, were: <ul style="list-style-type: none"> • developing an LCI database in compliance with the entry-level requirements of the European International Reference Life Cycle Data System (ILCD) Data Network. The LCI is based on 35 farms and 15 dairies (just as an indication, the consortium was not known during the proposal). Two datasets in total: raw milk and milk processing phases; • energy audits for 6 dairies; • EDSS tests on 3 other companies beyond Grana Padano and Comté.
<i>Achieved Results</i>
LCI database was developed in compliance with the European International Reference Life Cycle Data System (ILCD) Data Network, following the entry-level requirements. The LCI is based on 29 dairy farms, 19 dairies, and 5 refiners. Three datasets in total: raw milk, milk processing, and pul a supply chain dataset. The energy audit in 6 dairies was implemented to fit the EDSS concerning the Comté production. Three dairies belonging to the Asiago PDO Consortium and one dairy of the Provolone Valpadana PDO consortium were audited to analyze the scalability of the EDSS. Finally, a report on the use of EDSS on other PDOs and guidelines for the supervisor activity for BM development were written.
<i>Evaluation</i>
All the targets foreseen in the proposal were achieved. Regarding the number of companies analyzed, the action involved more than was expected in the project proposal 57 (achieved results) vs. 53 (project proposal).
C1 - Monitoring of the project impact
The monitoring actions were correctly implemented, as outlined in 4.1 section, and all the deliverables were produced.
Actions D1, D2, and D3
The dissemination actions were implemented correctly; all the targets were largely achieved respect results initially planned. The covid 19 situation conditioned some communication strategies, as online workshops substituted a few demonstrative days, and a massive press release replaced participation at fairs.
E2 - After LIFE plan
<i>Objectives</i>
The project had ambitious goals that could only be reached by proper planning and adequate coordination between all the partners. The continuation of the project represents a strategic EU added value. The exploitation of project results is also a promising source of future income for the Consortia partners, willing to return on the investment made by co-financing the project.
<i>Final results according to project proposal</i>

The final results, according to the project proposal were, provide effective means for the long-term sustainability of the project outcomes and results, mainly the widespread use, the continuous adaptation to new products, and the updates of the EDSS software, through i) exploitation plan and business model, ii) business plan, and iii) communication plan.

Achieved Results

The long-term sustainability of the project outcomes and results, mainly the widespread use, the continuous adaptation to new products, and the updates of the EDSS software, through i) exploitation plan and business model, ii) business plan, and iii) communication plan were implemented and ensured. As evidence of the results achieved, we highlight the project selection as a close 2 market project. Ernest & Young reviewed the business model implemented twice, in 2021 and 2022.

Evaluation

The activity went better than expected. Close to the end of the project, two PDO consortia signed agreements to use the EDSS software functionality. One of the two consortia does not belong to the dairy sector as evidence of the widespread use target was achieved.

As reported in D actions, the activities were effective both when organized within a workshop format and when LIFE TTGG was presented in other broader initiatives (conferences, fairs, open days, press releases). We reached more than 13 000 000 persons in dissemination events with a wide audience, ranging from students and technicians to farmers and broader society.

LIFE TTGG contributed to the revision of the Environmental Footprint method. During the project, several meetings were organized: i) with the Directorate-General for Environment – European Commission, the help desk of the Environmental Footprint, and the Environmental Dairy Association. The LIFE TTGG actively participated in developing the Made Green in Italy scheme (a national voluntary scheme for the assessment and communication of the environmental footprint of products) promoted by the Italian Ministry of Ecological Transition (MITE) for developing the national benchmark within specific category rules of the mentioned scheme. Due to the sharing of the LCI dataset of Grana Padano with the Joint Research Centre – European Commission, the project contributed to developing the ILCDC data network. Finally, the summary report provided to the policymakers contributes actively to the Rural Development Plan (see action B4).

EU ADDED VALUE OF THE PROJECT AND ITS ACTIONS: the Project has now contributed to three central areas of relevance for the EU economy: circular economy, efficiency and competitiveness, and environment. The implementation of a circular model, i.e., beyond the production of cheese, the project activity promoted the production of renewable energy (37 million kWh during the project lifespan) and recovered fertilizers (22.000 tons in the form of solid digestate and separated solid fraction of slurry). The project is leading the increase in the efficiency of dairy production (see B.5), thus increasing the competitiveness of the livestock sector and decreasing its environmental impacts: decrease in the use of synthetic fertilizers, avoiding the emission of methane due to the use of slurry for anaerobic digestion, and avoid emission due to the production of renewable energy.

Analysis of benefits

This section lists the environmental, economic, social, best practice lessons, innovation and demonstration value, and policy implications obtained by the project.

Environmental benefits

Direct/quantitative environmental benefits:

During the LIFE TTGG project period, some dairies adopted different improvement actions. Due to the high dehumidification load caused by the cheese maturing process (the cheese releases water in the air), the air is quite always cooled down to condensation condition (9-11°C for typical warehouse temperature and humidity conditions) by the cooling coil of AHU (Air Handling Unit). The set point temperature of the warehouse's internal ambient is 16-18°C. Thus, the air must be heated up at a maximum temperature of 23-25°C in winter. The heating coil of the AHU is usually powered by steam or hot water from a dedicated gas boiler. The PEFRM integrates recovered heat to feed the heating coil of the AHU. Using steam or high-temperature water produced with a gas boiler to heat up the air to 25°C represents a huge waste of enthalpy. The existing heating system is used as a backup. The efficiency measure consists of the chiller condenser heat recovery to feed the heating coil of warehouse AHU. This heat source is naturally balanced with warehouse heating demand. It also requires replacing the AHU heating coil with working with low-temperature water (25-30°C). This efficiency measure has been implemented in two dairies, one medium size dairy (52 000 wheels/year) and a large-size dairy (>140 000 wheels/year).

Among the dairy farms investigated, two have implemented mitigation actions concerning the application of livestock manure on the field and monitoring the quality of feed and diets being fed to the cows. The best agricultural practices for manure spreading result in a % reduction of NH₃ emission, compared to the reference manure application technique of adopting a conventional surface spreading where the manure is pumped through an orifice onto a splash plate from where it is spread onto the soil (“broadcast”). Low-emissions manure application techniques include machinery such as an injector or band spreader, representing the most effective means to improve the infiltration of slurries. One farm used the technology of injecting liquid slurry into the soil. This is a slurry distribution to a depth of no more than 0.15 m in the soil. The slurry is distributed with a particular machine that opens slits in the soil to facilitate its distribution and subsequent closure of the slits. In this way, N₂O and NH₃ emissions are significantly reduced.

Another farm has equipped its machinery for preparing and distributing feed to animals with an instrument called near-infrared (NIRs) reflectance spectroscopy, capable of analyzing the qualitative characteristics of feed in real-time to optimize the preparation of diets fed to dairy cows. This technology is important as the quality characteristics of feeds used in diet formulation can affect the estimated Digestible Energy (DE) and methane CH₄ production from enteric fermentation and manure handling. Knowing the quality and digestibility of forages fed to dairy cows is essential to estimate CH₄ emission, with the

potential for reducing enteric CH₄ through improved nutrient quality and digestibility and increased feed intake and productivity.

Reduction of greenhouse gas emissions (GHG)

The actions described above provide the benefits in terms of GHG reductions reported in Table 4 and Table 5.

Milk processing phase:

The percentage of reduction of electricity and methane at the end of the project and beyond 3 years are:

- 0.4% for electricity;
- 0.8% for methane.

See deliverable C1.7, “Extensive Monitoring Report: socio-economic and environmental impacts of the project”, for further details.

Table 4 shows the benefits at the end of the project.

Table 4. Benefits at the end of the project

Items	Grana Padano and Asiago
Energy vector	Electricity and Methane
Consumption [kWh / kg]	0.698 and 3.116
Reduction [%]	0.40% and 0.80%
Emission factor [kgCO ₂ eq / kWh]	0.549 and 0.253
Benefit [kgCO ₂ eq / kg]	0.01
Benefit [tCO ₂ eq / year]	55

(*) Emission factors are taken from EF 2.0 dataset. To assess the benefit in tCO₂eq / year, the amounts of energy saved listed in section “Consumption” were used.⁸

Table 5. Benefits beyond 3 years

Items	Grana Padano and Asiago
Energy vector	Electricity and Methane
Consumption [kWh / kg]	0.698 and 3.116
Reduction [%]	0.40% and 0.80%
Emission factor [kgCO ₂ eq / kWh]	0.549 and 0.253
Benefit [kgCO ₂ eq / kg]	0.01
Benefit [tCO ₂ eq / year]	400

Raw milk phase

⁸ **Electricity for Italian Consortia:** Residual grid mix {IT} | AC, technology mix | consumption mix, to consumer | 1kV - 60kV | LCI result + Conversion from electricity medium voltage to electricity low voltage {GLO} | Transformation of medium voltage electricity to low voltage | Consumption mix, to consumer | grid losses, from 0,54% to 18,18% see general comments | Unit process, single operation

Methane: Thermal energy from natural gas {EU-28+3} | technology mix regarding firing and flue gas cleaning | production mix, at heat plant | MJ, 100% efficiency | LCI result

The reduction in terms of CO₂eq emissions at the end of the project and beyond 3 years are:

- 0.26 kgCO₂eq / kg of milk considering 2 farms of Grana Padano;
- 0.90 kgCO₂eq / kg of milk, considering 50 farms producing Grana Padano and Asiago PDO.

See deliverable C1.7, “Extensive Monitoring Report: socio-economic and environmental impacts of the project”, for further details.

Table 6 shows the benefits at the end of the project.

Table 6. Benefits from raw milk production

Items	End of the project	Beyond 3 years
Reduction [%]	2%	6.9%
n. of farms involved	2	50
Benefit [kgCO ₂ eq / kg]	0.26	0.90
Benefit [tCO ₂ eq / year]	173	10 869

(*) Data are related just to Grana Padano and Asiago PDO.

Improved water quality

The optimization of water use was calculated considering the water scarcity for the production of 1 kg of Grana Padano PDO cheese, which is 3.34 m³. The improvement actions undertaken in 2 of the 67 dairy farms investigated resulted in a reduction of 0.07 m³ per kg of milk produced, i.e., (0.07 * 6.008) kg of milk needed to produce 1 kg of cheese. The indicator at the end of the LIFE TTGG project, therefore, achieved a reduction in water use of 0.42 m³ per kg of product.

Three years after the end of the project, good agricultural practices were assumed to be implemented, leading to a reduction of 0.15 m³ of water per kg of milk produced, i.e., (0.15 * 6.008) kg of milk needed to produce 1 kg of cheese. The reduction in water use will be 0.90 m³ per kg of product. Table 7 shows the improvements.

Table 7. Improved water quality

Time boundaries	Proposal	Project	Unit
Baseline	Not declared	3.34	m ³ unit produced
End of the project	Not declared	3.338	
Beyond 3 years	Not declared	3.29	

Better use of natural resources

Reduction of the need for feed purchases, improvement of the auto-produced feeds' quantity, reduction of water usage, and optimization of the nitrogen efficiency from animal manure will lead to a reduction in the use and waste of natural resources. Also, reducing energy consumption produces benefits in terms of non-renewable energy resources.

Impact on acidification and eutrophication

The actions related to energy efficiency, better use of natural resources, and reduction of direct emissions to the environment previously described reducing not only greenhouse gas emissions or resource consumption but also the effects of acidification and eutrophication. A reduction of the acidification and eutrophication potential was qualified as follows:

- 118 tNeq /year and 2.73 kmolc H+ / year at the end of the project;
- 644 t Neq / year and 94.5 kmolc H+ / year beyond 3 years.

Qualitative environmental benefits

The EDSS permits the application of sustainable farming practices and energy efficiencies in industrial plans. Figure 9 shows a screenshot from the report generated by the EDSS concerning the solution for dairy plants.

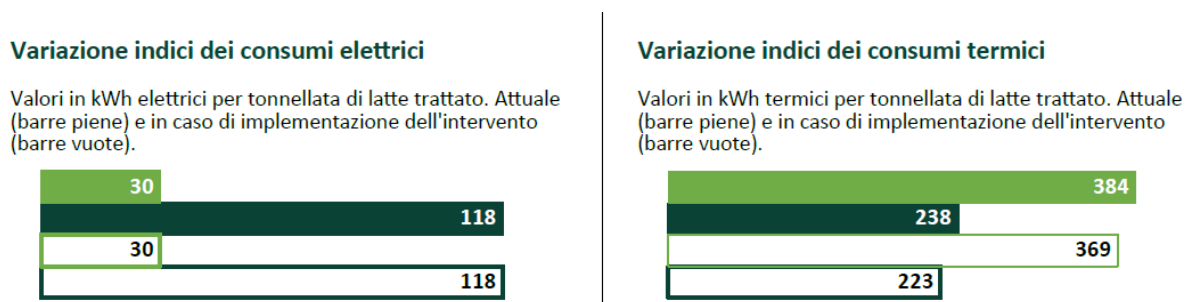


Figure 9. Solution for dairy plants

Economic benefits

The EDSS software permits two levels of economic benefits. The first level could be linked with the reduction cost of Life Cycle Assessment analysis implementations. The second benefit can be connected with the implementation of the solutions proposed.

Risparmio economico	Risparmio energia primaria	Emissioni evitate
66209 € 2,0%	77 tep 1,0%	139 CO ₂ eq 0,8%
Risparmio economico in bolletta, somma tra elettricità e combustibile	Energia primaria risparmiata, espressa in tonnellate equivalenti di petrolio	Riduzione delle emissioni, espressa in CO ₂ equivalente

Figure 10. Economic benefits by the EDSS

Social benefits

Awareness raising. During the project, approx. 13 000 000 persons were reached, directly by site visits and workshops and indirectly by press releases. They are thus now aware of the possibility of reducing the environmental profile through a more sustainable consumption (for consumers) or production (for manufacturers).

Improving technical knowledge on energy efficiency, circular economy, and use of renewable. LIFE TTGG provided important information on the energy efficiency in dairies and ripeners. Also, the farm phase and the packaging phase were well covered by the project. It offers solutions to increase the efficiency during raw milk production (i.e.,

managing appropriate manure, producing energy by the livestock slurry, and managing the heard composition) and handling the packaging appropriately, not only in the production phase but also in the consumers' home. In addition, the metric system developed with EDSS software allows actors in the supply chain to know their environmental footprint precisely.

Best Practice lessons

The best practices for improving the environmental footprint of dairies and farms are summarized in Figure 11.

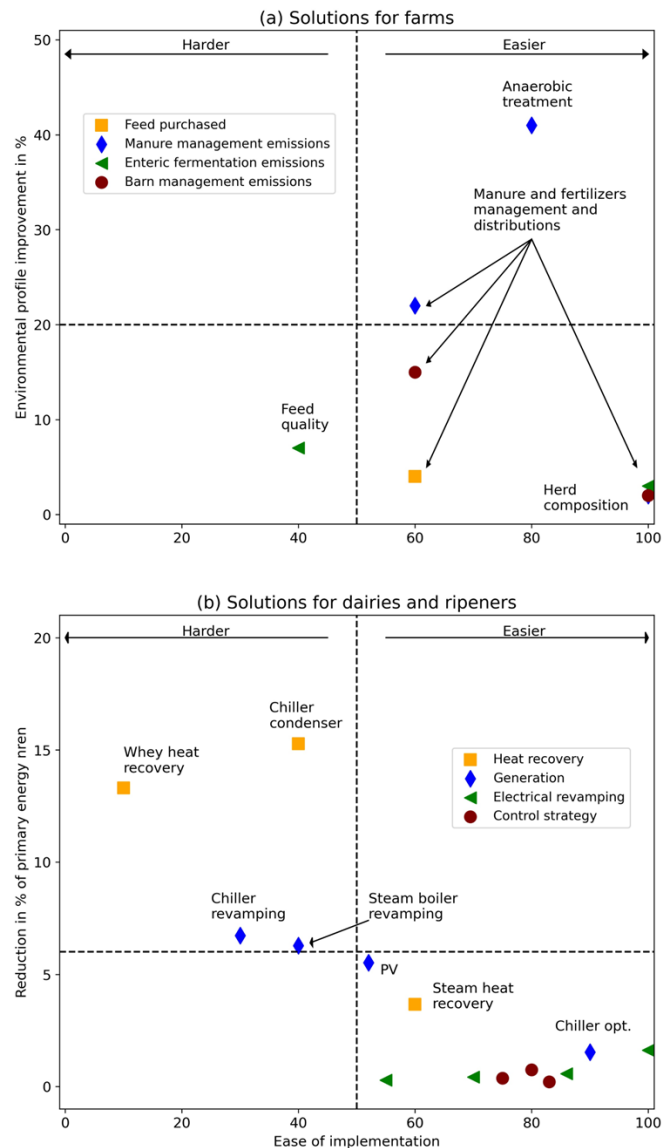


Figure 11. Solutions for (a) farms, (b) dairies, and ripeners

It provides a summary of the solutions presented was given underling the efficiency in terms of feasibility and (a) potential impact reductions, and (b) primary energy consumption non-renewable (nren).

As specified in deliverable B4.4 called “Summary report PEF reduction measures” the solutions with higher potential impact reduction and easy implementation shown in the previous figure are:

- For farms:
 - Management and distribution of livestock manure and distribution of mineral fertilizers;
 - Anaerobic treatment of livestock manure;
 - Heard composition.
- For dairies and ripeners:
 - Heat recovery from whey;
 - Heat recovery from chiller condenser;
 - Revamping cooling production.

Innovation and demonstration value

The life cycle assessment is considered the leading methodology for environmental metrics. Developing a complete life cycle assessment can be difficult and time-consuming, particularly discouraging to non-experts. Life cycle assessment software applications are aimed at single product evaluation, making consortium scale data management and environmental assessment complicated or impractical. The novelty of this work is a new software that allows an extensive environmental assessment of companies belonging to a specific consortium and proposes solutions to improve the supply chain. The EDSS expands the life cycle assessment method application at the consortium scale where the existing software applications are not specifically designed to be implemented and fail mainly due to the massive data processing.

Thus the originality of the project can be emphasized thanks to the intuition of proposing a robust and always up-to-date systemic approach that covers the entire production chain. The EDSS software is the only software on the market that aggregates and interconnects the various production phases of PDO and PGI products, assesses the environmental profile according to the European PEF method, proposes supply chain efficiency solutions, and allows the comparison of one's own business reality with a dynamic benchmark (which updates over time) representative of one's own consortium.

Policy implications

The evolution of regulations at the European level has favored the development and diffusion of certified quality schemes. New patterns of food consumption and the economic crisis are also driving businesses to strategically reposition quality, especially in its connotations linked to sustainability and ethics. The strongest signals come from large-scale retailers and consumers who demand a real differentiation of production concerning the quality, origin of agro-food production, and their environmental and social impacts, which are becoming a major issue in public debates. Over the past 20 years, the European system (particularly in Italy, France, Spain, and Portugal) has gained a strong reputation making the certification a subject capable of directly involving agricultural producers, manufacturers, sales channels, and even consumers. It increased awareness of the quality

and environmental impact of agro-food products⁹. In particular, the environmental perception is having a predominant influence on consumer choices, also in the selection of products labeled as Product Designation of Origin (PDO), Protected Geographical Indication (PGI), and Biological. These labels are conditioned by the image of protection of the territory and respect for social aspects that these brands carry with them¹⁰.

In the COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, AND THE COMMITTEE OF THE REGIONS - Roadmap to a Resource Efficient Europe¹¹, the European Commission has set an important objective. By 2020, citizens and public authorities will be adequately encouraged to choose the most resource-efficient products and services, with correct price signals and clear environmental information. Their purchasing choices will incentivize companies to innovate and offer more efficient goods and services. Minimum environmental performance standards will be set to remove less efficient and polluting products from the market. There will be strong consumer demand for more sustainable products and services. In the COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Building the Single Market for Green Products - Facilitating better information on the environmental performance of products and organizations,¹² the Commission announced: “The Roadmap to a Resource Efficient Europe”. It sets an ambitious target for 2020: encouraging citizens and public authorities to choose the most resource-efficient products through correct price signals and clear environmental information. It also recognizes the key role of the Internal Market in rewarding resource-efficient products. The initiative “Building the Single Market for Green Products” is an important step in this direction. This Communication sets out two shared European Environmental Footprint methodologies for measuring the environmental performance of products and organizations and a set of principles on which to base their communication. The Communication is accompanied by a Commission Recommendation encouraging the Member States and the private sector to use these new approaches, as appropriate, to improve the functioning of the internal market¹³. In the COUNCIL CONCLUSIONS ON

⁹ Ravaglia, P., Famiglietti, J., Valentino, F., 2018. Certification and Added Value for Farm Productions, in: Capri, E., Alix, A. (Eds.), *ADVANCES IN CHEMICAL POLLUTION, ENVIRONMENTAL MANAGEMENT AND PROTECTION Sustainable Use of Chemicals in Agriculture*. Academic Press, Elsevier, pp. 63–106. <https://doi.org/http://dx.doi.org/10.1016/bs.apmp.2018.03.003>

¹⁰ Aprile, M.C., Caputo, V., Nayga, R.M., 2012. Consumers’ valuation of food quality labels: The case of the European geographic indication and organic farming labels. *Int. J. Consum. Stud.* 36, 158–165. <https://doi.org/10.1111/j.1470-6431.2011.01092>.

¹¹ European Commission, 2011. COMUNICAZIONE DELLA COMMISSIONE AL PARLAMENTO EUROPEO, AL CONSIGLIO, AL COMITATO ECONOMICO E SOCIALE EUROPEO E AL COMITATO DELLE REGIONI - Tabella di marcia verso un’Europa efficiente nell’impiego delle risorse - Com (2011) 571. Bruxelles. <https://doi.org/10.1017/CBO9781107415324.004>

¹² European Commission, 2013. COMUNICAZIONE DELLA COMMISSIONE AL PARLAMENTO EUROPEO E AL CONSIGLIO Costruire il mercato unico dei prodotti verdi Migliorare le informazioni sulle prestazioni ambientali dei prodotti e delle organizzazioni.

¹³ European Commission, 2013. Single Market for Green Product Initiative. URL: <http://ec.europa.eu/environment/eussd/smgp/>

ECO-INNOVATION: ENABLING THE TRANSITION TOWARDS A CIRCULAR ECONOMY, the Council of the European Union invites the Commission “to explore also the possible uses of the Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF). PEF and OEF aim to measure and communicate environmental information, taking full account of the need to maintain the competitiveness of Member States”¹⁴.

In this context, the LIFE TTGG project, written in 2016 and, based on the Product Environmental Footprint (PEF) method, was focused on implementing the European Environmental Footprint method on PDO European cheese, developing an Environmental Decision Support System in an EDSS software. The software allows adequate dissemination even in realities such as small and medium enterprises that would find it challenging to bear total certification costs. The project also focused on defining appropriate communication strategies thanks to the activity implemented in action B3.

Concerning the policy implications as already mentioned above, the project teams found several methodological limitations. They were communicated to the Directorate-General for Environment – European Commission (on 26 October 2020), the help desk of the Environmental Footprint (Studio Fieschi srl – May 2022), and the Environmental Dairy Association during several online meetings in 2020, 2021, and 2022. Summarizing the limitations found are:

- Technical limitations within the Product Environmental Footprint Category Rules for dairy products:
 - lack of inventory data for energy systems and dairy processing phase (i.e., Combined Heat and Power Plant, reverse osmosis systems, ripening warehouse);
 - raw milk can be transported in insulated trucks (not refrigerated). This option should be included in the PEFCR;
 - the allocation method for the farm’s co-products is not clear, especially when anaerobic digestion plants are present at the farm level;
 - the dataset: «Cow milk, at the farm, mixed system, per kg FPCM (IT)» uses as a proxy a UK farm (92 % grassland) with significant differences from an average Italian system;
 - inconsistencies between the Dairy PEFCR annex 6 (use phase model) and the LCI model (life of the fridge: 15 vs. 10 years; washing cycles of the dishwasher 1’500 vs. 15’000. No direct emission of phosphate in annex 6, exclusion of some processes and elementary flows);
 - it seems that some PEF datasets are not available for purchase (i.e., feed from Blonk);
 - national water characterization factors are too general and not really suitable for a reliable assessment.

¹⁴ Council of the European Union, 2017. Council conclusions on eco-innovation: enabling the transition towards a circular economy, in: PRESS RELEASE 18 December 2017. Brussels, pp. 2–3

Technical limitations would create problems applying the PEF method, especially for fair comparisons among dairy products, if the benchmark was not appropriately assessed.

- Application of the PEF method to national certification schemes:
 - The LCI database developed for the Grana Padano Consortium was used within the Italian Certification scheme called “Made Green in Italy” (a national voluntary scheme for the assessment and communication of the environmental footprint of products) promoted by the Italian Ministry of Ecological Transition (MITE) for developing the national benchmark within specific category rules of the mentioned scheme. Even if the scheme adopts the PEF method, datasets developed within the European methodology (EF) are not available free of charge to Made Green in Italy scheme members. On the contrary, EF 2.0 datasets turn out to be more expensive than commercial datasets (i.e., ecoinvent), causing problems for the specially developed model of EDSS in Italy.

Applying this methodology with an EU-financed project allowed the LIFE TTGG team to experiment in deep detail with the PEF method. The data collected and elaborated in the project were implemented in the European International Reference Life Cycle Data System (ILCD) Data Network, following the entry-level requirements, and shared with the Joint Research Centre – European Commission for further research. In addition, the foreseen activities in the project sustainability action (E2) will help the LIFE TTGG team to provide potential improvement for the PEF methodology promoted by the European Commission in the dairy sector and other Geographical Indications realities, i.e., the replication activities of the EDSS software for Prosciutto Crudo di Parma PDO consortium and Asiago PDO consortium.

Key Project-level Indicators

The final actual values of the KPIs were filled in the online KPI database (<https://webgate.ec.europa.eu/eproposalWeb/kpi>). Table 8 provides the list of KPIs assessed.

Table 8: Key Project-level Indicators (KPIs)

Indicator	Baseline	End of the project	Beyond three years	Unit
1.5 Project area/length	0	3 499 4 669	55 259 4 669	ha for Italy ha for France
1.6 Humans influenced by the project	0 0 0 0	133 75 8 4 546 226	763 75 8 5 197 289	People in Italy People in France People in the UK and Spain Dissemination
2.3.5.3. Water consumption for production	210 657 19 0	210 657 19 0	210 657 19 0	kg of cheese involved
	3.34	3.338	3.29	m ³ / kg of cheese
3.1 Waste management – Mass reduction due to waste prevention	0	6	289	t / year
3.1 Waste management – Mass of non-appropriately managed waste	2 686	2 680	2 418	t / year
4.1.1 Consumption - Electricity	147 039	147 019	146 896	MWh / year
4.1.1 Consumption - Methane	656 408	656 234	655 132	MWh / year
4.4 Resource efficiency - circular economy	0	1	38	n. of entities
4.4 Resource efficiency - circular economy	0	825 427	3 199 000	units
4.4 Resource efficiency - circular economy	1.00	1.00	1.00	Mass of output of waste per unit produced kg / kg of unit produced
4.4 Resource efficiency - circular economy	0.00	0.01	0.03	Mass of input of actually recycled waste per unit produced kg / kg of unit produced
8.1.1 GHG mitigation - CO ₂ eq. for industrial processes	2 738 541 13.00	2 738 486 12.99	2 738 141 12.99	t CO ₂ eq. per year kg CO ₂ eq. per kg
8.1.1 GHG mitigation - CO ₂ eq. for agriculture	2 738 541 13.00	2 738 368 12.74	2 727 672 12.10	t CO ₂ eq. per year kg CO ₂ eq. per kg
10.2 Involvement of non-governmental organizations (NGOs) and other stakeholders in project activities	0	6	9	Number of stakeholders involved due to the project
11.1 Website	0	4 717	7 547	n. unique website visits
11.2 Other tools - Number of different publications made (Journal/conference)	0	4	6	Number of outcomes (e.g., nr of reports, events, etc)
11.2 Other tools - Number of articles in print media (e.g., newspaper and magazine articles)	0	179	286	Number of outcomes (e.g., nr of reports, events, etc.)
11.2 Other tools - Other distinct media products created (e.g.,	0	5 230	8 368	Number of outcomes (e.g., nr of reports, events, etc.)

different videos/broadcast/leaflets)				
11.2 Other tools - Number of different displayed information created (posters, information boards)	0	156	250	Number of outcomes (e.g., nr of reports, events, etc.)
11.2 Other tools - Number of Hotline/information centers created	0	1	2	Number of outcomes (e.g., nr of reports, events, etc.)
11.2 Other tools - Number of events/exhibitions organized	0	36	57	Number of outcomes (e.g., nr of reports, events, etc.)
11.3 Surveys carried out regarding awareness of the environmental/climate problem addressed (only mandatory for information and awareness projects)	0	945	945	Number of individuals surveyed
12.1 Networking	0	547	875	n. of individuals
13. Jobs	0	5	20	N. of FTE
14.1 Running cost/operating costs during the project and expected in case of continuation/replication/transfer after the project period	0	2 148 987	2 528 987	€
14.2.1 Capital expenditure expected in case of continuation/replication/transfer after the project period	-	100 000	80 000	€
14.2.2 Operating expenses expected in case of continuation/replication/transfer after the project period	-	120 000	80 000	€
14.3 Future funding	0	100 000.00	80 000.00	€
14.4 Entry into new entities/projects	0	60 000.00	Replication	€

Comments on the financial report

The project is being funded by the LIFE programme for 99.8%, the Politecnico di Milano contributed for the 41.1% and the six other associated beneficiaries have contributed for the 58.9%.

Summary of Costs Incurred

This is in line with the expenditure and objectives foreseen at this stage of the project. At the moment, there are no budget deviations to report.

Table 9: Total Eligible costs from 03/07/2017 to 30/06/2022

Budget breakdown categories	Budget according to the grant agreement in €	Costs incurred in €	% of Budget
1. Personnel	1 285 956	1 403 393.44	109.1%
2. Travel and subsistence	115 204	37 034.38	32.2%
3. External assistance	431 100	374 870.64	87.0%
4. Durable goods	-	-	-
4.1 Infrastructure	-	-	-
4.2 Equipment	24 353	14 549.80	59.7%
4.3 Prototype	-	-	-
5. Land purchase / long-term lease	-	-	-
6. Consumables	0	2 334.82	-
7. Other Costs	123 000	142 960.44	116.2%
8. Overheads	138 569	138 257.00	99.8%
TOTAL	2 118 182	2 113 400.50	99.8%

Accounting system

The accounting systems of the different beneficiaries are organized in accordance with the respective obligations included in National legislation.

- POLIMI: has an electronic accounting system that complies with the rules issued by the Ministry of Education and by the University administration. In particular, the accounting system used is U-GOV.
- CNIEL: has an electronic accounting system based on two main tools, which are:
 - Sybil, to follow the budget, the expenditures, the subcontractor convention, and to create the Purchase orders when necessary;
 - Esker, to validate all the invoices we receive and to keep track of all the elements in the accounting.
- CTFGP: has an electronic accounting system that complies with Italian legislation.
- ENERSEM: has an accounting system that complies with the Italian rules; it is an ordinary accounting system (not a simplified one), with the costs divided into costs centres.

- **Fondazione QUALIVITA:** has an accounting system in which through the use of private management "Qualidata" all the incoming and outgoing movements of the institution are recorded every day.
- **UNIVERSITA CATTOLICA:** has an electronic accounting system. Each research project has a unique reference code. The accounting software used is SAP.
- **OriGIn:** uses an enterprise accountancy management software named WinBIz. Our accounts are verified by an independent control body named FIPROM.

Table 10: Code identifying the project costs in the analytical accounting system

POLIMI	AMM7RUEU06
CNIEL	5S431000
CTFGP	31018
ENERSEM	Cost centre n° 02
Fondazione QUALIVITA	2019-063-TTGG LIFE - POLIMI
UCSC	R2094300127
OriGIn	3040

- Brief presentation of the procedure of approving costs

1) POLIMI

The project expenditures have a double authorization: Project Leader and Department Manager.

For the acquisition of goods and services, the National and Regional legislation obliges all public beneficiaries to fulfil the compliance with the rule of the best value for money. Public beneficiaries have to refer to the Consip spa (MEPA system Electronic Market for Public Administration) or Sintel (Regional system of e-procurement for public administrations) as first option. When the MEPA may not fulfil the requirements (e.g. lack of products or not correspondence with the required characteristics), the administration may implement the rule of the best value for money.

The hiring of temporary personnel for the project activities for public beneficiaries is made with public tenders (approved by the National financial authority Corte dei Conti) in compliance with both the National rules and the specific indications of each central administration.

2) CNIEL

Project expenditure are authorized throughout a purchase order that will be validated by the project manager, then by the team leader, then the pole leader and the General Secretariat. Depending on the amount, the Director General may also have to validate.

For subcontractors a partnership agreement with all the financial specificities is prepared and signed by the director general. The invoices are validated by the project leader, the team leader and the General secretariat.

3) CTFGP

project costs are approved by the CTFGP board of directors. If the project have specific expenditure rules, these are followed for the selection of the external assistance expenditures.

4) ENERSEM

Project expenditures are authorized by the project manager, Matteo Zanchi.

For the acquisition of goods, we either ask for multiple bids, after a market research for identifying the best value for money or, for minor expenses we directly purchase from web market places like Amazon or others, looking for the best offers using the research engine of these platforms.

5) Fondazione QUALIVITA

For expenses, the director of the Qualivita Foundation, responsible for the project, authorizes and approves the expenses to be incurred. With regards to the selection, the external personnel who will temporarily perform some of the project activities will be chosen by the ordinary selection criteria followed by the Qualivita Foundation, or through the curriculum, the experiences and a direct interview.

6) UNIVERSITA CATTOLICA DEL SACRO CUORE (UCSC)

has multiple structures involved in the cost controlling procedure. The Research Office communicates to the Principal Investigator (the professor/researcher) in charge of the project which are the rules (internal and call related) applied to the project.

As far as consumables and other costs are concerned, the principal investigator approves the best offer provided by a pool of suppliers and a request of purchase is made through SAP. The request is verified against the set criteria (type of supply, reference to the project, CUP, etc.) and then approved by the Research Office supervisor and is transformed into an effective order. The order is sent to the supplier. A best value for money is used as a standard principle.

The hiring of temporary staff is made through public tenders for research fellows and directly for collaborators (co.co.co, prestazione occasionale), in compliance with the internal rules.

The purchase of equipment follows a process similar to the purchase of consumables and other goods and services and is made according to internal procedures.

7) oriGIn

The accounts of the Organization are presented at the General Assembly, which meets every two years. The General Assembly approves the accounts and the overall budget of the Organization. The secretariat in Geneva is in charge of implementing the action plan and its costs according to the decision of the general assembly with the support of the executive committee.

- Type of time recording system used, i.e. electronic or manually completed timesheets

The time recording system of all Beneficiaries is based on manually completed timesheets, filled on daily/weekly bases, organized in agreement with the format acknowledged by the LIFE toolkit system.

- 1) POLIMI: produce an internal daily independent electronic registration system. The permanent and temporary staff involved in project activities, in addition to the project timesheets, have also a daily electronic registration system.
 - 2) CNIEL: have an internal electronic daily registration system but with no automatic linkage with our project's timesheet which is manually completed
 - 3) CTFGP: an independent internal manual daily registration system is produced, and in addition, the timesheets of the project are produced.
 - 4) ENERSEM has an electronic (Excel) registration system, based on the timesheets. These timesheets are regularly updated, printed at the end of each month, signed and then collected and stored in a paper hard copy in ENERSEM office.
 - 5) Fondazione QUALIVITA has a system for recording attendance through the "monthly attendance sheet" which summarizes the hours of work, holidays, permits, days of absence due to illness, etc., of each employee of the Foundation. Once completed, the monthly attendance sheet is sent to the labour consultant, who will process the individual payslips based on the data contained in the attendance sheet.
 - 6) UNIVERSITA CATTOLICA has two systems for encoding time worked on a project. teachers, researchers, research fellows are required to fill in only one of these systems. The software is called Genius and provides an overall view of all the activities carried out by the abovementioned categories. Lab technicians and other administrative staff employed on projects have a badge based electronic system that registers the overall worked hours in addition to Genius.
 - 7) OriGIn: The timesheets are produced manually for the project.
- Brief presentation of the registration, submission and approval procedure/routines of the time registration system

Each project beneficiary has an appointed administrative responsible which, in combination with the technical manager, is entrusted to verify the timing and correctness of periodic registration of the own personnel involved in project activities.

In order to avoid, as much as possible, mistakes and time consuming remaking of inappropriate documents, the timesheets are recorded in electronic version; the copy is hence initially checked by the Beneficiary management and subsequently, submitted to the Coordinating management (Administrative responsible and Coordinator) for the final approval after the evaluation of the technical compliance with requested mandatory information and with scheduled activities. The approved timesheet is finally signed by the Beneficiary responsible. The hard paper copies are kept by the administration of each corresponding Beneficiary, while the electronic true consistent copies are sent to the Coordinating beneficiary, that stored it in the recording system.

- Brief explanation on how it is ensured that invoices contain a clear reference to the LIFE project showing how invoices are marked in order to show the link to the LIFE project

For all the documents related to project costs and expenses (i.e., offers, invoices, contracts etc) is mandatory for all beneficiaries to either require or include a clear reference to the project based on both identification code and acronym (LIFE 16 ENV/IT/000225 – LIFE TTGG).

For POLIMI, as Public Body, we have an additional identification code, a specific Italian project's unique code for financial traceability. LIFE TTGG Codice Unico di Progetto: CUP n° D42F16001330006.

Certificate on the financial statement

The certificate on the financial statement is not mandatory for any of the beneficiaries of the LIFE TTGG project, as stated in Article II.23.2 of the amendment letter received from ESAME the 16.08.2018. It is because any beneficiaries received a total contribution lower than € 750 000.00.

Estimation of person-days used per action

Table 11: budgeted person-days by group of actions

Action type	Budgeted person-days	Estimated % of person-days spent
Action B: Implementation actions	5 389	112%
Action C: Monitoring of the impact of the project action	163	92%
Action D: Public awareness/communication and dissemination of results	1 143	85%
Action E: Project management	837	108%
TOTAL	7 568	107%

Annex

Table 12 shows the list of annexes to the present report.

Table 12. List of annexes

Folder	Name of the annex	Date of completion or the last revision
B1	Deliverable B1.1 - LCI database. The LCI will produce primary data to be implemented in ILCD Data Network following the Compliance rules and entry-level requirements	04.11.2022
B1	Deliverable B1.2 - Guidelines on LCI database adaptation	22.11.2021
B1	Results concerning the 8 datasets	31.08.2022
B2	Deliverable B2.1 - Life Cycle Impact Assessment (LCIA)	20.06.2022
B2	Deliverable B2.2 - Report on the LCIA tool and Life Cycle Impact Assessment (LCIA) description	20.06.2022
B3	Deliverable B3.1 - Dossier with visual maps	30.06.2022
B3	Deliverable B3.2 - Maps, mood boards	30.06.2022
B3	Deliverable B3.3 - Signs and rules for the PEF identity	30.06.2022
B3	Deliverable B3.4 - Maquette, mock-up, aesthetic prototype	30.06.2022
B3	Deliverable B3.5 - Report Packaging communication system design	30.06.2022
B4	Deliverable B4.1 - Audit description and results	11.09.2020
B4	Deliverable B4.2 - PEF reduction measures: description	16.11.2020
B4	Deliverable B4.3 - PEF reduction measures: EDSS sheets	30.08.2022
B4	Deliverable B4.4 – Summary report "PEF reduction measures: description"	19.11.2021
B4	Policy feedbacks	31.08.2022
B5	Deliverable B5.1 – Requirements specification document	08.01.2020
B5	Deliverable B5.2 – Software design documentation	27.01.2020
B5	Deliverable B5.3 – Release alpha version of the software	20.06.2022
B5	Deliverable B5.4 – Release beta version of the software	20.05.2022
B5	Deliverable B5.5 – Release final version of the software	30.06.2022
B5	Deliverable B5.6 - Release of software user manual and technical documentation	30.06.2022
B5	Validation by CSQA	30.06.2022
B6	Deliverable B6.1 - Transferability plan	06.11.2018
B6	Deliverable B6.2 - EU PDO Datasheets (collection of PDO products information and best practices)	23.11.2018
B6	Deliverable B6.3 - Workshop material (Speakers' presentations, studies, etc.)	30.06.2022
B7	Deliverable B7.1 - LCI database. The LCI will produce primary data to be implemented in ILCD Data Network following the Compliance rules and entry-level requirements	30.06.2022
B7	Deliverable B7.2 - EDSS test on other companies	31.08.2022
B7	Deliverable B7.3 - Report on the use of EDSS on other PDOs (besides Grana Padano) and guidelines for the supervisor activity for BM development	30.06.2022
C1	Deliverable C1.1 - Monitoring Protocol. It will include the description of the monitoring procedure and the monitoring indicators	25.09.2017
C1	Deliverable C1.2 - Report on progress on performance indicators	02.07.2018
C1	Deliverable C1.3 - Report on progress on performance indicators	30.11.2018
C1	Deliverable C1.4 - Report on progress on performance indicators	30.09.2019
C1	Deliverable C1.5 - Report on progress on performance indicators	07.01.2022
C1	Deliverable C1.6 - Report on progress on performance indicators	20.06.2022

C1	Deliverable C1.7 - Extensive Monitoring Report: socio-economic and environmental impacts of the project	04.11.2022
C1	Deliverable C1.8 - Report on progress on performance indicators	30.06.2022
D1	Deliverable D1.1 - Project website	28.11.2018
D1	Deliverable D1.2 and D1.5 - Video and brochure and Articles for magazines	20.06.2022
D1	Deliverable D1.3 - Guidelines on consumers' engagement	27.01.2022
D1	Deliverable D1.4 - Packaging test report and TV	31.08.2022
D1	Deliverable D1.6 - Layman's report	30.06.2022
D1	Deliverable D1.7 - Notice boards	09.06.2022
D2	Deliverable D2.1 - Dissemination & Communication Plan	16.03.2020
D2	Deliverable D2.2 - Stakeholders contacts database	05.03.2020
D2	Deliverable D2.3 - Designing of template and layout for the dissemination & communication materials	20.10.2020
D2	Deliverable D2.4 - Implementation of the following dissemination & communication materials	30.06.2022
D3	Deliverable D3.1 - Mid-term deliverable	22.07.2019
D3	Deliverable D3.2 - Final-term deliverable	30.06.2022
E1	Deliverable E1.1 - Monitoring protocol and contingencies plan	11.10.2018
E1	Deliverable E1.2 - Progress report	16.02.2019
E1	Deliverable E1.3 - Mid-term report	29.11.2019
E1	Deliverable E1.4 - Progress report	05.03.2021
E1	Deliverable E1.5 - Progress report	15.02.2022
E1	Presentations and other material used during the annual audits	30.06.2022
E1	CTFGP declaration on travel allowance paid in addition to the reimbursement of actual travel costs for personnel employees	31.08.2022
E1	Polimi statement on rate of personnel per day	31.08.2022
E1	UCSC statement on change of the director	31.07.2022
E1	Financial statements and other financial information	31.08.2022
E2	Deliverable E2.1 - Business model and business plan	03.08.2020
E2	Deliverable E2.2 - Communication plan	31.08.2022
E2	Deliverable E2.1 - Business model and business plan reviewed	30.06.2022