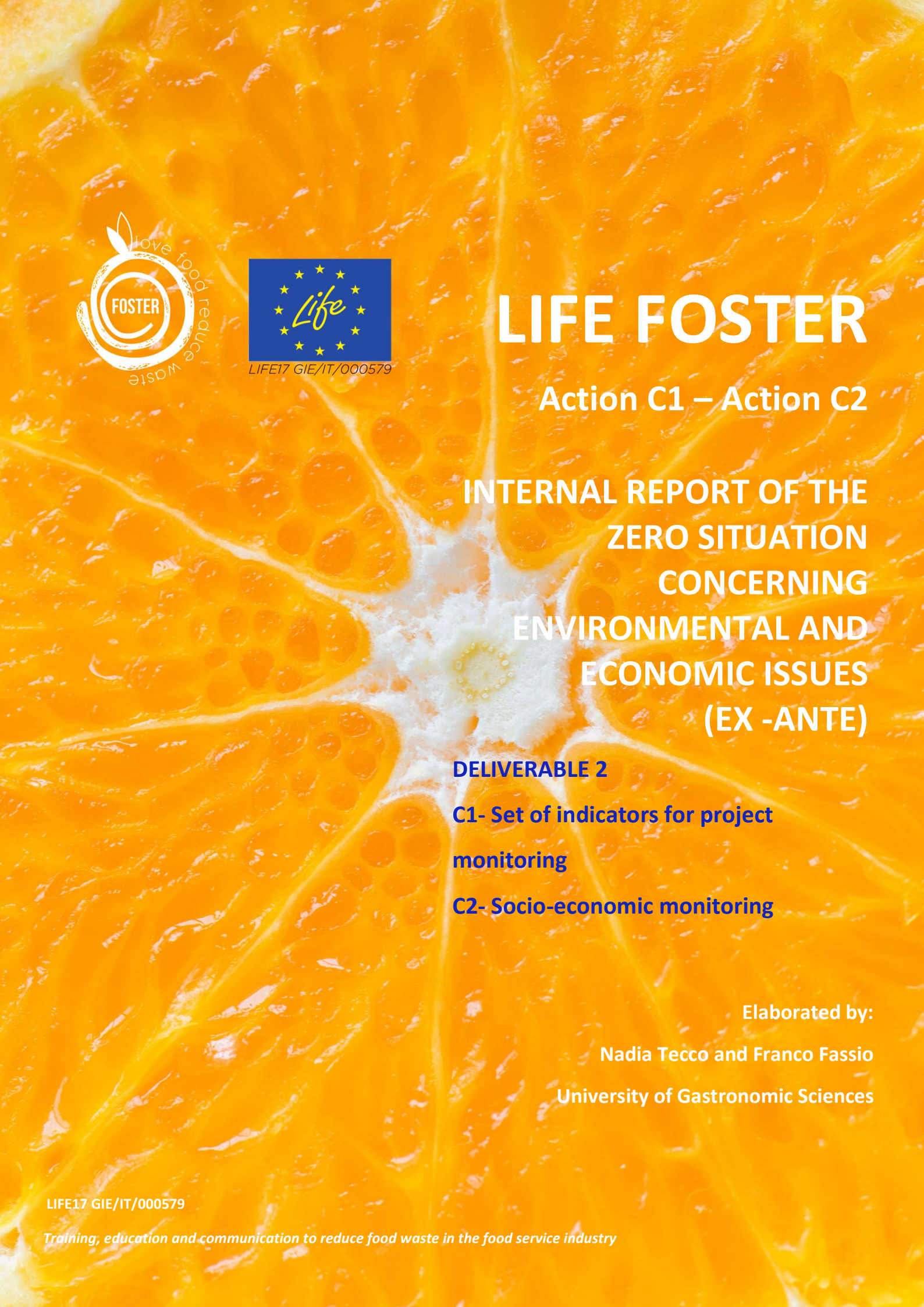

LIFE17 GIE/IT/000579

LIFE FOSTER

Action C1 – Action C2

INTERNAL REPORT OF THE ZERO SITUATION CONCERNING ENVIRONMENTAL AND ECONOMIC ISSUES (EX -ANTE)

DELIVERABLE 2

C1- Set of indicators for project monitoring

C2- Socio-economic monitoring

Elaborated by:

Nadia Tecco and Franco Fassio

University of Gastronomic Sciences

Internal report of the ZERO situation concerning environmental issues

highlight of the situation at the beginning of the FOSTER project

EX-ANTE MONITORING

DELIVERABLE 2

C1- Set of indicators for project monitoring

C2- Socio-economic monitoring

The opinions expressed in this Report are those of the authors and do not necessarily reflect the opinions of the European Commission, or any other organization mentioned. As a result, these will be verified before implementation of any of the recommendations contained herein.

Version: 01 Final Date*: 07.11.2020*
Developed by: Franco Fassio, University of Gastronomic Sciences
Nadia Tecco, University of Gastronomic Sciences

Contact details: info@lifefoster.eu

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

EXECUTIVE SUMMARY

The report **"Internal report of the ZERO situation concerning environmental and economic issues"** presents the main findings and results of the actions C1- Set of indicators for project monitoring and C2- Socio-economic monitoring with regard to the economic and environmental dimensions for the baseline/ex-ante phase. The mmonitoring activity is therefore the focus of this report, but it is relevant to draw attention that the monitoring activity has become an integral part of the LIFE FOSTER **Food Waste Tool (FWT)** (see the Deliverables "Rationale of the LIFE FOSTER strategy to prevent and reduce food waste in the restaurant sector" and "Method for food waste quantification of possible benefits that the project LIFE FOSTER will use").

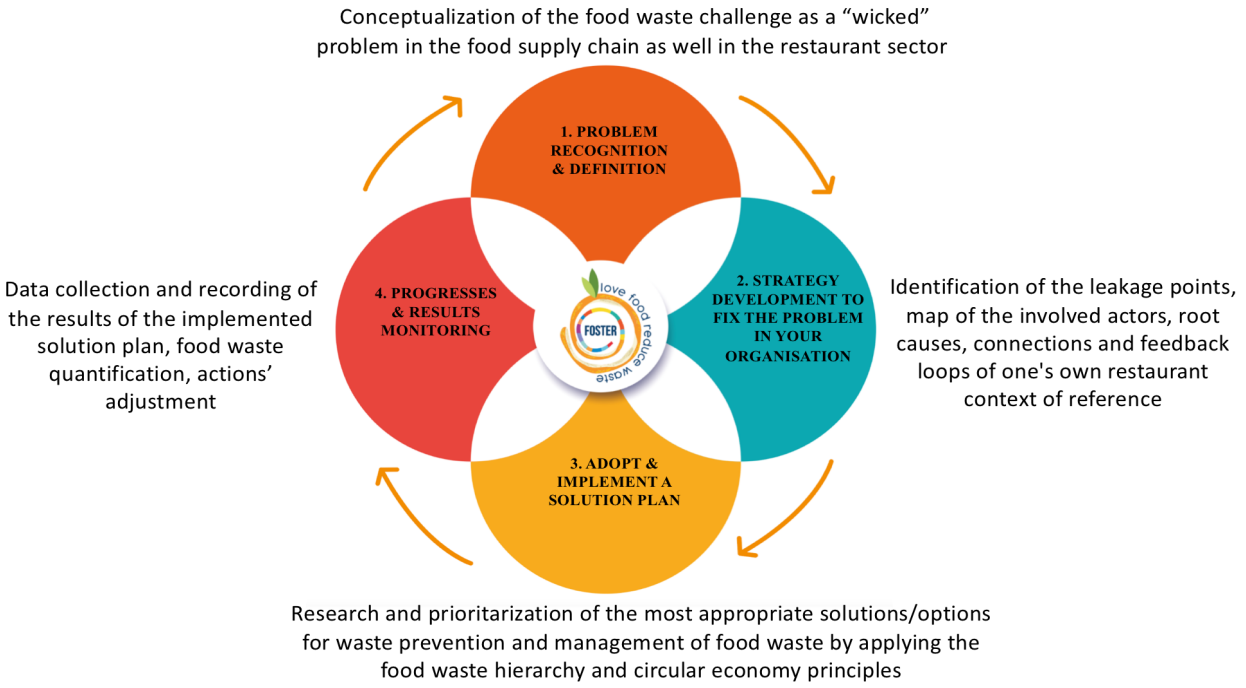

Figure I: schema of the LIFE FOSTER **Food Waste Tool (FWT)**

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

After a first reference to the methodology used to collect the data and the characteristics of the sample (number of voluntary training centres involved, number of menus and recipes subject to the sample analysis, quality and completeness of the data) the report provides an overview of the analysis results, to supplement and complete the reporting carried out at the micro and meso level for each single recipes and menu (see annexes).

Given the diversity of recipes (in terms of ingredients, number of ingredients, complexity in processing) and contexts in which the various training centres operate (only laboratories, laboratories and restaurant, different king of students), this triple level of restitution (micro, meso and macro) has been opted for.

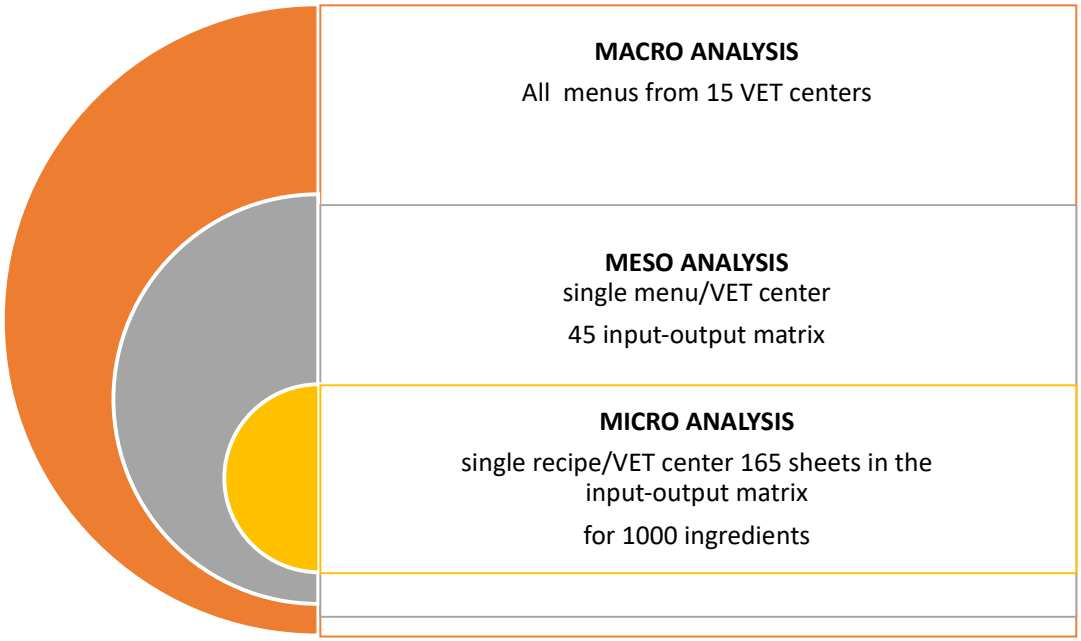

Figure II: The different level of analysis starting from the ingredients, to the recipe, menu from all VET centres involved in the monitoring

MICRO: recipes and ingredients have been the starting point. This level allows to have a precise view on the elaboration of the single recipe, allowing to collect basic quantitative and economic data relating to the single ingredients, whose flow is monitored during the elaboration of the recipe until it flows into the final product.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

MESO: the level of detail on the single menu, presented in the excel spreadsheets will allow the training centres to obtain specific elements to adopt solutions aimed at preventing food waste, by contextualizing at best the weaknesses (spillage and leakages points) present within one's flow of matter and energy and by adopting/adapting/customizing the array of solutions accordingly to their specific needs consistently with the LIFE FOSTER training model.

MACRO: the macro analysis carried out mirroring what has been realized on a micro scale, will allow instead to carry out transversal and more general (where possible aggregated) considerations relating to the characterization of vocational training centres, data quality and difficulties in terms of data entry, mainly functional to the improvement of data collection in the subsequent phases of the project. This first monitoring in fact assumed a strategic value for the progress of C1 and C2 activities during the project, defining the baseline on which the progress obtained by the vocational training centres and restaurants involved in the project will be monitored and it has constituted a first testing and running of the food waste data gathering tool (Food Waste Flow Balance) and of the algorithms that has been used for the development of the web application.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

CONTENTS

1. DATA COLLECTION

   1.1. DATA COLLECTION METHODOLOGY
   1.2. DURATION OF DATA COLLECTION
   1.3. DESCRIPTION OF THE SAMPLE OF THE VOCATIONAL TRAINING CENTERS

2. DATA ANALYSIS

   2.1. COMMENTS ON PRIMARY DATA QUALITY AND DATA ENTRY OPERATIONS
   2.2. DATA ELABORATION
   2.3. DATA ANALYSIS

3. FEEDBACKS FOR THE "IN ITINERE" MONITORING"

   ANNEX I-VXV: INPUT-OUTPUT MATRIX

1. DATA COLLECTION

1.1. DATA COLLECTION METHODOLOGY

The responsible of the implementation of the Action C1 and C2 was the University of Gastronomic Sciences (UNISG). ENAIP-NET, AFPA, ITS and CECE supported UNISG in collecting data and information for the monitoring, each for their own country of origin. The process of data collection has been realized for the baseline through the use of the Food Flow Balance (FfB)[1], a tool designed by UNISG and configured as an excel grid for data entry associated with a calculation tool, where all the operations of imputation of data and their processing are carried out in order to calculate the food flows inherent to the waste balance. Each data collection/survey takes as a reference the preparation of a menu, thus composed:

- Dish 1: Starter/Appetizer
- Dish 2: First course (es. Pasta, soup, risotto)
- Dish 3: Main course with vegetables (es. Meat or fish with vegetables)
- Dish 4: Dessert

The choice was made to improve the internal comparability of the measurements within the single center, among the different centers and in the future also with the data coming from the restaurants. The menu elaborated in the VET centers for the monitoring laboratory is in fact made up of a number of courses that are equivalent to those proposed by a menu in a restaurant. Comparability will also be possible, because each survey will be traced back to the product categories used for the preparation of the dishes that make up the menu and environmental and economic indicators have been created capable of providing information on the menu/recipes, regardless of their composition such as the

[1] The first deliverable about action C1 and C2 ""Method for food waste quantification of possible benefits that the project LIFE FOSTER will use" describes the methodology with which the tool, the Food Waste Balance, was conceived and built.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

ratio food waste amount / food amount for menu OUTPUT / INPUT (see pag. 20) and the ratio food waste cost / food cost OUTPUT /INPUT (see pag. 21). Furthermore, the recipe-menu relationship was considered the most appropriate level for the implementation for a circular menu design and planning, as a result of the experiments conducted in UNISG canteen as part of the project.

University of Gastronomic Sciences
Università degli Studi di Scienze Gastronomiche

La settimana del Menù Circolare

27 - 31 Gennaio 2020, Pollenzo, Tavole Accademiche

Le Tavole ACCADEMICHE UNISG

	Lunedi'	Martedì	Mercoledì	Giovedì	Venerdì
Antipasto e/o Zuppa	Flan di carote su base di spinaci	Ribollita di cavolo nero	Zucca in diverse consistenze	Patè di fegatini su crostone di pan brioche e maionese di fondo bruno	Crema di porri e patate con le sue chips
	Il cuore delle carote viene utilizzato per il flan mentre le bucce serviranno per fare brodi vegetali	*Gli avanzi saranno utilizzati per la torta salata di verdure*	*Piatto in cui la zucca è utilizzata in tutte le sue parti*	*Piatto che utilizzza i fegatini di pollo e coniglio. Il pan brioche avanzato sarà usato per il Pain perdù*	*Piatto in cui gli ingredienti sono utilizzati completamente. La buccia delle patate è utilizzata per le chips*
Beati i primi	Gnocchi ai formaggi	Risotto ai porri	Ruote pazze al ragù di frattaglie	Cappellacci in brodo di cipolle bruciate	Zuppa Valpellinense
	Il formaggio avanzato sarà utilizzato per la zuppa Valpellinense	*I porri avanzati saranno utilizzati per la crema di porri e patate*	*Piatto che utilizza le frattaglie del pollo e del coniglio*	*Piatto che utilizza i rossi d'uovo avanzati dalla preparazione della meringa e il brodo creato a partire dalla buccia delle cipolle*	*Per la sua preparazione si utilizza il pane vecchio, il brodo fatto con le bucce delle carote e il formaggio avanzato dagli gnocchi ai formaggi*
Main	Cipolle ripiene di verdure	Pollo alla cacciatora	Torta salata di verdure	Insalata di legumi con tonno di coniglio	Polpette in foglie di verza
	Cipolle ripiene di verdure *Le parti più esterne delle cipolle verranno utilizzate per il brodo dei cappellacci*	*Le interiora verranno utilizzate per il ragù delle ruote pazze, i fegatini verranno utilizzati per il patè di fegatini, mentre con le ossa si farà un brodo.*	*Piatto che utilizza le verdure avanzate dalla ribollita*	*Le interiora del coniglio verranno utilizzate per il ragù delle ruote mentre i fegatini verranno utilizzati per il patè*	*Vengono utilizzati gli avanzi di carni e verdure*
Dolcino	Carrots cake con meringa italiana	Torta di nocciole	Pere al vino con sorbetto speziato	Brownies di cioccolato e zucca	Pain perdu con gelato al fior di latte
	Gli albumi sono utilizzati per la meringa italiana, mentre i rossi delle uova saranno impiegati per la pasta dei cappellacci		*Il fondo di cottura delle pere è riutilizzato per aromatizzare il sorbetto che le accompagna*	*Viene utilizzata la zucca avanzata dalle diverse consistenze di zucca*	*Viene utilizzato il pan brioche avanzato dal "patè di fegatini su crostone di pan brioche"*

Figure II: The week-menu experimented in UNISG to test the use of circular economy principle in the menu design

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

For each menu, defined as a variable set of dishes (each plate has a dedicated compilation space within the FfB report), the FfB tracks the quantity of food waste produced and its economic value during the life cycle of preparing a menu and the dishes that compose it at different moments/stations: from receiving goods to storage, from storage to preparation, from preparation to consumption

To accomplish this purpose, the data entry mask has been structured into 5 parts/sheets described in the following table.

SHEET	DATA TO ENTER
1. VET center profile and laboratory information	1.1 VET CENTER NAME
	1.2. VET CENTER CITY
	1.3. VET CENTER COUNTRY
	1.4. NUMBER OF KITCHEN LAB IN THE VET CENTERS FOR SCHOOL YEAR (for restaurants average number of seats for day by considering one year of operation)
	1.5. AVERAGE NUMBER OF STUDENTS FOR CLASS
	1.6. CONTACTS OF THE PEOPLE IN CHARGE FOR DATA COLLECTION
	1.7. PERIOD OF DATA COLLECTION
2. Data on equipment and energy and water costs	2.1. KITCHEN EQUIPMENT LIST
	2.2. EQUIPMENT WATTAGE
	2.3. COST OF WATER EXPRESSED IN €/m³, cost of energy expressed in €/kWh;
	2.4. COST OF ENERGYEXPRESSED IN €/kWh;,
3. Data along the purchasing and storage phase (IN or station 1)	3.1. INGREDIENTS LIST FOR DISH (INPUT)
	3.2. QUANTITY OF INGREDIENTS PURCHASED (INPUT)
	3.3. COST FOR EACH INGREDIENT (INPUT)
	3.4. QUANTITY OF INGREDIENT WASTED DURING THE STORAGE PHASE (OUTPUT)
4. Data along the processing and cooking phase (DURING or station 2):	4.1. NUMBER OF PLANNED PORTIONS (INPUT)
	4.2. AMOUNT OF WATER FOR PROCESSING AND COOKING PHASE (INPUT)

	4.3. AMOUNT OF ENERGY FOR PROCESSING AND COOKING PHASE (INPUT) BY USING TIME USE OF EQUIPMENT
	4.4. QUANTITY OF WASTE TRACED DURING THE PROCESSING AND COOKING PHASE FOR EACH INGREDIENTS/RECIPE
	4.5. EDIBILITY / INEDIBILITY OF FOOD WASTE FOR EACH INGREDIENTS
5. Data along the consumption phase (OUT or station 3):	5.1. NUMBER OF CONSUMED PORTIONS (INPUT)
	5.2. WEIGHT FOR PORTION
	5.3. AMOUNT OF LEFTOVER (OUTPUT) Sum of the mass ("weight") for the food scraps for each kind of plate
	5.4 AMOUNT OF FOOD DUE TO MISSED CONSUMPTION (OUTPUT)
	5.5. FINAL DESTINATION OF FOOD DUE TO MISSED CONSUMPTION (STOCKED, WASTED OR OTHER)
	5.6. FINAL DESTINATION OF FOOD WASTE

Table I: Sections of the data mask for the data entry

For each country, a contact person was identified for monitoring who was explained how the tool works. Where it was considered appropriate, UNISG held face-to-face meetings in Italy or in streaming video calls in the case of Spain, Malta and France to explain the rationale and methods of compiling the data entry. Assistance was also provided in the course of data allocation in order to explain and settle doubts about the monitoring.

1.2. DURATION OF THE DATA COLLECTION

The collection of the data for monitoring for the purposes of identifying the baseline[2] took place in the period between November 2019 and April 2020[3].

3 With the exception of the VET of Valencia, which realized the monitoring in the month of October 2020.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

1.3. DESCRIPTION OF THE SAMPLE OF THE VOCATIONAL TRAINING CENTERS

For the baseline data collection UNISG has collected 45 menù from 15 different VET centers. Data has been collected for the preparation and consumption of 165 singles dishes/recipes, on average 4(3,66) dishes for menu. 824 people (trainers+students) have been involved in this action with an average of 17 participants for laboratory (all the data all listed in Table II.

Country/Region	Vocational training center	Menu ID[4]	Number of dishes/recipes	Number of students in the menu elaboration
Italy/Veneto	Conegliano	I	5	27
Italy/Veneto	Conegliano	II	5	10
Italy/Veneto	Bassano del Grappa	I	4	16
Italy/Veneto	Bassano del Grappa	II	4	16
Italy/Veneto	Bassano del Grappa	III	4	20
Italy/Veneto	Dolo	I	3	15
Italy/Veneto	Isola della Scala	I	4	18
Italy/Veneto	Isola della Scala	II	4	18
Italy/Veneto	Isola della Scala	III	4	18
Italy/Veneto	Feltre	I	4	15
Italy/Veneto	Feltre	II	4	15
Italy/Veneto	Feltre	III	4	15
Italy/Veneto	Longarone	I	1	18
Italy/Veneto	Longarone	II	1	18
Italy/Veneto	Padova	I	4	16

[4] The number in the column corresponds with the identifier created for each input-output matrix compiled for the 45 menus with the following wording: Matrix input-output_baseline_Country (IT, FR, SP, MT)_Vocational training center_Menu_number of the menu (I, II, III) (see Annexes).

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

Italy/Veneto	Padova	II	4	18
Italy/Veneto	Padova	III	4	14
Italy/Veneto	Padova	IV	3	15
Italy/Veneto	Padova	V	3	18
Italy/Veneto	Piazzola	I	1	20
Italy/Veneto	Piazzola	II	4	15
Italy/Veneto	Piazzola	III	2	12
Italy/Veneto	Piazzola	VI	4	14
Italy/Veneto	Porto Viro	I	4	22
Italy/Veneto	Porto Viro	II	4	22
Italy/Veneto	Porto Viro	III	4	22
Italy/Veneto	Porto Viro	IV	4	20
Italy/Veneto	Porto Viro	V	4	20
Italy/Veneto	Porto Viro	VI	4	20
Spain	Bilbao	I	4	15
Spain	Bilbao	II	4	16
Spain	Bilbao	III	4	14
Spain	Valencia	I	4	25
Spain	Valencia	I	4	25
Spain	Valencia	I	4	25
France	Stains	I	4	11
France	Stains	II	4	20
France	Colmar	I	3	12
France	Colmar	II	3	12
France	Colmar	III	3	12
France	Rennes	I	2	15
France	Rennes	II	3	15
France	Rennes	III	3	15
Malta	Hal-Luqa	I	6	12
Malta	Hal-Luqa	II	6	12

Table II: Recipe / menu prospectus for each survey in the various vocational training centers and number of students involved in the preparation of the recipes and related monitoring

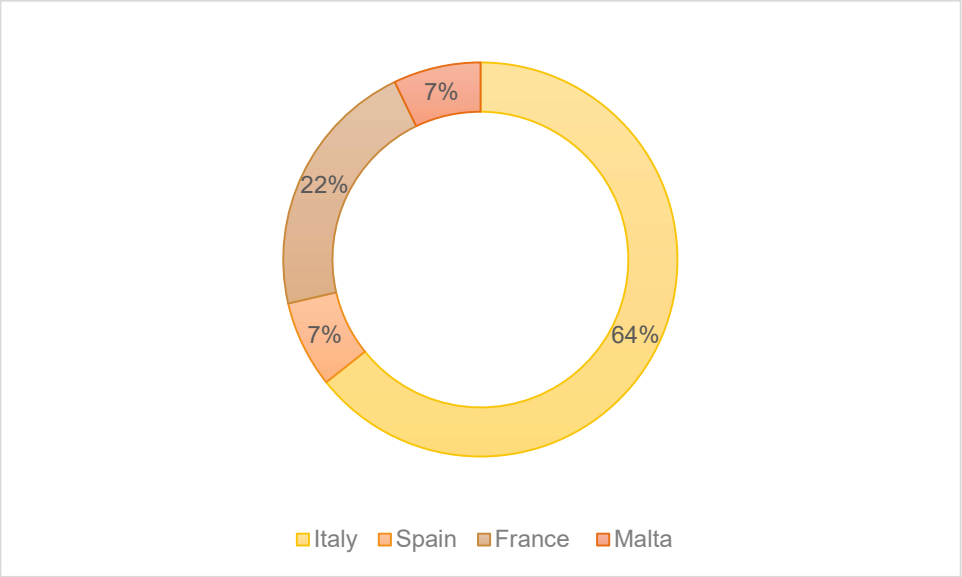

Figure III: Country of origin of the 15 VET centers involved in the monitoring action in percentage

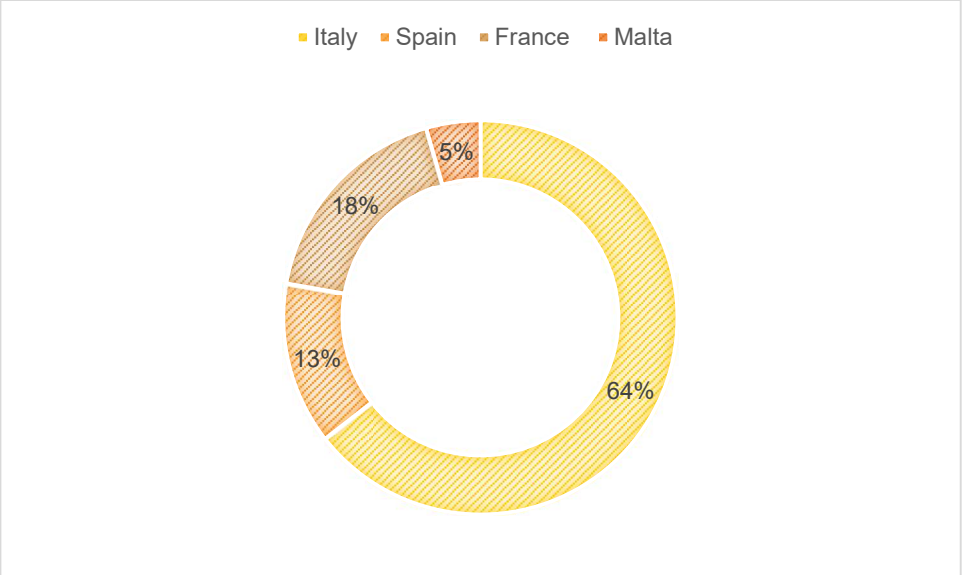

Figure VI: Number of menus provided by country by percentage, total 45

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

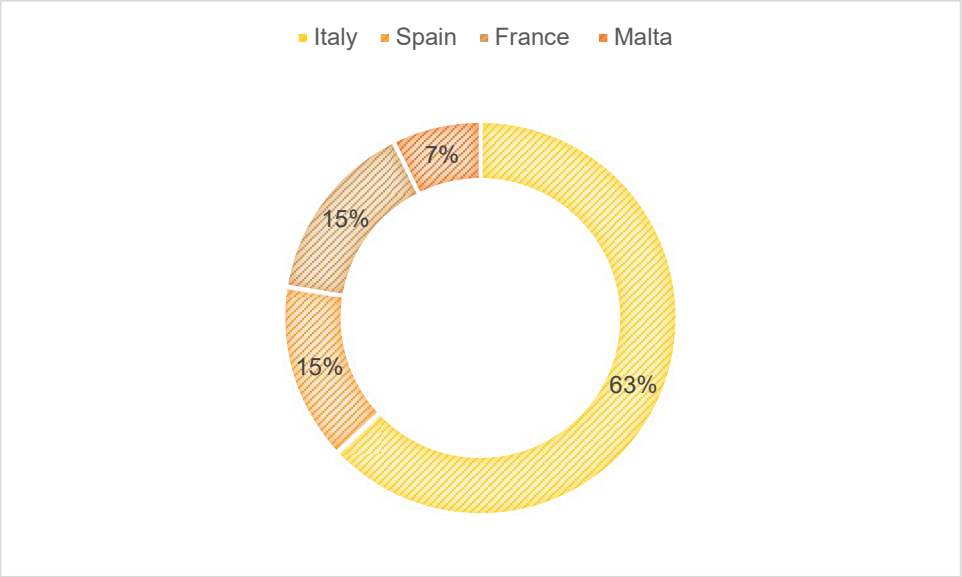

Figure V: Number of recipes provided by country in percentage, total 165 for 1000 ingredients

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

2. DATA ANALYSIS

2.1. COMMENTS ON PRIMARY DATA QUALITY AND DATA ENTRY OPERATIONS

Data quality is uneven depending on the VET center and in particular by the degree of accuracy with which the data entry was completed by the reference person. Some VET centers completed the excel grid in a correct and exhaustive way. In others, however, the compilation was partial or even missing for some sections. The incompleteness of the data has a highly variable character: in some cases, the economic data relating to the cost of the raw material are missing, in others there isn't the sheet relating to the consumption of water and energy, the equipment supplied or the sheet relating to consumption (station 3) are missing. Where there were no/partial data on the energy consumption of the equipment or where the prices of raw materials were absent, it was necessary to determine, through interpolation, approximate values starting from the known values communicated by other training centers of the same country of origin or available on the market at the national level (in the case of the ingredients' prices). In this way, part of the data was recovered in the face of extra work to get them by UNISG. A common trend in the data charges of the various training centers is linked to the low presence of food waste detected in station 1 (goods reception-storage). The nature of this data in addition to highlighting an effective quantity of food waste for this phase in the training centers, which mostly adopt a weekly or bi-weekly purchasing model depending on the laboratory activities, could however also be linked to a lack of knowledge / access to the flow of information on this specific phase of the person responsible for data attribution, identified in the figure of the kitchen laboratory manager.

Country/Region	Vocational training center	Menu ID	Number of dishes	Degree of completeness of food waste data	Degree of completeness of food inputs costs	Degree of completeness of energy-water inputs costs	Degree of completeness across the stations
Italy/Veneto	Conegliano	I	5	Total	Total	Total	Total
Italy/Veneto	Conegliano	II	5	Total	Total	Total	Total
Italy/Veneto	Bassano del Grappa	I	4	Total	Total	Total	Total
Italy/Veneto	Bassano del Grappa	II	4	Total	Total	Total	Total
Italy/Veneto	Bassano del Grappa	III	4	Total	Total	Total	Total
Italy/Veneto	Dolo	I	3	Total	Total	Total	Total
Italy/Veneto	Isola della Scala	I	4	Total	Total	Partial	Total
Italy/Veneto	Isola della Scala	II	4	Total	Total	Total	Total
Italy/Veneto	Isola della Scala	III	4	Total	Total	Total	Total
Italy/Veneto	Feltre	I	4	Total	Missing	Total	Total
Italy/Veneto	Feltre	II	4	Total	Missing	Total	Total
Italy/Veneto	Feltre	III	4	Total	Missing	Total	Total
Italy/Veneto	Longarone	I	1	Total	Missing	Total	Partial

Italy/Veneto	Longarone	II	1	Total	Missing	Total	Partial
Italy/Veneto	Padova	I	4	Total	Missing	Missing	Total
Italy/Veneto	Padova	II	4	Total	Missing	Missing	Total
Italy/Veneto	Padova	III	4	Total	Missing	Missing	Total
Italy/Veneto	Padova	IV	3	Total	Missing	Missing	No station 3
Italy/Veneto	Padova	V	3	Total	Missing	Missing	No station 3
Italy/Veneto	Piazzola	I	1	Total	Missing	Total	No station 3
Italy/Veneto	Piazzola	II	4	Total	Missing	Total	No station 3
Italy/Veneto	Piazzola	III	2	Total	Missing	Total	No station 3
Italy/Veneto	Piazzola	VI	4	Total	Missing	Total	No station 3
Italy/Veneto	Porto Viro	I	4	Total	Total	Total	Total
Italy/Veneto	Porto Viro	II	4	Total	Total	Total	Total
Italy/Veneto	Porto Viro	III	4	Total	Total	Total	Total
Italy/Veneto	Porto Viro	IV	4	Total	Total	Total	Total
Italy/Veneto	Porto Viro	V	4	Total	Total	Total	Total
Italy/Veneto	Porto Viro	VI	4	Total	Total	Total	Total
Spain	Bilbao	I	4	Total	Total	Total	Total
Spain	Bilbao	II	4	Total	Total	Total	Total
Spain	Bilbao	II	4	Total	Total	Total	Total
Spain	Valencia	I	4	Total	Total	Total	Total
Spain	Valencia	II	4	Total	Total	Total	Total
Spain	Valencia	II	4	Total	Total	Total	Total

France	Stains	I	4	Total	Missing	Total	Total
France	Stains	II	4	Total	Missing	Total	Total
France	Colmar	I	3	Total	Missing	Partial	Total
France	Colmar	II	3	Total	Missing	Partial	Total
France	Colmar	III	3	Total	Missing	Partial	Total
France	Rennes	I	2	Missing	Missing	Partial	No station 3
France	Rennes	II	3	Missing	Missing	Partial	No station 3
France	Rennes	III	3	Total	Missing	Partial	Partial
Malta	Hal-Luqa	I	6	Partial	Total	Missing	No station 3
Malta	Hal-Luqa	II	6	Partial	Total	Missing	No station 3

Table III: Prospectus on the level of completeness of the data provided for each individual menu

In other cases, where for example station 3 (consumption) was missing, it was not possible to retrieve the data, being contextual to the execution of the kitchen laboratory itself. In these cases (10/45[5] menus), the data were entered into the calculation tool (Matrix input-output) at the micro level, but they were not used for the purpose of cross-sectional considerations for the macro analysis part. However, it is important to reiterate how the difficulties related to data entry operations linked to the type of laboratory activity in training centers, in which the teacher, in addition to training the class, had to collect data for the purposes of imputation and the lack of input are been collected as useful feedback for structuring the web application.

2.2. DATA ELABORATION AND RESTITUTION

2.2.1 MICRO AND MESO LEVEL OF DATA ELABORATION

For the data processing at the micro and meso level (recipes) UNISG has developed a spreadsheet named as input-output matrix. The level of data aggregation is the menu, which consists of the sum of the data relating to the preparation and consumption of the individual dishes. To do this, the matrix collects all the information collected during the preparation of the menu, with an excel sheet dedicated to each single recipe. A transfer work was then carried out in making the data entry of the Food Flow Balance accessible in a single excel sheet, compared to 5 in the previous phase. This sheet contains the environmental and economic information collected during the monitoring, including the quantity and cost of the raw material used and the portion that has become waste, the quantity and cost with respect to energy and water inputs, classification of ingredients and

[5] Menu IV and 5 for Padova, Menu I, II, III, IV and V for Piazzola, Menu I, II for Rennes and Menu I, II for Hal Luqa.

waste by product type during the various stations, the degree of edibility for each fraction of waste produced identified within a scale from 0 (not edible) to 1 (completely edible), the portion of food in excess and used for other preparations or for consumption by the staff. The information has been linked with a further excel sheet (the first in order of display, which returns the information at the aggregate level of a single menu (meso level) with a graphical display of the results. In this sheet it is therefore possible to find the indicators and the categories of analysis that have been used to display the menu data with their relative graphic representation.

Output/input quantity ratio-MICRO & MESO LEVEL: this indicator measures the ratio between the total food waste amount in Kg (output) and the total food amount in Kg (input): the closer it is to 1, the higher the waste rate, as most of the raw material it becomes waste, the closer it gets to 0, the more the share of waste is reduced compared to the quantity of raw material / ingredient used. The graph shows the data aggregated at menu level, where each single sphere corresponds to a preparation / recipe. For example, in this graph it is possible to see a greater amount of waste relative to the first of the five preparations made. The same indicator has been calculated for each dish.

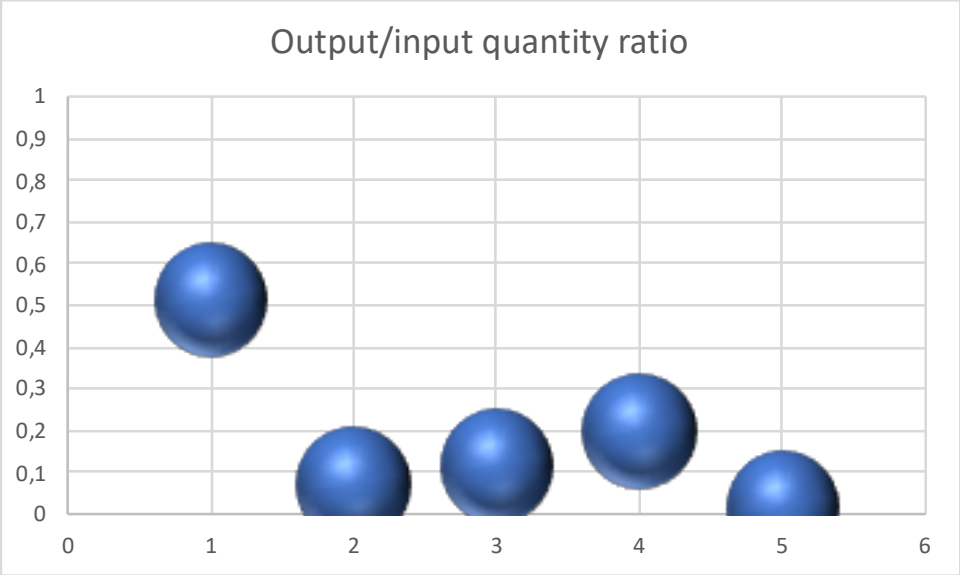

Figure VI: The output/input quantity ratio for the menu I of the VET center of Conegliano (Italy)

Source: data elaboration about BILBAO_Menu_1

Output/input cost ratio-MICRO & MESO LEVEL: this indicator measures the ratio between the total food waste value in Euro (output) (energy and water included) and the total food value in euro (input) (energy and water included): the closer it is to 1, the higher the waste rate is, as most of the raw material cost it becomes loss, the closer it gets to 0, the more the share of waste is reduced compared to the cost of raw material / ingredient used. The graph shows the data aggregated for the menu, where each single sphere corresponds to a preparation / recipe. For example, in this graph it is possible to see a greater cost of waste relative to the first of the five preparations made. The same indicator has been calculated for each dish.

It is interesting to note how the Output / input quantity ratio in relation to the Output / input cost ratio graph shows the incidence of the cost of food waste in relation to the cost of the different ingredients used (which is why recipes that require high raw material costs, for example fish-based preparations with a high amount of inedible waste show higher rates in the cost graph than in the quantity graph or recipes that requires a considerable amount of energy by using the oven for a prolonged period).

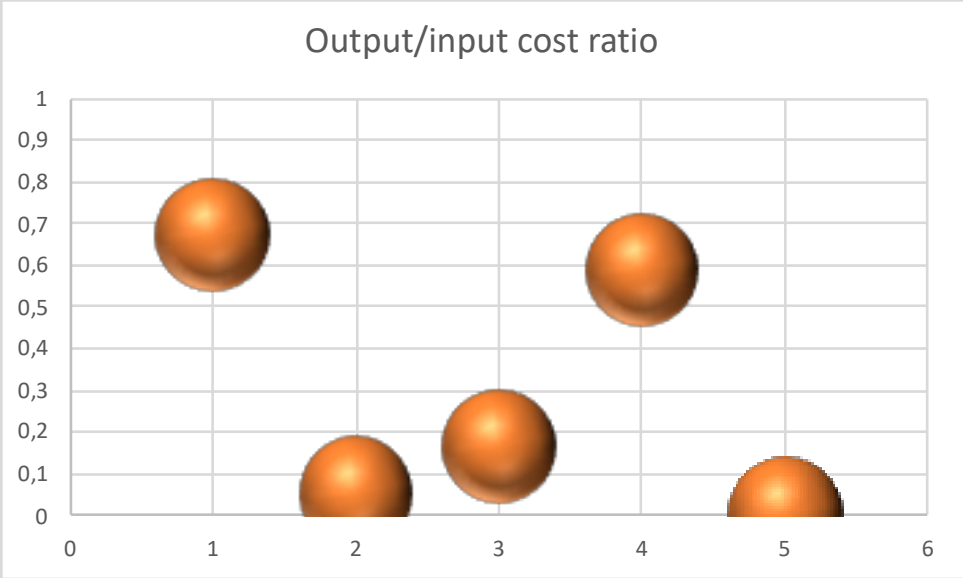

Figure VII: Figure VI: The output/input cost ratio for the menu I of the VET center of Conegliano (Italy)

Food waste amount (Kg) for dish and station-MICRO & MESO LEVEL: this type of data elaboration allows you to view the aggregate quantity (as a result of the various preparations that make up the menu) of waste made during the three monitoring stations. In the example proposed by the processing of the graph of Figure VIII, the concentration of waste in phase 2 is immediately visible with particular reference to 3 different preparations.

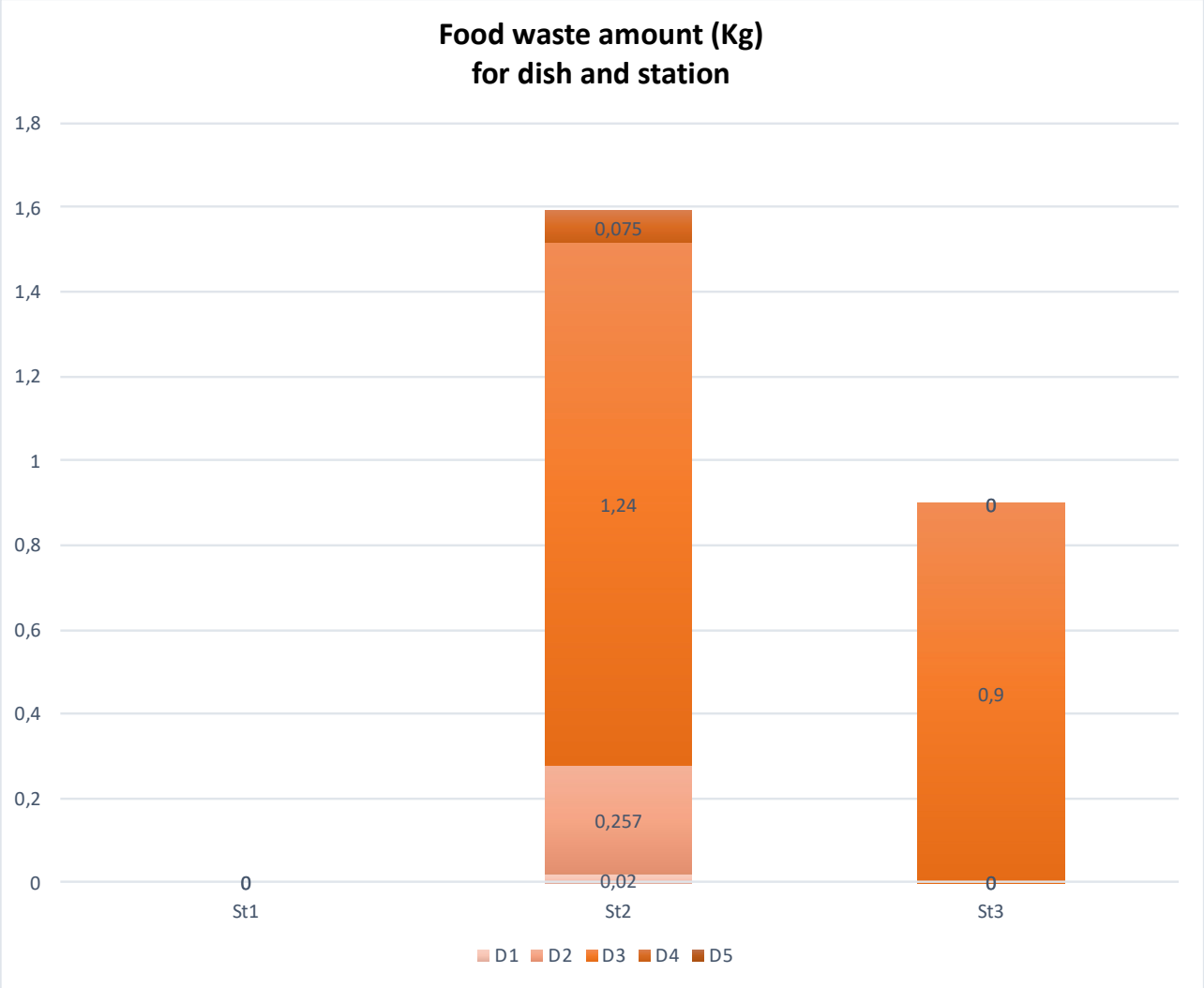

Figure VIII: Breakdown of the food waste among the recipes and station for the Menu II of the VET center in Bassano del Grappa (Italy)

Categories of food waste (kg)-MESO LEVEL: this type of data elaboration allows you to view the quantity of food waste according to the food product categories along the 3 stations for a menu

realisation. In the final station, it is no longer possible to continue to refer to the individual ingredients, which is why the wording of final product has been introduced. In the graph shown here for example, it is possible to see how waste is present in the kitchen/processing part, especially for the categories of vegetables and diary products, but there is also a share of waste in the consumption phase of the final product.

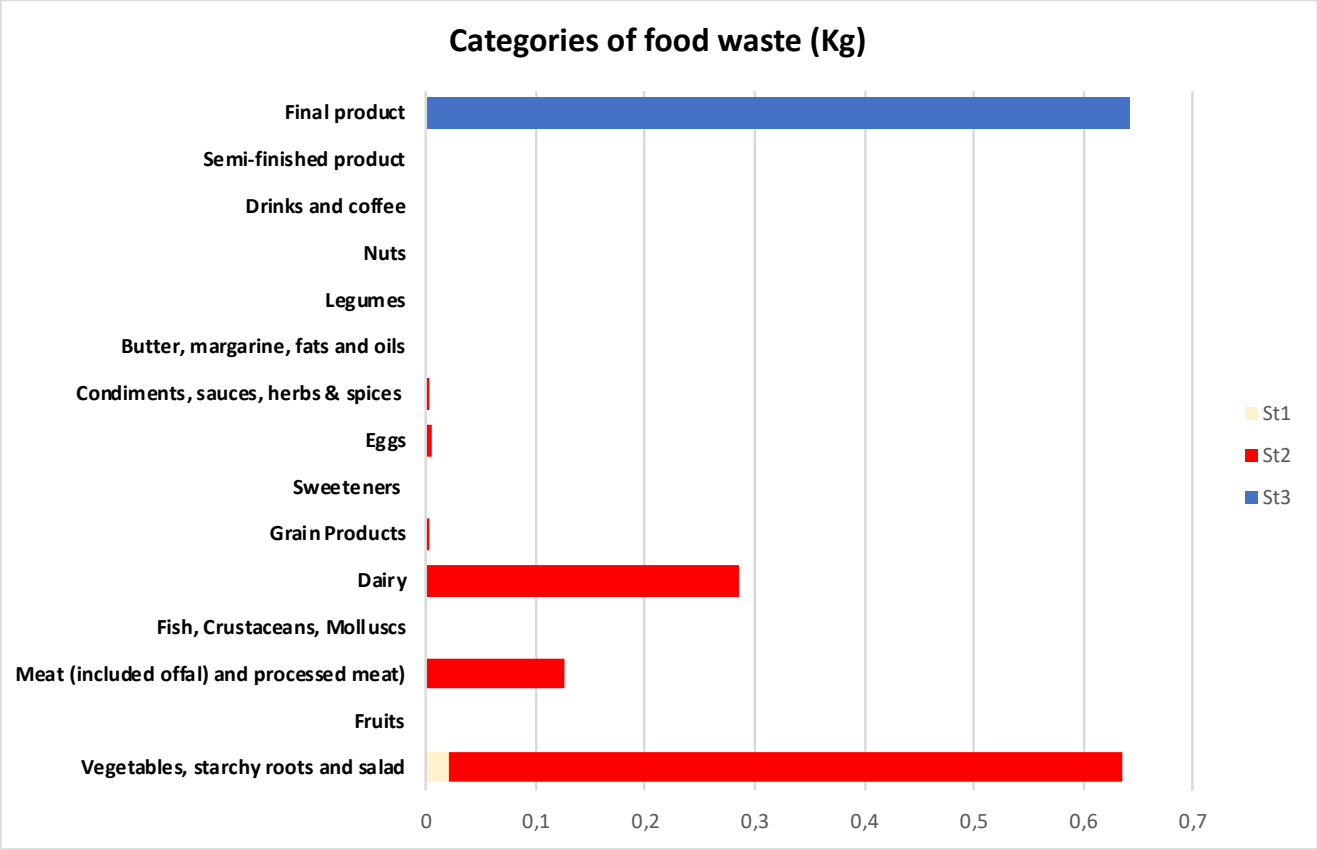

Figure IX: Amount of food waste according to the food categories for the Menu II of the VET center of Valencia (Spain)

Food waste amount composition, edibility and not edibility rate-MESO LEVEL: this type of data elaboration allows you to view the percentage of consumed, saved (excess or non-consumption that has found a new use) and wasted food. For the waste percentage it is possible to view the composition in terms of edible and non-edible share. This information may be relevant to understand what the fixed cost of the waste and its variable component, on which to affect in view of the prevention of waste.

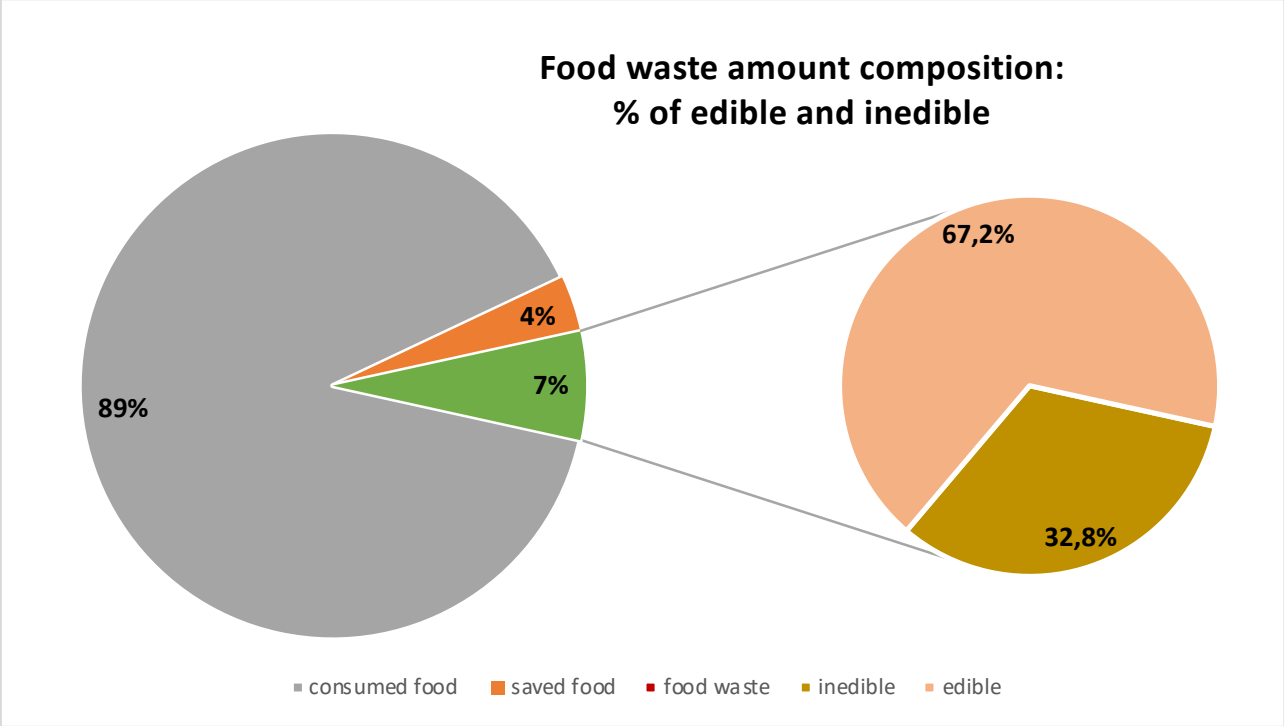

Figure X: Food waste breakdown in edible and not edible percentage for the Menu I of the VET center of Stains (France).

Source of food waste production- MESO LEVEL: this type of data elaboration allows you to view for each menu how the quantity of food waste is distributed in percentage across the 3 stations. In this case, 18% of the quantity of food waste is attributable for 90,4% to the preparation part and for 9,6% to the consumption phase.

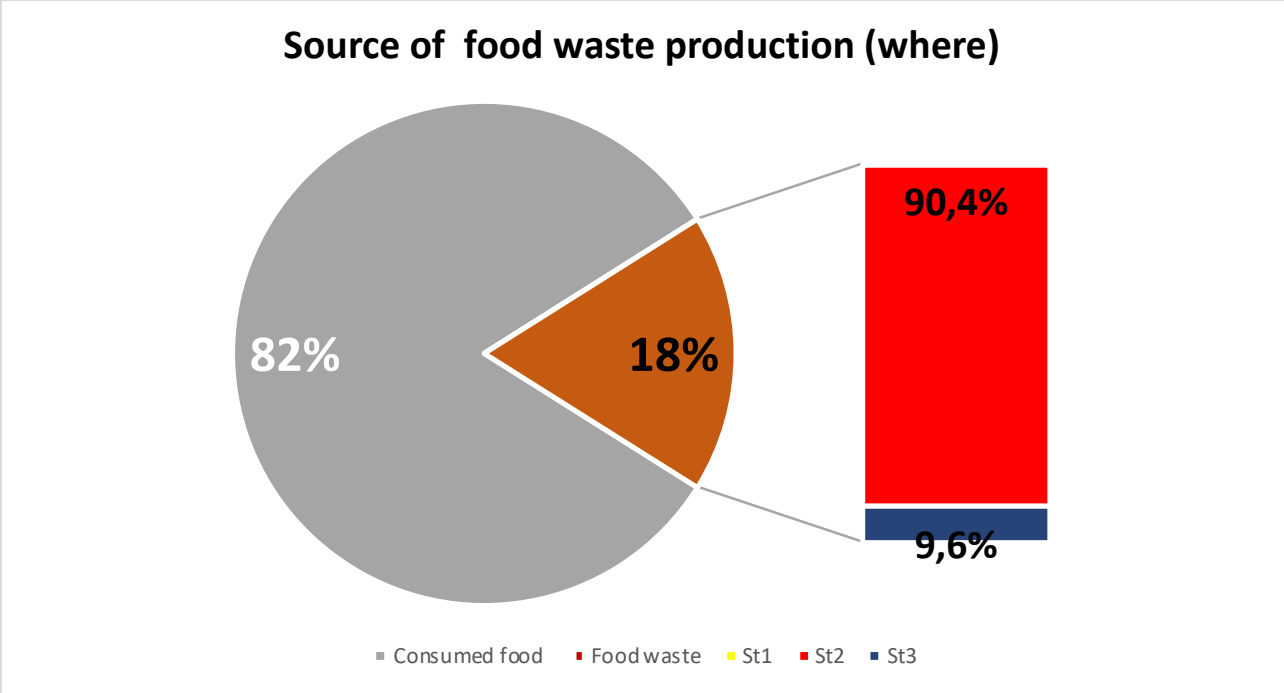

Figure XI: Food waste breakdown according to the sources in the 3 stations for the Menu II of the VET center of Bilbao (Spain).

Food value breakdown-MESO LEVEL: this type of data elaboration allows you to assess for each menu allows you to assess for each menu the reparation of the economic value of the raw material among consumed, saved or wasted food.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

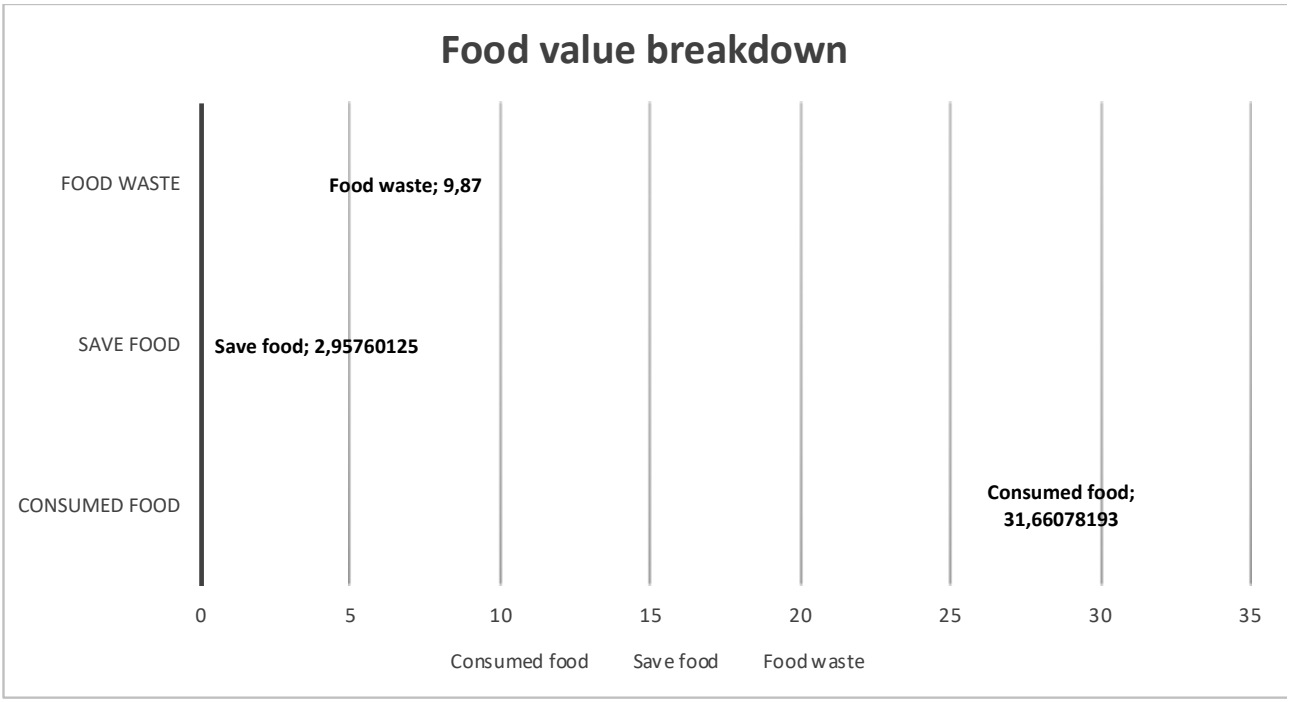

Figure XII: Food value breakdown (in Euro) considering the wasted, saved and consumed food for the Menu III/second class fo the VET center of Porto Viro

In the annex (1-45) all the input-output matrixes for data elaboration are provided for the 165 recipes organized in 45 menus.

2.2.2 MACRO LEVEL OF DATA ELABORATION

In this section some considerations are reported starting from the macro level, the one that analyzes the data collected across the various training centers with the aim of indicating a starting point for the project to verify the improvements that can be found in the future as a result of the training, awareness and communication activities carried out in training centers and restaurants by the LIFE FOSTER project.

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

Table 3 lists the data relating to the calculation of the total food waste amount for menu (OUTPUT), the total food amount for menu (INPUT) and the ration between the two. Table 4 lists the data relating to the calculation of the total food waste cost for menu (OUTPUT), the total food cost for menu (INPUT) and the ration between the two.

Country/Region	Vocational training center	Menu ID	Number of dishes	Ratio food waste amount/food amount for menu OUTPUT/INPUT
Italy/Veneto	Conegliano	I	5	0,206280177
Italy/Veneto	Conegliano	II	5	0,122346196
Italy/Veneto	Bassano del Grappa	I	4	0,193887168
Italy/Veneto	Bassano del Grappa	II	4	0,155023328
Italy/Veneto	Bassano del Grappa	III	4	0,1172646
Italy/Veneto	Dolo	I	3	0,133174552
Italy/Veneto	Isola della Scala	I	4	0,114082255
Italy/Veneto	Isola della Scala	II	4	0,429021287
Italy/Veneto	Isola della Scala	III	4	0,24370095
Italy/Veneto	Feltre	I	4	0,163001145
Italy/Veneto	Feltre	II	4	0,153134355
Italy/Veneto	Feltre	III	4	0,127424464
Italy/Veneto	Longarone	I	1	0,282146161
Italy/Veneto	Longarone	II	1	0,105308964
Italy/Veneto	Padova	I	4	0,182344732
Italy/Veneto	Padova	II	4	0,221543018
Italy/Veneto	Padova	III	4	0,305516814
Italy/Veneto	Padova	IV	3	*
Italy/Veneto	Padova	V	3	*
Italy/Veneto	Piazzola	I	1	*
Italy/Veneto	Piazzola	II	4	*
Italy/Veneto	Piazzola	III	2	*
Italy/Veneto	Piazzola	VI	4	*

Italy/Veneto	Porto Viro	I	4	0,116666667
Italy/Veneto	Porto Viro	II	4	0,094435937
Italy/Veneto	Porto Viro	III	4	0,133117633
Italy/Veneto	Porto Viro	IV	4	0,015755475
Italy/Veneto	Porto Viro	V	4	0,182450043
Italy/Veneto	Porto Viro	VI	4	0,136643308
Spain	Bilbao	I	4	0,259348613
Spain	Bilbao	II	4	0,217736029
Spain	Bilbao	II	4	0,234561069
Spain	Valencia	I	4	0,064231548
Spain	Valencia	II	4	0,084216012
Spain	Valencia	II	4	0,064845007
France	Stains	I	4	0,07366798
France	Stains	II	4	0,064932993
France	Colmar	I	3	0,104060048
France	Colmar	II	3	0,113199105
France	Colmar	III	3	0,098039216
France	Rennes	I	2	*
France	Rennes	II	3	*
France	Rennes	III	3	0,320300607
Malta	Hal-Luqa	I	6	*
Malta	Hal-Luqa	II	6	*
Total (calculated on 35 menus, excluding the menu with *		35	131	**0,17392532**

Table IV: Ratio food waste amount/food amount for menu OUTPUT/INPUT for all the 45 menus

According to the data analysis, VET centers waste 17,4% of all the inputs they use for cooking (Table IV) and 19,2% of all the input they purchased (Table V). These rates are higher than what the scientific literature shows for the restaurant sector with a rate of 12% of food cost attributable to food waste (REFED, 2018).

Country/Region	Vocational training center	Menu ID	Number of dishes	Ratio food waste cost/food cost OUTPUT/INPUT
Italy/Veneto	Conegliano	I	5	0,2659568
Italy/Veneto	Conegliano	II	5	0,096626773
Italy/Veneto	Bassano del Grappa	I	4	0,167468068
Italy/Veneto	Bassano del Grappa	II	4	0,176313661
Italy/Veneto	Bassano del Grappa	III	4	0,136059576
Italy/Veneto	Dolo	I	3	0,10396983
Italy/Veneto	Isola della Scala	I	4	0,094127271
Italy/Veneto	Isola della Scala	II	4	0,281638416
Italy/Veneto	Isola della Scala	III	4	0,284079322
Italy/Veneto	Feltre	I	4	0,213485608
Italy/Veneto	Feltre	II	4	0,259944558
Italy/Veneto	Feltre	III	4	0,069828275
Italy/Veneto	Longarone	I	1	0,299526199
Italy/Veneto	Longarone	II	1	0,202734541
Italy/Veneto	Padova	I	4	0,303358407
Italy/Veneto	Padova	II	4	0,257276277
Italy/Veneto	Padova	III	4	0,324368645
Italy/Veneto	Padova	IV	3	*
Italy/Veneto	Padova	V	3	*
Italy/Veneto	Piazzola	I	1	*
Italy/Veneto	Piazzola	II	4	*
Italy/Veneto	Piazzola	III	2	*
Italy/Veneto	Piazzola	VI	4	*
Italy/Veneto	Porto Viro	I	4	0,192485624
Italy/Veneto	Porto Viro	II	4	0,103619821
Italy/Veneto	Porto Viro	III	4	0,221774056

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

Italy/Veneto	Porto Viro	IV	4	0,032041518
Italy/Veneto	Porto Viro	V	4	0,129300938
Italy/Veneto	Porto Viro	VI	4	0,13430231
Spain	Bilbao	I	4	0,309441889
Spain	Bilbao	II	4	0,290489987
Spain	Bilbao	II	4	0,33203887
Spain	Valencia	I	4	0,083124983
Spain	Valencia	II	4	0,100401663
Spain	Valencia	II	4	0,083190149
France	Stains	I	4	0,027066418
France	Stains	II	4	0,028584406
France	Colmar	I	3	0,051856557
France	Colmar	II	3	0,121656569
France	Colmar	III	3	0,134973857
France	Rennes	I	2	*
France	Rennes	II	3	*
France	Rennes	III	3	0,300943388
Malta	Hal-Luqa	I	6	*
Malta	Hal-Luqa	II	6	*
Total (calculated on 35 menus excluding the menu with *		35	131	**0,19122027**

Table V: Ratio food waste cost/food cost for menu OUTPUT/INPUT for all the 45 menus

However, it is necessary to underline the high variability found in the course of the creation of the menus by the various training centers, which is even more evident with the representation using a scatter graph, both for the ratio food waste amount / food amount (Fig. XIV) and for the food waste cost / food cost ratio (Fig XV).

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

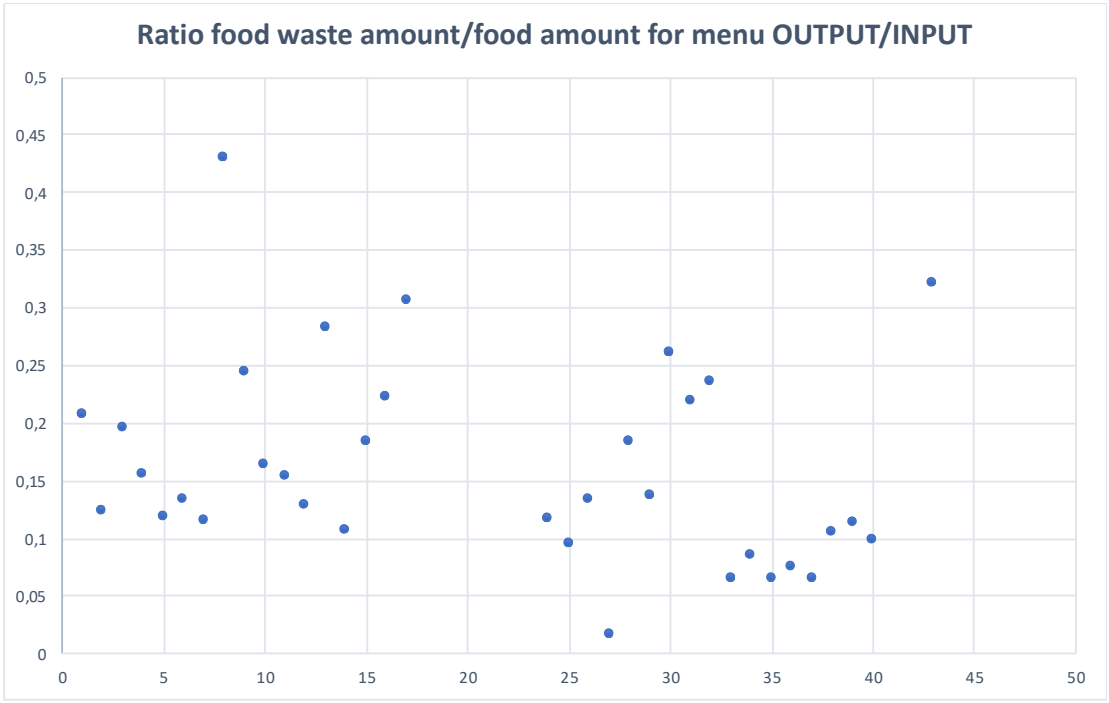

Figure XIII: Ratio food waste amount/food amount for menu OUTPUT/INPUT for the 35 menus listed in Table IV

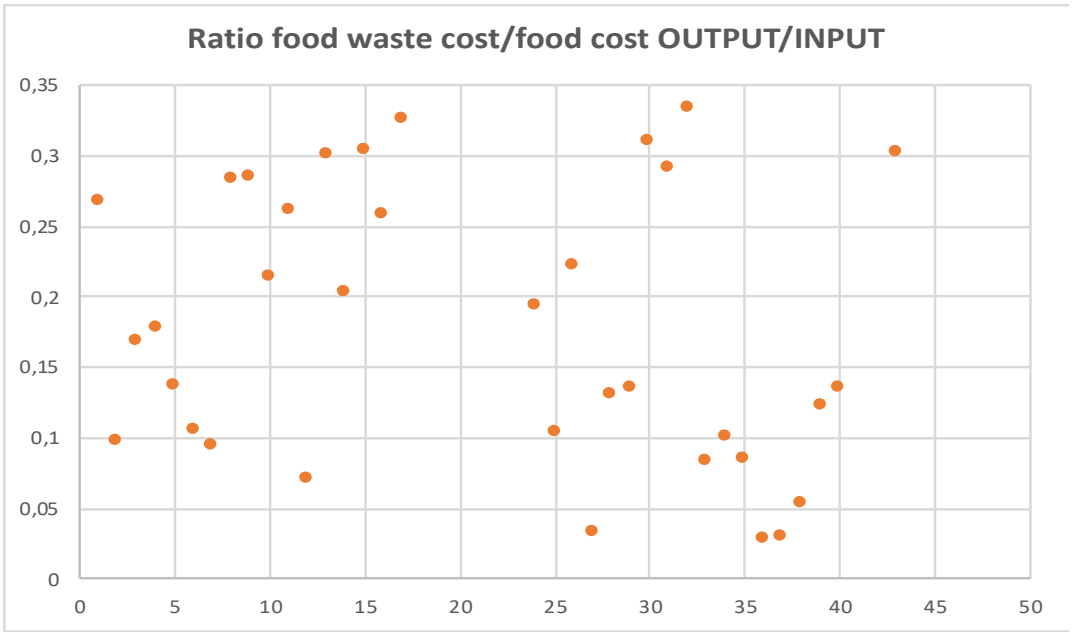

Fig. XIV: Ratio food waste cost/food cost for menu OUTPUT/INPUT for the 35 menus listed in Table V

Food waste mainly involves station 2, with a percentage of 72% and station 3 with a percentage of 28%. As already mentioned above, the absence of station 1 is not to be attributed to the lack of food waste in the storage phase, but to a fallacy into the data entry reference contact for the monitoring. The reason is to be attributed to the fact that since the monitoring was carried out during the laboratories, it was difficult for the person in charge to connect to a stock flow in the warehouse. In any case, as already pointed out, this quantity should not be so significant, considering that the training centers purchase the raw materials necessary for the realization on a weekly basis and in some cases biweekly. The greater concentration of food waste in the production phase, for a vocational training center, in particular, could also be attributable to the poor skills (still being learned and improved) by students in the operations of husking, peeling, first preparation of ingredients. This is confirmed by the breakdown of food waste into the various product categories, where the largest share of waste concerns the "vegetables, starch roots and salad" category followed by the "fruit" category. The third category concerns the finished product attributable to the consumption phase, where it is generally possible to observe that food waste is caused by an overproduction of portions compared to how many are actually consumed.

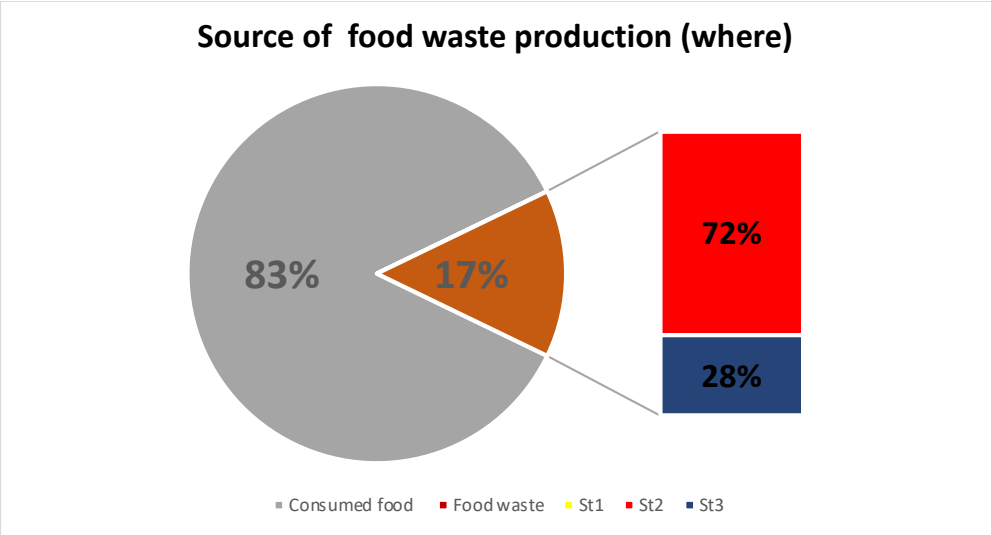

Fig. XV: Food waste breakdown according to the sources in the 3 stations for all the 35 menus

Therefore, this is not a problem attributable to the non-liking of the dish by those who consume it (the same students who made it). The overproduction could also be linked to the fact of cooking a quantity functional to the demonstration and learning of practical activities, on which, however, one could intervene with greater planning upstream. In our opinion, the data relating to the quantity of saved food is linked to this modus operandi, which in quantitative terms is almost equivalent to the amount of food waste generated (Fig. XVII). In most cases (68.5%), the food saved is destined for the staff meal or for domestic consumption of it through the use of doggie bags. Although this is an operation that finds its own logic within the waste hierarchy, it would be worth reflecting on whether this upstream quantity could be avoided, with a moderate saving by the vocational training centers (Fig. XVIII).

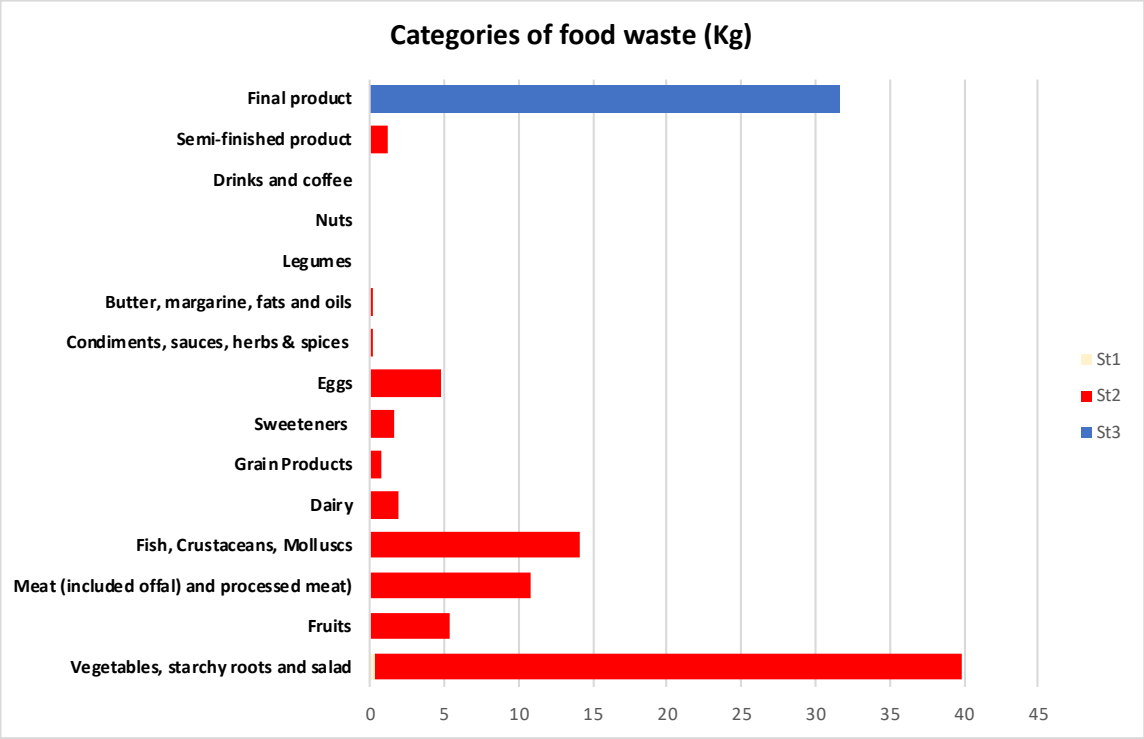

Fig. XVI: Amount of food waste according to the food categories for the 35 Menus

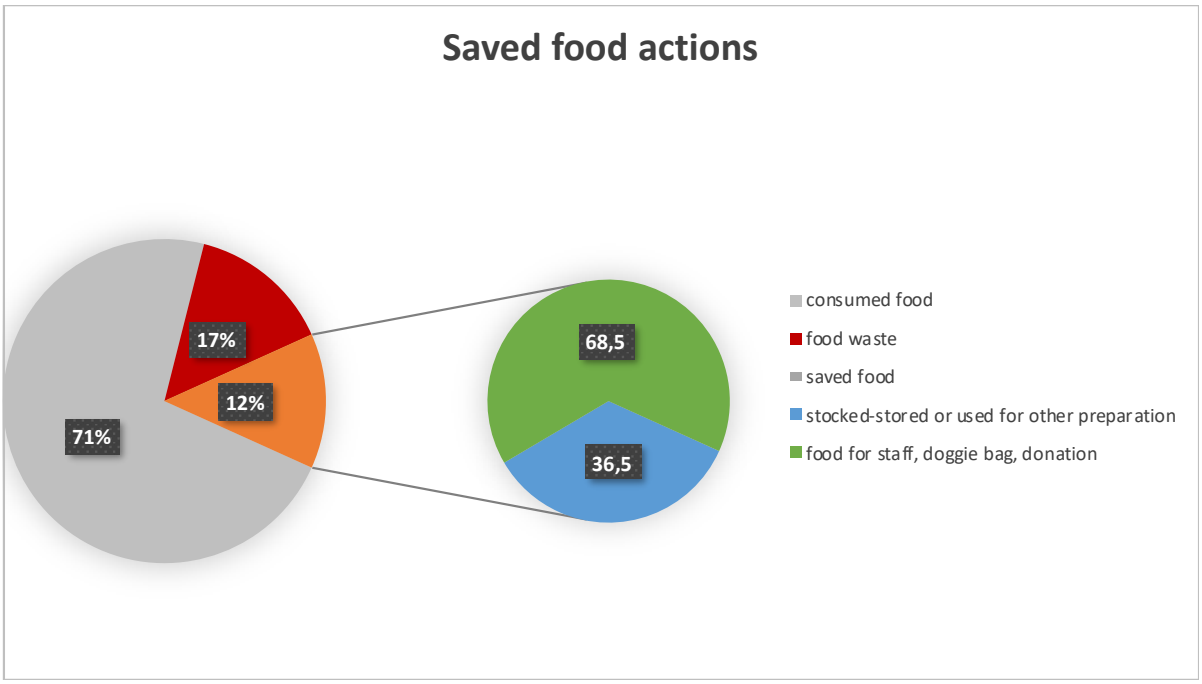

Fig. XVII: Percentage breakdown among consumed, saved and wasted food quantity + percentage breakdown of saved food kind of action

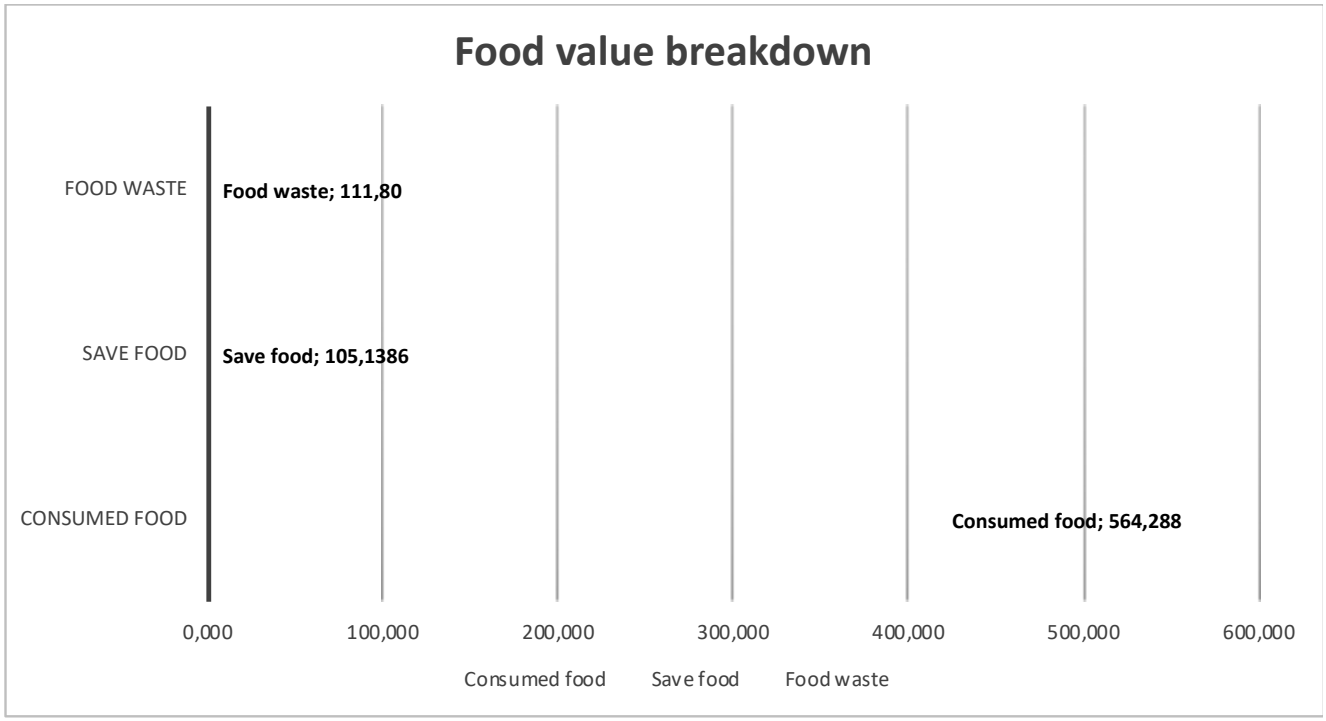

Fig. XVIII: Food value breakdown (in Euro) considering the wasted, saved and consumed food for all the 35 Menu

Another aspect on which it is necessary to dedicate an in-depth analysis, also with a view to identifying possible actions to prevent food waste is the percentage of the edible share on the total waste generated, which is more than 50%. This portion contains the portion of waste in the consumption phase, but occupying 28% of the total waste generated, this implies that a significant portion of waste generated in phase 2 is edible, and for this reason it could represent an input to be exploited in the recipes prepared during the laboratory being monitored or stored for future use with a view to applying the principles of circular economy to the dynamics of planning/preparation of meals.

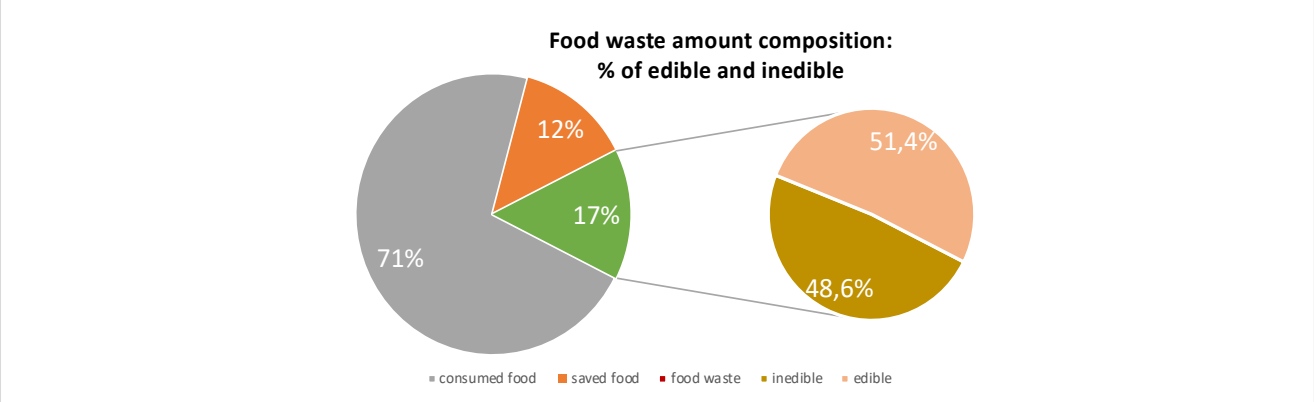

Fig. XIX: Food waste breakdown in edible and not edible percentage for all the 35 Menus

3. FEEDBACKS FOR THE “IN ITINERE” MONITORING”

This first monitoring, in addition to defining the baseline regarding the production of food waste in vocational training centers, has been used to define the operational aspects for monitoring in the next phase starting from what is tested here.

Monitoring is certainly time-consuming and represents an endeavor for those who, like trainers in vocational training centers, are fully immersed in the training center's daily operations. However, in the same way, accurate data collection and data entry is required for monitoring to produce reliable results. In order to facilitate this operation and overcome the problem of missing fields, the second monitoring is going to involve the use of a web application, designed ad hoc starting from the results of the first monitoring. The web application, the Food Waste Flow Balance, will guide the user in compiling, including by inserting mandatory fields. The user will also find a series of pre-filled fields, in which to enter only the numerical values. During use, it will also be possible to save recipes and menus, with the ability to update only the data relating to preparations and administrations.

Another activity that was highly costly from the point of view of the use of time was the completion of the missing data and their processing. Regarding the first aspect, it will be overcome thanks to the use of the web application. The web application will also resolve the issue of data processing, which will take place simultaneously with the data entry operation. The business analysis section in the application will allow the user to view the analysis results in real time in a simple and intuitive way. The single user can view all the data uploaded by him or apply temporal filters.

At the same time, the administrator will have the ability to remotely monitor data upload and quality and no longer upon receipt. The administrator can view the data for each recipe, menu, training center or have views in aggregate form. The data entry and data analysis sections will be

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

combined in a single tool, maintaining the micro, meso and macro hierarchy through the 3 stations of the production flow.

In the design of the tool, reference was also made to the target of restaurateurs, as their involvement in monitoring is expected. The categories for data entry have therefore been optimized to be usable both at the compilation level of a professional center and of a restaurant.

The data analysis for the two categories will be treated separately.

4. ANNEXES

- Matrix input-output_baseline_FR_Colmar_Menu_I.xlsx
- Matrix input-output_baseline_FR_Colmar_Menu_II.xlsx
- Matrix input-output_baseline_FR_Colmar_Menu_III.xlsx
- Matrix input-output_baseline_FR_Rennes_Menu_I.xlsx
- Matrix input-output_baseline_FR_Rennes_Menu_II.xlsx
- Matrix input-output_baseline_FR_Rennes_Menu_III.xlsx
- Matrix input-output_baseline_FR_Stains_Menu_I.xlsx
- Matrix input-output_baseline_FR_Stains_Menu_II.xlsx
- Matrix input-output_baseline_IT_Bassano_Menu_I.xlsx
- Matrix input-output_baseline_IT_Bassano_Menu_II.xlsx
- Matrix input-output_baseline_IT_Bassano_Menu_III.xlsx
- Matrix input-output_baseline_IT_Conegliano_Menu_I.xlsx
- Matrix input-output_baseline_IT_Conegliano_Menu_II.xlsx
- Matrix input-output_baseline_IT_Dolo_Menu_I.xlsx
- Matrix input-output_baseline_IT_Feltre_Menu_I.xlsx
- Matrix input-output_baseline_IT_Feltre_Menu_II.xlsx
- Matrix input-output_baseline_IT_Feltre_Menu_III.xlsx
- Matrix input-output_baseline_IT_IsoladellaScala_Menu_I.xlsx
- Matrix input-output_baseline_IT_IsoladellaScala_Menu_II.xlsx
- Matrix input-output_baseline_IT_IsoladellaScala_Menu_III.xlsx
- Matrix input-output_baseline_IT_Longarone_Menu_I.xlsx
- Matrix input-output_baseline_IT_Longarone_Menu_II.xlsx
- Matrix input-output_baseline_IT_Padova_cucina_Menu_I.xlsx
- Matrix input-output_baseline_IT_Padova_cucina_Menu_II.xlsx
- Matrix input-output_baseline_IT_Padova_cucina_Menu_III.xlsx
- Matrix input-output_baseline_IT_Padova_sala_Menu_I.xlsx
- Matrix input-output_baseline_IT_Padova_sala_Menu_II.xlsx

LIFE FOSTER project is co-funded by LIFE's European Union Programme | info@lifefoster.eu – www.lifefoster.eu

- Matrix input-output_baseline_IT_Piazzola_Menu_I.xlsx
- Matrix input-output_baseline_IT_Piazzola_Menu_II.xlsx
- Matrix input-output_baseline_IT_Piazzola_Menu_III.xlsx
- Matrix input-output_baseline_IT_Piazzola_Menu_IV.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe2_Menu_I.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe2_Menu_II.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe2_Menu_III.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe3_Menu_I.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe3_Menu_II.xlsx
- Matrix input-output_baseline_IT_PortoViro_classe3_Menu_III.xlsx
- Matrix inpMut-output_baseline_MT_Voyage_Restaurant_Menu_I
- Matrix inpMut-output_baseline_MT_Runaway_Restaurant_Menu_I
- Matrix input-output_baseline_SP_Bilbao_Menu_I.xlsx
- Matrix input-output_baseline_SP_Bilbao_Menu_II.xlsx
- Matrix input-output_baseline_SP_Bilbao_Menu_III.xlsx
- Matrix input-output_baseline_SP_Valencia_Menu_I.xlsx
- Matrix input-output_baseline_SP_Valencia_Menu_II.xlsx
- Matrix input-output_baseline_SP_Valencia_Menu_III.xlsx