



# LIFE FOSTER

**Action C1 – Action C2**

## **FIRST ENVIRONMENTAL AND ECONOMIC MONITORING REPORT IN ITINERE MONITORING**

### **DELIVERABLE 3**

**C1- Set of indicators for project  
monitoring**

**C2- Socio-economic monitoring**

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**LIFE17 GIE/IT/000579**

*Training, education and communication to reduce food waste in the food service industry*



# First Environmental and Economic Monitoring Report IN ITINERE MONITORING

## DELIVERABLE 3

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.*

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## EXECUTIVE SUMMARY

The report “In-itinere Environmental and Economic Monitoring Report” 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 “in-itinere” phase. The expression in-itinere refers to the collection of data during the training path of trainers and students of the vocational training centers. In this phase, the goal is to verify if and how much the adoption of preventive and reduction measures starting from training translated into a reduction of the food waste quantity. The report refers both to the analysis of the data in the specific period in which the second monitoring campaign was activated (October 2020-May 2021) and the comparison of the values in terms of quantity and economic value from the baseline outlined with the first campaign of data collection for the baseline construction (see Internal report of the ZERO situation concerning environmental issues/ First Environmental and Economic Monitoring Report) to the in-itinere phase.

After a first reference to the methodology used to collect the data with the introduction of the [Food Waste Flow Balance Web Application](#) (FWfb) and the description of 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 a critical 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 in the Dashboard section of the FWfb. The structuring of the analysis into levels (micro, meso and macro) adopted for the baseline is therefore maintained, as is the methodology of data collection and processing, moving what was performed through the input-output matrix as an excel sheet to the web application.



## RATIONAL OF THE ANALYSIS IN THE EX-ANTE MONITORING REPORT

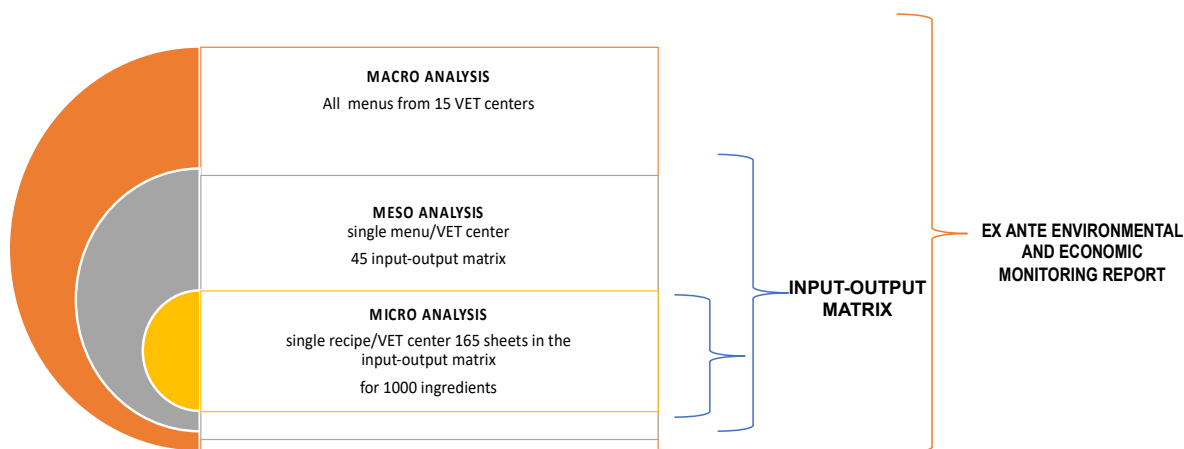


Figure I: The different level of analysis starting from the ingredients, to the recipe, menu from all VET centres involved in the baseline monitoring

## RATIONAL OF THE ANALYSIS IN THE IN ITINERE MONITORING REPORT

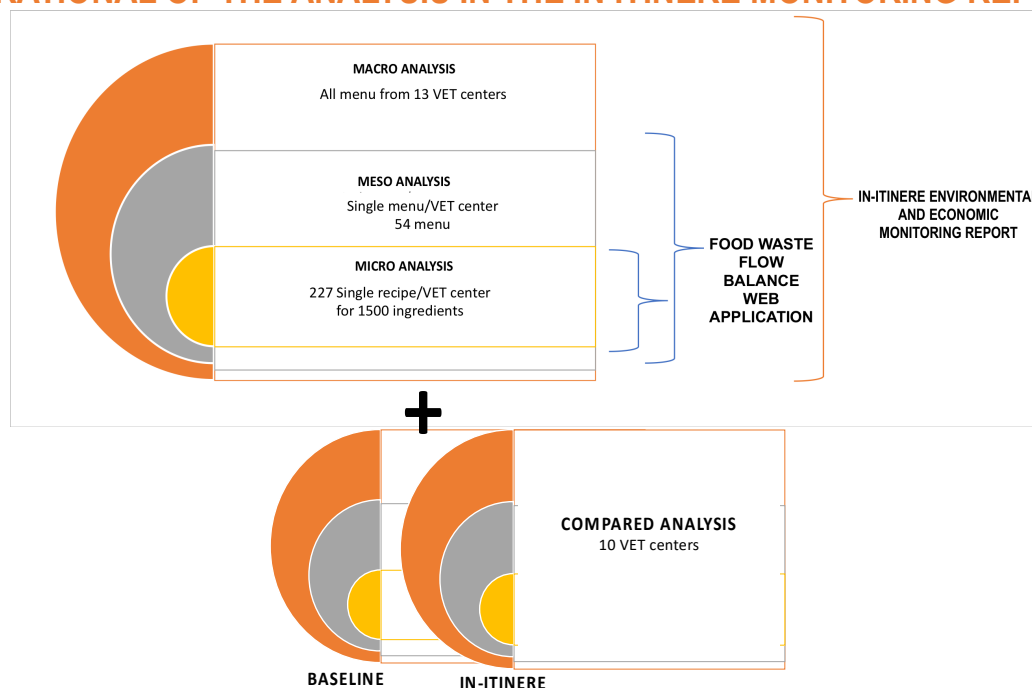


Figure II: The different level of analysis starting from the ingredients, to the recipe, menu from all VET centres involved in the in-itinere monitoring



**MICRO:** recipes and ingredients are the starting point. This section 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.

**MESO:** the level of detail on the single menu available in the web application 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 and meso 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.

**COMPARED ANALYSIS:** At this level, an aggregate assessment of the quantitative reduction of food waste is carried out also in relation to the project KPIs

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# 1. DATA COLLECTION

## 1.1. DATA COLLECTION METHODOLOGY THROUGH THE LIFE FOSTER WEB APPLICATION, FOOD WASTE FLOW BALANCE (FWFB)

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 collection of data for the in-itinere monitoring was carried out in continuity with the criteria used for the baseline data collection to ensure the comparability of the results. The vocational training centers that had already participated in the monitoring for the definition of the baseline were asked to carry out the data collection during the realization (storage/kitchen/consumption stages) of three menus composed as follows:

- 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 difference** compared to the baseline monitoring activity **concerns the data entry**. Unlike what happened in the monitoring for the definition of the baseline with the compilation of the excel matrix elaborated by UNISG, data were uploaded directly by VET centers to the web application “Food Waste Flow Balance” (FWfb) ([http://95.110.171.18:9335/life-foster/WebContent/jsp\\_application/table.jsp?list=ricette&navId=anag](http://95.110.171.18:9335/life-foster/WebContent/jsp_application/table.jsp?list=ricette&navId=anag)). This web application



designed in Java technology was designed by UNISG with the technical support of DGS1 starting from the calculation algorithm provided by UNISG (excel matrix sheets).

In agreement with the other beneficiaries of the LIFE FOSTER project it was decided to migrate what was developed during the first part of monitoring with the creation of the excellent grid at the web application level, mainly for the following reasons:

- facilitation of secure data entry with a simple and intuitive user experience;
- have remote control over the progress of the compilation and the level of completeness of the data;
- create an information archive for VET centers;
- presentation of data through graphical and tabular aggregations (dashboard) for single menu or in a defined time frame;
- optimization of the application that took place during the testing phases based on user feedbacks collected by the supplier;
- provide an accessible and free monitoring tool;
- make a monitoring tool available even after the end of the project

It is necessary to underline that the result of this action goes well beyond the change of the data input modality and represents the design, creation and availability of a complete monitoring tool, which includes the part of data collection, processing and analysis. With FWfb, restaurant owners and VET trainers will be able to quantify the food waste that is generated from their work, both for catering activities and restaurants. FWFB allows, starting from the preparations made (various dishes on the menu), to trace the entire flow, from the storage phase of the raw material, passing through the execution of the recipe, up to the administration of the dish. Thanks to the application, it is possible

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1 To this point see also in section 3 "Feedbacks for the in itinere monitoring" of the Deliverable "Internal report of the ZERO situation concerning environmental issues (highlight of the situation at the beginning of the FOSTER project) (ex ante)"





to create a personalized profile for tracking the entire work process, including preparation, from the storage of raw materials to the execution of the recipe and the final dish. Through the application it is also possible for users to monitor over time the quantities and economic values relating to food and energy waste produced by the structure to which they belong

This information is summarized in clear and accurate graphs, so it is easier to identify the critical loss and waste points, enabling you to intervene to prevent and reduce food waste by choosing the most appropriate solutions for improving operating procedures. Here are summarized the main function of the web application. In particular, the user associated with a structure can:

- view the list of product categories, ingredients and various energy sources within the system
- view, insert and modify the list of menu and recipes related to the structure to which it belongs
- assign new storage, production and consumption events, both in terms of use of food goods and in terms of energy consumption, relative to the reference structure, rather than modifying the existing ones
- view the previously entered data both in aggregate form (time range), and specific for a single date, relating to his structure, through the Dashboard section
- view the profile of his structure and update his user profile
- quantify food waste and its value during all phases (receipt and storage of goods, food preparation, cooking and service);
- classify and quantify food waste according to the category of the product;
- measure the proportions of edible and non-edible waste;

- measure energy and water consumption associated with the preparation;
- compare different menus/meals in terms of waste production;
- monitor food waste trends over time.

Particular attention was paid to maintaining the modus operandi started with the excel matrix to also ensure continuity in accessibility to the tool. The structuring of the information blocks has maintained the same structure, with minimal changes to the coding of the sections (see Table I).

SHEETS OF THE EXCEL MATRIX	SECTIONS OF THE WEB APPLICATION
1. VET center profile and laboratory information	User data Master data Pillars/product categories/ingredients
2. Data on equipment and energy and water costs	Pillars/energy sources
3. Data along the purchasing and storage phase (IN or station 1)	Usage Data/Storage
4. Data along the processing and cooking phase (DURING or station 2):	UsageData/Production-Consumption/Production Data/Preparation of recipes
5. Data along the consumption phase (OUT or station 3)	UsageData/Production-Consumption/Consumption Data

Table I: Sections of the data mask for the data entry in the excel and web application version

In conjunction with the first release phase of the web tool, UNISG prepared a tutorial (web application users' guide) to make the use of the tool by vocational training centers more effective during the "in

itinere" phase. UNISG has created and transmitted the access credentials to ENAIP-NET, CECE, AFPA and ITS for a total of 28 accounts.

Some changes/integration were also made to the web application to improve the degree of usability of the application and to make compilation more intuitive. Feedback collected by VET centers have been incorporated in a second release of the web application occurred on June 11<sup>th</sup>.

## 1.2. DURATION OF THE DATA COLLECTION

The collection of the data for monitoring for the in-itinere monitoring took place in the period between November 2020 and May 2021. As already happened during the monitoring for the baseline, the timing of the realization of the laboratories for data collection was influenced by the constraints related to the pandemic context in the various countries.

## 1.3. DESCRIPTION OF THE SAMPLE OF THE VOCATIONAL TRAINING CENTERS

For the in itinere data collection UNISG has collected 54 menù from 17 different VET centers. Data has been collected for the preparation and consumption of 227 singles dishes/recipes, on average 4(4,2) dishes for menu (all the data all listed in Table II).

Country/Region	Vocational training center	Menu ID <sup>2</sup>	Number of dishes/recipes	Data of realization
Italy/Veneto	Conegliano	I D'AMBROSI_menu 1 LF_2B	7	03/03/21
Italy/Veneto	Conegliano	II Menu 2	4	24/02/21
Italy/Veneto	Conegliano	III Menu 3	3	25/02/21
Italy/Veneto	Bassano del Grappa	Menu 1-B	4	25/02/21

<sup>2</sup> The number in the column corresponds with the identifier created for each menu in the FWfb during the data entry.



Italy/Veneto	Bassano del Grappa	Menu 2A	4	26/02/21
Italy/Veneto	Bassano del Grappa	Menu 3	4	02/03/21
Italy/Veneto	Isola della Scala	I	4	22/02/21
Italy/Veneto	Isola della Scala	II	4	01/03/21
Italy/Veneto	Isola della Scala	III	4	15/03/21
Italy/Veneto	Feltre	I menu 1 - 02/03/2021	5	02/03/21
Italy/Veneto	Feltre	II menu 2 - 09/03/2021	5	09/03/21
Italy/Veneto	Feltre	III menu 3 - 23/03/2021	4	23/03/21
Italy/Veneto	Longarone	I menu semplice	2	
Italy/Veneto	Longarone	II menu completo rist 2	6	
Italy/Veneto	Longarone	III menu completo rist 3	5	
Italy/Veneto	Padova	I Menù 2RB	4	18/03/21
Italy/Veneto	Padova	II Menù 2RA	6	19/03/21
Italy/Veneto	Padova	III Menù 3ra	4	24/03/21
Italy/Veneto	Piazzola	I Menù 19/02/2021	4	19/02/21
Italy/Veneto	Piazzola	II Menù 25/02/2021	4	25/02/21
Italy/Veneto	Piazzola	III Menù 11/03/2021	4	11/03/21
Italy/Veneto	Porto Viro	I Menu 2^ Ristorazione 30/04/2021	4	20/04/21
Italy/Veneto	Porto Viro	II Menu 2^ Ristorazione 23/04/2021	4	23/04/21
Italy/Veneto	Porto Viro	III Menu 2^ Ristorazione 30/04/2021	4	30/04/21
Italy/Veneto	Noale	I 2 RIST .IL PASSAGGIO DELLE STAGIONI	4	
Italy/Veneto	Noale	II FANTASIA 1 RISTORAZIONE	4	
Italy/Veneto	Noale	III 3 RIST. la primavera nel piatto	4	
Italy/Veneto	Rovigo	Hotel Menu	4	01/03/21
Italy/Veneto	Rovigo	Menu carnevalesco(22.02.2021)	4	22/02/21
Italy/Veneto	Rovigo	Menu Pasqua 2021	4	11/03/21
Italy/Lombardia	Busto Arsizio	44252	2	25/02/21

Italy/Lombardia	Busto Arsizio	44261	4	06/03/21
Italy/Lombardia	Busto Arsizio	44280	5	25/03/21
Spain	Bilbao	I Menu ESHBI Slow Food	5	23/03/21
Spain	Bilbao	II Menu Artxanda	5	30/03/21
Spain	Bilbao	IV Gastronomo 01	3	13/04/21
Spain	Bilbao	V Gastronomo 02	3	27/04/21
Spain	Valencia	I	3	27/04/21
Spain	Valencia	II	3	27/04/21
Spain	Valencia	II	3	27/04/21
France	Stains	I	4	13/04/21
France	Stains	II	4	13/04/21
France	Stains	II	4	13/04/21
France	Colmar	I	4	15/04/21
France	Colmar	II	4	20/04/21
France	Colmar	III	4	19/04/21
France	Rennes	I	5	13/04/21
France	Rennes	II	5	22/04/21
France	Rennes	III	5	23/04/21
Malta	Voyage	I	3	XX/04/21
Malta	Apron	II	3	XX/04/21
Malta	Runaway	II	3	XX/04/21

Table II: Recipe / menu prospectus for the 17 vocational training centers participating to the monitoring



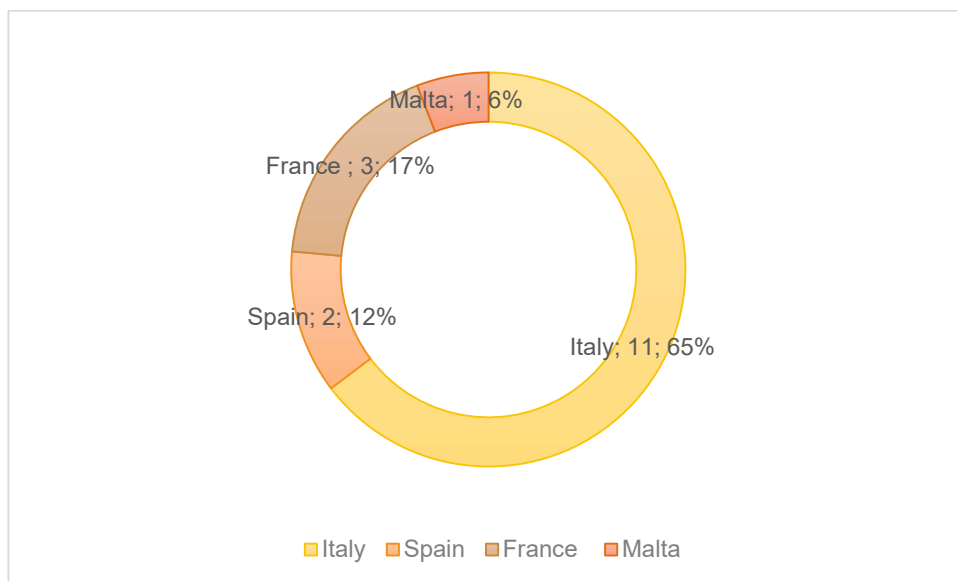


Figure III: Country of origin of the 17 VET centers involved in the monitoring action in number and percentage

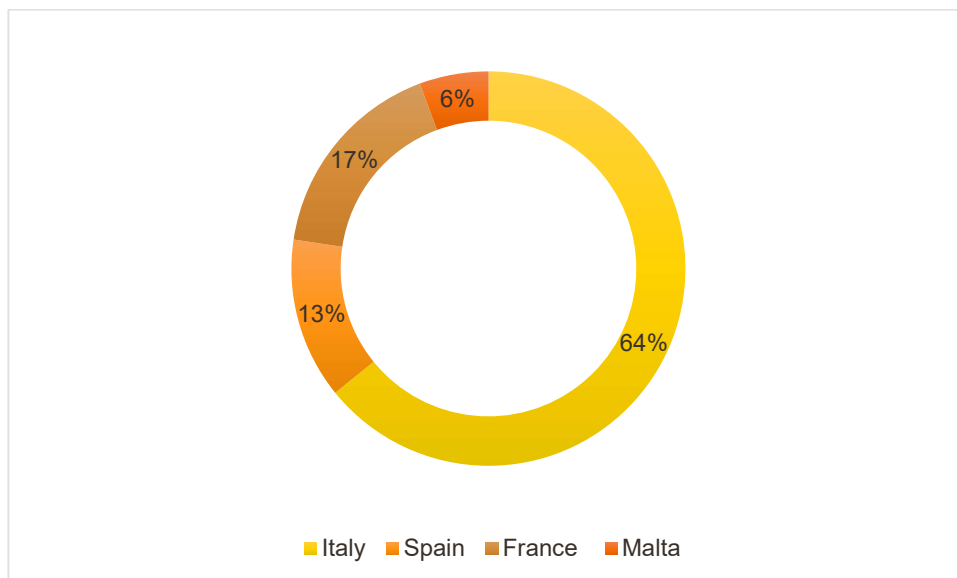


Figure VI: Number of menus provided by country by percentage, total 54

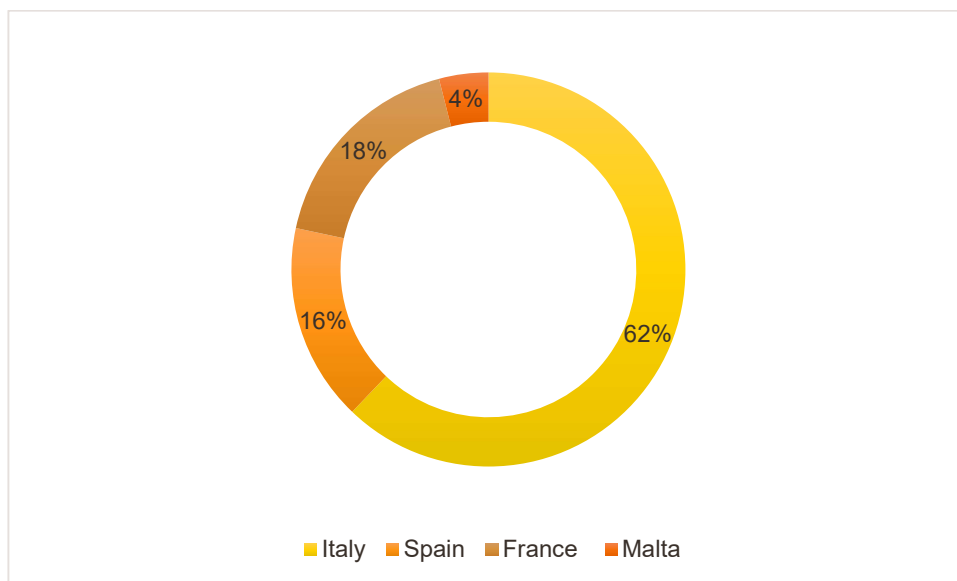


Figure V: Number of recipes provided by country in percentage, total 227 for 1500 ingredients

## 2. DATA ANALYSIS

### 2.1. COMMENTS ON PRIMARY DATA QUALITY AND DATA ENTRY OPERATIONS

As already noted during the data collection for the baseline, 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 sections of the FWfb in a correct and exhaustive way. In others, however, the compilation was partial or even missing for some sections. The incompleteness of the data in most cases concerned the usage data section (storage and consumption subsections). 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). In case of incomplete data (12/54<sup>3</sup> menus), the data were entered into the web application but it is not possible to view the charts in the dashboard section. It was therefore not possible to use these data for the purpose of cross-sectional considerations for the macro analysis part. This further limited the sample useful for making the comparison between the first and second data collection campaign, which was carried out for the centers, in total 10, which in both monitoring provided complete data (see Table III). 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. Another possible cause could be attributed to the loss effect caused by using the web application instead of the excel matrix.

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<sup>3</sup> Menu I, II, III for Feltre, Menu I, II, III for Longarone, Menu I, II, III for Noale, Menu 44252, 44261, 44280 for Busto Arsizio.



Country/Region	Vocational training center	Degree of completeness of the baseline data	Degree of completeness of the baseline data	Data used for baseline-in itinere comparison
Italy/Veneto	Conegliano	Complete	Complete	✓
Italy/Veneto	Bassano del Grappa	Complete	Complete	✓
Italy/Veneto	Dolo	Partial	Missing	
Italy/Veneto	Isola della Scala	Complete	Complete	✓
Italy/Veneto	Feltre	Complete	Partial	
Italy/Veneto	Longarone	Complete	Partial	
Italy/Veneto	Padova	Complete	Complete	✓
Italy/Veneto	Piazzola	Partial	Complete	
Italy/Veneto	Porto Viro	Complete	Complete	✓
Italy/Veneto	Noale	Complete	Partial	
Italy/Veneto	Rovigo	Missing	Complete	
Italy/Lombardia	Busto Arsizio	Missing	Complete	
Spain	Bilbao	Complete	Complete	✓
Spain	Valencia	Complete	Complete	✓
France	Stains	Complete	Complete	✓
France	Colmar	Complete	Complete	✓
France	Rennes	Complete	Complete	✓
Malta	ITS centres	Partial	Complete	

Table III: Prospectus on the level of completeness of the data provided across the baseline and in-itinere monitoring

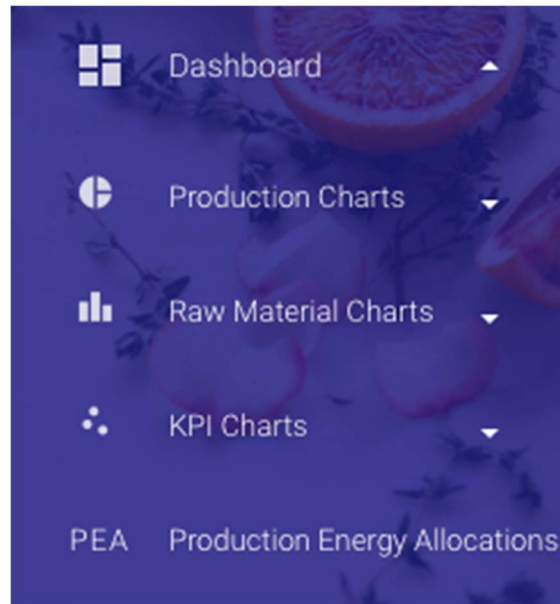
## 2.2. DATA ELABORATION AND RESTITUTION

### 2.2.1 MICRO AND MESO LEVEL OF DATA ELABORATION

The data processing at the micro and meso level (recipes) is performed by the algorithms that have been inserted into the web application which replicates the logic of the input-output matrix. The level of data aggregation is maintained at the menu level, which consists of the sum of the data relating to the preparation and consumption of the individual dishes. To do this, the web application collects all the information collected during the preparation of the menu, with dedicated section for each single recipe. The sections dedicated to data upload require to provide environmental and economic information, 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, the classification of ingredients and 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). These usage data facts are directly related with the dashboard section, which returns the information at the aggregate level of a single menu (meso level) with a graphical display of the results. In this section, 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 already during the data analysis phase of the baseline, with a slightly different graphic formatting due to the constraints of web application development with Java technology.

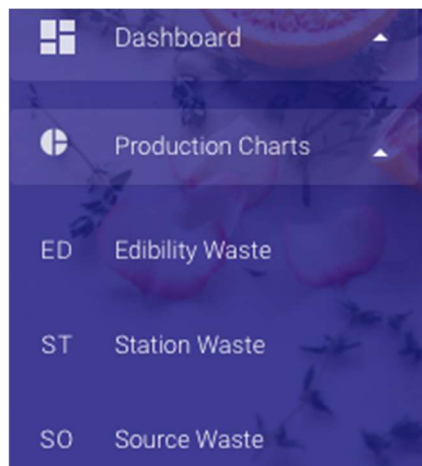
The dashboard section is divided in Production, Raw Materials, KPI charts, Production Energy Allocations.





*Fig. VI. Dashboard sections*

In the Productions Charts section, for each VET centers/restaurants it is possible to view the percentage incidence of the value (Euro) of food waste for each individual menu, by entering the production date or for multiple menus contained within a time interval. The Production Charts section is divided into three subsections: Edibility, Station and Source Waste (Fig. VII).



*Fig. VII. Production Charts subcategories/sections*

Next to the aerogram relating to the percentage incidence of the value (Euro) it is possible to view the percentage of edibility/non-edibility of the waste produced (Fig VIII), the percentage of

production of the waste in relation to the storage phases (station 1), preparation (station 2) and consumption (station 3) (Fig. IX), the percentage breakdown between raw material and energy costs (Fig. X)



Fig. VIII Edibility waste: rate of edibility/non-edibility



Fig. IX Station waste: percentage contribution of the different phases (storage, production and consumption)



Fig. X. Source waste; percentage breakdown between raw material and energy costs

In the Raw Material Charts section, for each VET centers/restaurants it is possible to go into detail on the waste of individual preparations and the contribution to food waste of the various product categories. The Raw Material Charts section is divided into three subsections: Recipe Waste (Kg), Recipe Waste (Euro) and Product Categories Waste (Fig.XI).

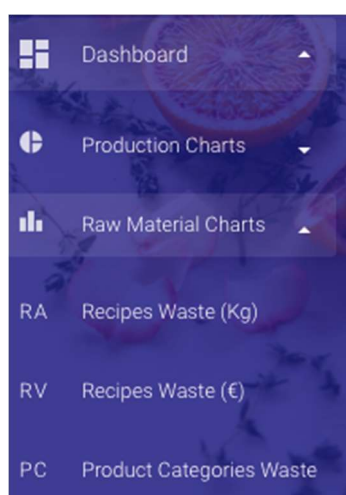


Fig. XI. Raw Material Charts subcategories/sections

At the menu level, it is possible to view (Fig. XII), the percentage incidence of the quantity (Kg) of food waste of every single course by entering the production menu date. It is also possible to view the amount of waste produced for each recipe in the different phases.



*Fig. XII. Recipe Waste (Kg): incidence of waste of individual preparations on the quantity of production inputs and by preparation phase*

At the menu level, it is possible to view (Fig. XII), the percentage incidence of the value (Euro) of food waste of every single course by entering the production menu date. It is also possible to view the value of waste produced for each recipe in the different phases.



Fig. XIII. Recipe Waste (Euro): incidence of waste of individual preparations on the value of production inputs and by preparation phase

It is possible to view the incidence of the different product categories to waste for each individual menu, by entering the production date or for multiple menus contained within a time interval (Fig. XIV).

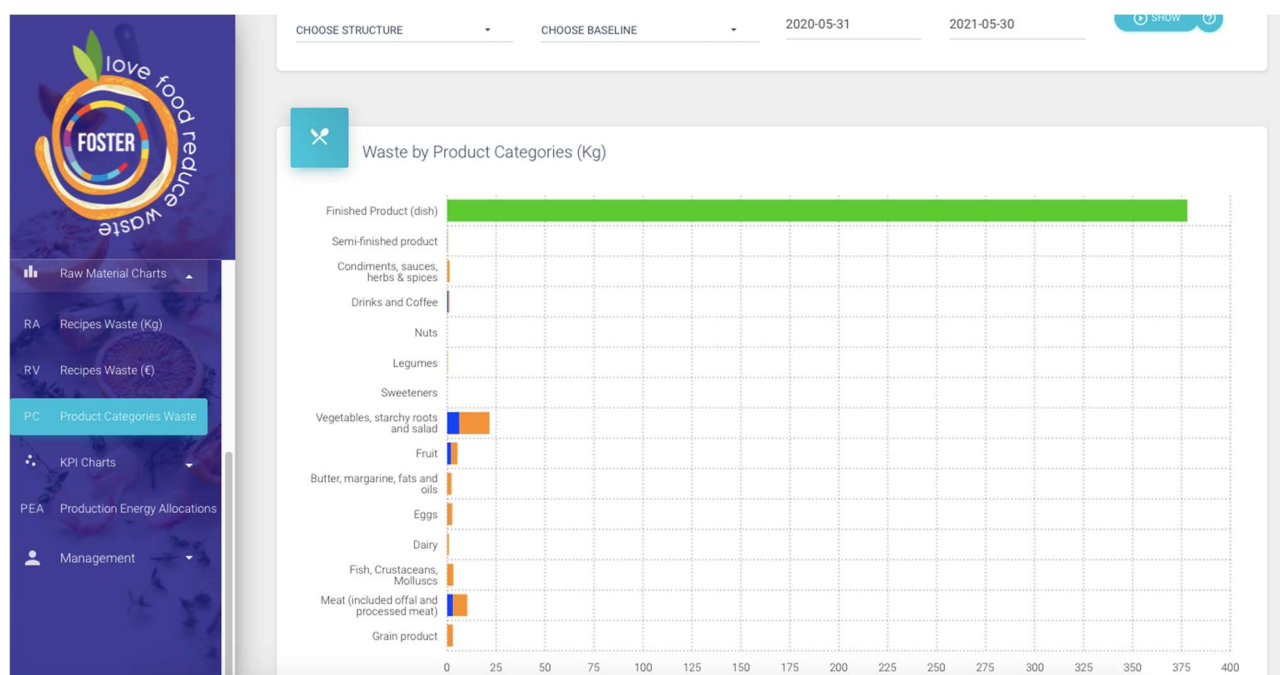


Fig. XIV Product Categories Waste: incidence of waste for the different product categories at the single menu level or at menu aggregation level.



The KPI Charts contains the Waste Index section (Fig.XV). Here is possible to visualize simultaneously at the single menu level the Waste Amount Ratio and the Waste Cost Ratio.

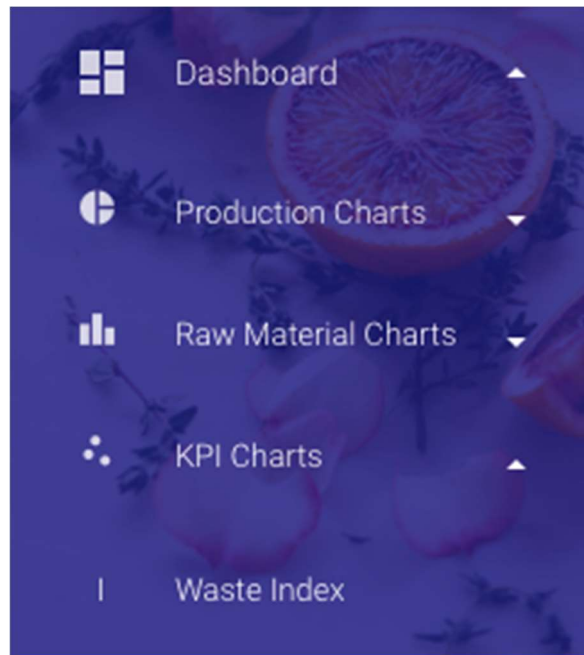


Fig. XV KPI Charts subcategories/sections

The Waste Amount Ratio 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.

The Waste Cost Ratio 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.

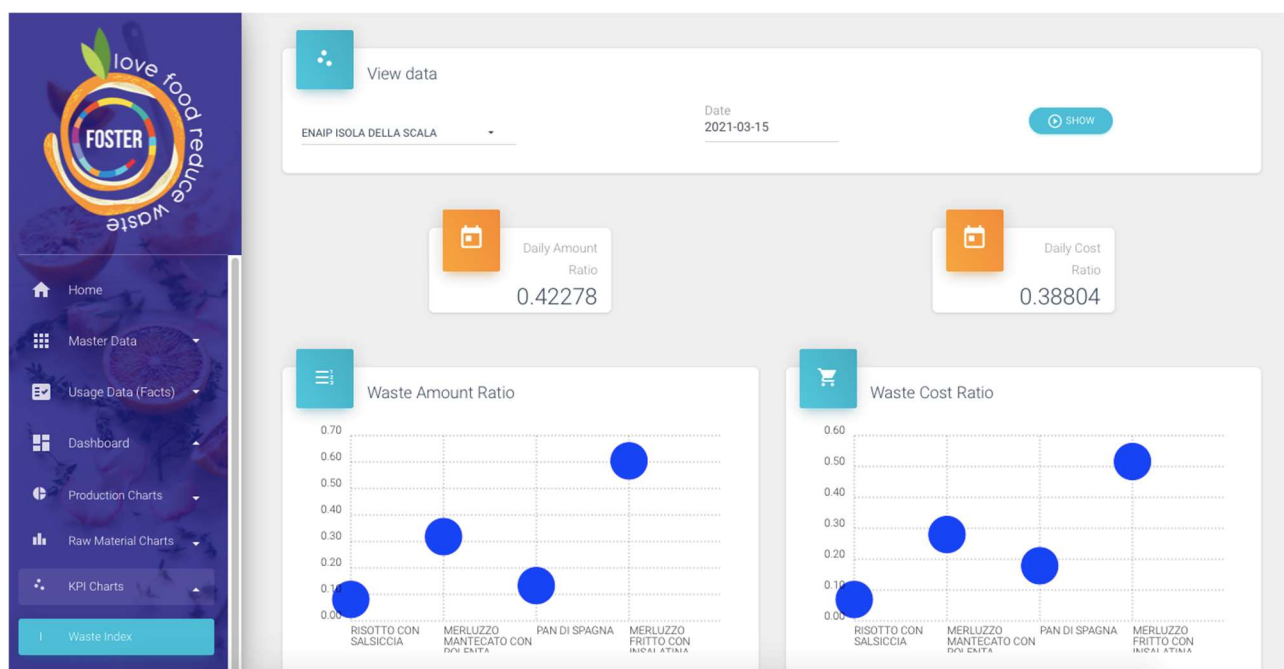


Fig. XVI. KPI Charts: Waste and Cost Ratio

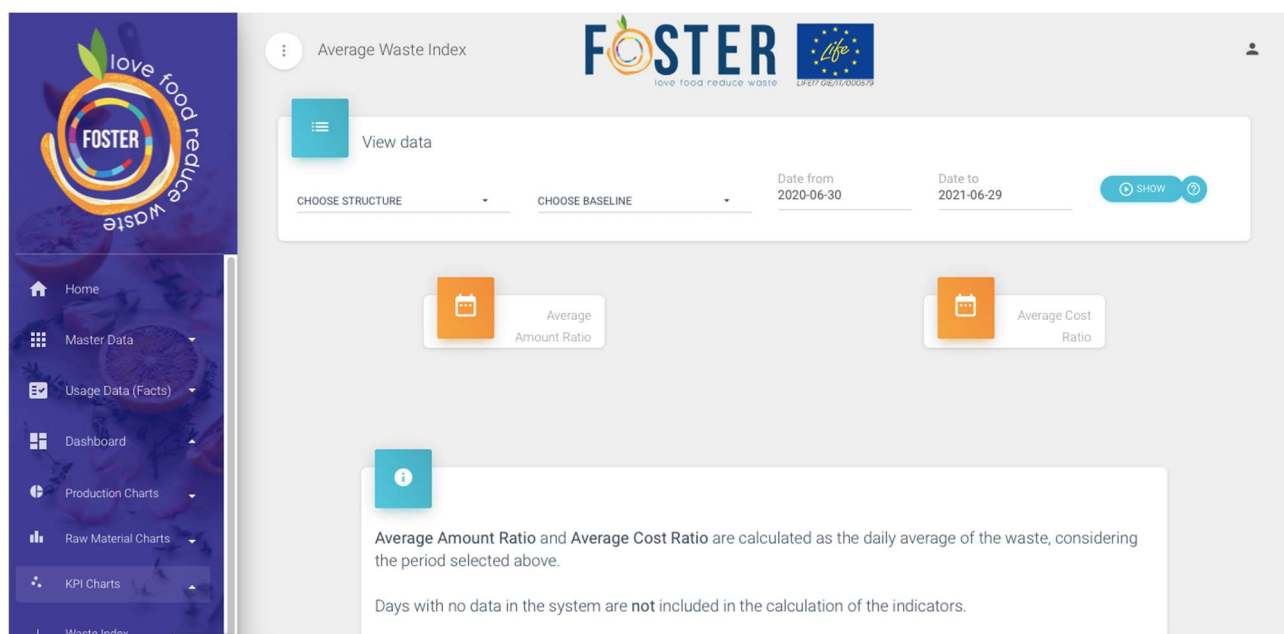



Fig. XVII. KPI Charts: Average Waste and Cost Ratio over a time period

It is also possible to display the average value of the Waste Amount Ratio and of the Waste Cost Ratio over a time period defined by the user (Fig. XVII). This allows you to monitor the data for time intervals, beyond the variability conditioned by the individual menus.

The section Production Energy Allocations lists the economic value of all the energetic and water consumption voices for all the uploaded preparations. It possible to view these data by single menu (entering the production date) or by multiple menus (entering a time interval).



Search for Energy Allocations

ENAIIP ISOLA DELLA SCALA

Date from (\*) 2020-05-31

Date to (\*) 2021-05-31

SEARCH

Energy Allocations

Show 10 entries

Search records

Recipe	Source	Structure	Menu	Date	% Coefficient	Energy Alloc.	Cost Alloc. (€)	Action
MERLUZZO MANTECATO CON POLENTA	Gas	Enaip Isola della Scala	SINFONIA DI MERLUZZO	2021-02-22	0.50	1.00000	0.03000	
MERLUZZO MANTECATO CON POLENTA	Water	Enaip Isola della Scala	SINFONIA DI MERLUZZO	2021-02-22	0.29	0.00286	0.28571	
RISOTTO CON ZUCCHINE E MERLUZZO	Gas	Enaip Isola della Scala	SINFONIA DI MERLUZZO	2021-02-22	0.50	1.00000	0.03000	
RISOTTO CON ZUCCHINE E MERLUZZO	Water	Enaip Isola della Scala	SINFONIA DI MERLUZZO	2021-02-22	0.29	0.00286	0.28571	

Fig. XVIII Production Energy Allocation

## 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 to monitor the progress in terms of food waste reduction achieved by VET centers (and starting from September 2021 also by restaurants) during the project time frame as result of the training, awareness and communication activities carried out in training centers and restaurants by LIFE FOSTER. This section then provides an analysis and comment on the results relating to the aggregate performance of the vocational training centers during the second monitoring campaign. Complete and usable data for this macro level analysis purposes were 40 menus from 13 VET centers.

Table IV lists the data relating to the calculation of the VET center average ratio between the total food waste amount (in Kg) for menu (OUTPUT) and the total food amount (in Kg) for menu (INPUT) during the in-itinere monitoring.

Table V lists the data relating to the calculation of the VET center average ratio between the total food cost (in Euro) for menu (OUTPUT) and the total food cost (in Euro) for menu (INPUT) during the in-itinere monitoring.

Country/Region	Vocational training center	Menu ID <sup>4</sup>	Number of dishes/recipes	Food waste amount (Kg) (OUTPUT)	Food amount (Kg) INPUT	Ratio food waste amount/food quantity OUTPUT/INPUT
Italy/Veneto	Conegliano	I D'AMBROSI_menu 1 LF_2B	7	2,302	24,159	0,09619
Italy/Veneto	Conegliano	II Menu 2	4	2,214	13,724	0,16132
Italy/Veneto	Conegliano	III Menu 3	3	1,788	11,930	0,14987
Italy/Veneto	Bassano del Grappa	Menu 1-B	4	1,224	26,135	0,04683
Italy/Veneto	Bassano del Grappa	Menu 2A	4	0,376	8,407	0,04472
Italy/Veneto	Bassano del Grappa	Menu 3	4	1,003	8,859	0,11322
Italy/Veneto	Isola della Scala	I	4	1,250	6,740	0,189681335
Italy/Veneto	Isola della Scala	II	4	1,140	6,180	0,184210526
Italy/Veneto	Isola della Scala	III	4	1,290	7,900	0.16329
Italy/Veneto	Padova	I Menù 2RB	4	1,368	5,937	0,23042
Italy/Veneto	Padova	II Menù 2RA	6	1,652	7,076	0,23347
Italy/Veneto	Padova	III Menù 3ra	4	2,328	9,860	0,23611
Italy/Veneto	Piazzola	I Menù 19/02/2021	4	4,700	9,000	0,522
Italy/Veneto	Piazzola	II Menù 25/02/2021	4	2,500	11,815	0,2116
Italy/Veneto	Piazzola	III Menù 11/03/2021	4	2,340	11,464	0,20412
Italy/Veneto	Porto Viro	I Menu 2^ Ristorazione 30/04/2021	4	2,200	51,550	0,04268
Italy/Veneto	Porto Viro	II Menu 2^ Ristorazione 23/04/2021	4	2,235	53,198	0,04258
Italy/Veneto	Porto Viro	III Menu 2^ Ristorazione 30/04/2021	4	1,070	15,330	0,0698

<sup>4</sup> The number in the column corresponds with the identifier created for each menu in the FWfb during the data entry.



Italy/Veneto	Rovigo	Hotel Menu	4	2,521	15,981	0,1577
Italy/Veneto	Rovigo	Menu carnevalesco(222.02.2021)	4	2,004	9,898	0,20257
Italy/Veneto	Rovigo	Menu Pasqua 2021	4	0,405	10,248	0,03962
Spain	Bilbao	I Menu ESHBI Slow Food	5	4,416	49,940	0,09043
Spain	Bilbao	II Menu Artxanda	5	3,840	50,452	0,07611
Spain	Bilbao	IV Gastronomo 01	3	1,176	18,360	0,06405
Spain	Bilbao	V Gastronomo 02	3	0,100	0,400	0,25
Spain	Valencia	I	3	0,300	2,500	0,12
Spain	Valencia	II	3	0,300	2,600	0,115384615
Spain	Valencia	II	3	0,318	2,659	0,119593832
France	Stains	I	4	3,441	24,109	0,142726783
France	Stains	II	4	3,000	20,000	0,15
France	Stains	II	4	3,000	22,000	0,136363636
France	Colmar	I	4	5,238	39,440	0,13281
France	Colmar	II	4	5,036	40,912	0,12309
France	Colmar	III	4	3,307	24,893	0,14731
France	Rennes	I	5	3,033	25,046	0,1211
France	Rennes	II	5	2,312	20,674	0,11183
France	Rennes	III	5	2,699	23,576	0,11448
Malta	Voyage	I	3	1,540	7,420	0,20754
Malta	Apron	II	3	2,660	5,500	0,4836
Malta	Runaway	II	3	2,056	5,800	0,3544
Total calculated on 40 menus				85,682	711,672	<b>0,120</b>

Table IV: Ratio food waste amount/food amount for menu OUTPUT/INPUT for all the 40 menus

Country/Region	Vocational training center	Menu ID <sup>5</sup>	Number of dishes/recipes	Food waste cost (Euro) (OUTPUT)	Food cost (Euro) INPUT	Ratio food waste cost/food cost OUTPUT/INPUT
Italy/Veneto	Conegliano	I D'AMBROSI_menu 1 LF_2B	7	9,7491	65,2	0,15029
Italy/Veneto	Conegliano	II Menu 2	4	9,9712	56,8	0,17555
Italy/Veneto	Conegliano	III Menu 3	3	7,808883	36,71	0,21272
Italy/Veneto	Bassano del Grappa	Menu 1-B	4	4,171	24,99	0,16691
Italy/Veneto	Bassano del Grappa	Menu 2A	4	1,695	41,46	0,04088
Italy/Veneto	Bassano del Grappa	Menu 3	4	2,8622	32,76	0,08737
Italy/Veneto	Isola della Scala	I	4	10,5201	64,06	0,16422
Italy/Veneto	Isola della Scala	II	4	4,5329	25,78	0,175803
Italy/Veneto	Isola della Scala	III	4	13,8926	57,92	0,23986
Italy/Veneto	Padova	I Menù 2RB	4	3,0305	16,42	0,18456
Italy/Veneto	Padova	II Menù 2RA	6	1,756148	17,656	0,09946
Italy/Veneto	Padova	III Menù 3ra	4	10,3763	39,7	0,2615
Italy/Veneto	Piazzola	I Menù 19/02/2021	4	19,618	32,2	0,60988
Italy/Veneto	Piazzola	II Menù 25/02/2021	4	8,259	36,69	0,2251
Italy/Veneto	Piazzola	III Menù 11/03/2021	4	5,968	23,91	0,2496
Italy/Veneto	Porto Viro	I Menu 2^ Ristorazione 30/04/2021	4	7,006	36,43	0,19231
Italy/Veneto	Porto Viro	II Menu 2^ Ristorazione 23/04/2021	4	8,22815	31,25	0,26342
Italy/Veneto	Porto Viro	III Menu 2^ Ristorazione 30/04/2021	4	1,9724	18,6	0,10634

<sup>5</sup> The number in the column corresponds with the identifier created for each menu in the FWfb during the data entry.

Italy/Veneto	Rovigo	Hotel Menu	4	19,65337	65,61	0,30343
Italy/Veneto	Rovigo	Menu carnevalesco(22.02.2021)	4	6,4	42,74	0,15008
Italy/Veneto	Rovigo	Menu Pasqua 2021	4	1,3169	76,63	0,01752
Spain	Bilbao	I Menu ESHBI Slow Food	5	12,824	116,44	0,11013
Spain	Bilbao	II Menu Artxanda	5	3,84	50,45	0,07611
Spain	Bilbao	IV Gastronomo 01	3	1,176	18,36	0,06405
Spain	Bilbao	V Gastronomo 02	3	0,1	0,4	0,25
Spain	Valencia	I	3	0,74	3	0,246666667
Spain	Valencia	II	3	0,8	4	0,2
Spain	Valencia	II	3	1,00578	5,5	0,182869091
France	Stains	I	4	19,16665	142,428	0,13457
France	Stains	II	4	6	45	0,109090909
France	Stains	II	4	7,8	55	0,141818182
France	Colmar	I	4	18,86539	114,610	0,1646
France	Colmar	II	4	31,73	202,48	0,15674
France	Colmar	III	4	12,75685	91,43314	0,13952
France	Rennes	I	5	11,92347	111,236	0,10719
France	Rennes	II	5	6,762986	78,2702	0,08641
France	Rennes	III	5	7,4395	89,1580	0,08305
Malta	Voyage	I	3	15,01	79,9	0,1898
Malta	Apron	II	3	22,1175	41	0,5394
Malta	Runaway	II	3	13,22	34,5	0,3834
Total calculated on 40 menus				352,065	2126,68	<b>0,16554691</b>

Table V: Ratio food waste cost/food cost for menu OUTPUT/INPUT for all the 40 menus

Aggregated data showed that VET centres wasted 12% of all inputs used for cooking (Table IV) – equal to a reduction of 5.4% compared to the baseline – and 16.5% of all purchased input (Table V) – equal to a reduction of 2.7% compared to the baseline.

As already highlighted in the analysis of the report for the baseline, there is a high variability 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. XIX) and for the food waste cost / food cost ratio (Fig XX).

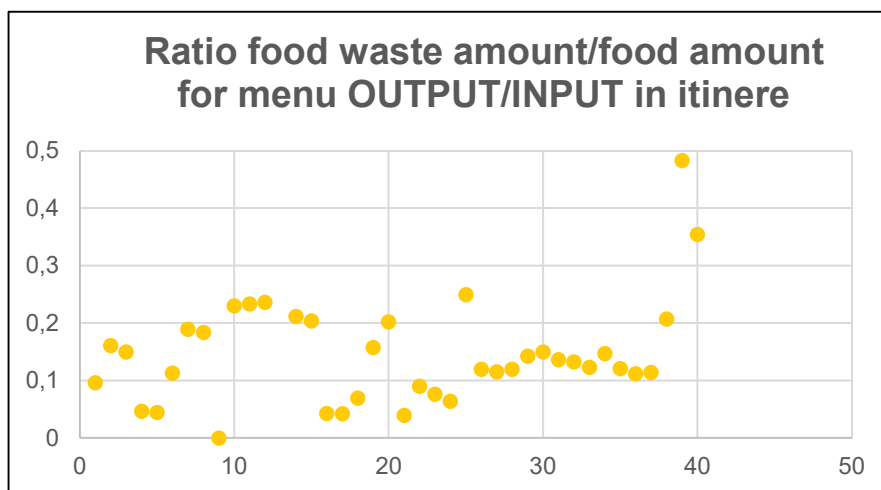


Figure XIX: Ratio food waste amount/food amount for menu OUTPUT/INPUT for the 40 menus listed in Table IV

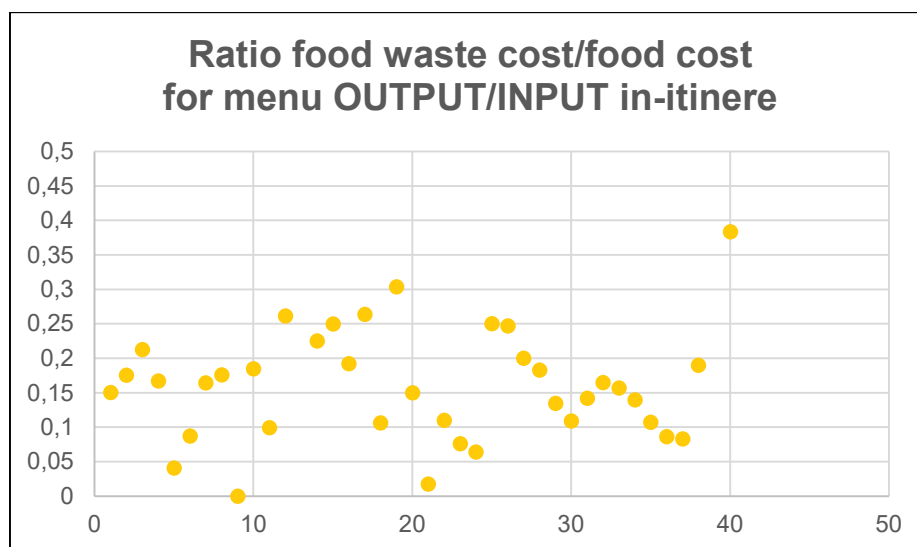


Fig. XX: Ratio food waste cost/food cost for menu OUTPUT/INPUT for the 40 menus listed in Table V

### 2.2.3 COMPARISON BETWEEN THE RESULTS OF THE MONITORING CAMPAIGNS (BASELINE & IN-ITINERE)

In this section are reported the considerations from the comparison of the results between the baseline and the in-itinere monitoring with the aim to monitor the progress in terms of food waste reduction achieved by VET at this point in the project. Due to some discrepancies between the baseline and first monitoring campaigns, as some VET centres were not able to complete the data upload in the app, the comparative analysis was carried out on 10 centers (see Table III, column 5). The comparison of the results between baseline and first monitoring, in line with the results of the macro analysis at the aggregate level, confirms and highlights a reduction in food waste at the level of individual vocational training center

The reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (i.e. saved food quantity indicator) is 5.18% for those VET centres for which it was possible to compare the two periods. The result is in the value range expected by the project KPI<sup>6</sup> (5.1 and 14%) (see Table VI).

Even if this value is in the lower range, the result is considered as satisfactory because

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<sup>6</sup> KPIs: Prevention of food waste. The amount corresponds to an average reduction of 450 kg/vocational training centre x 13 centres involved (10% reduction per year) until project end. We foresee that there is no further decrease in food waste amount after 3 years, therefore the number does not change. However, after 3 years we plan to have involved 73 centres. Therefore, the reduction will be 450 kg/vocational training centre x 73 centres, with a total reduced amount of 32.85 tn/y against 5.85 tn/y corresponding to 13 centres. We underline that the project aims to reduce food waste in a value range between 5.1 and 14%, depending on the situation of each centre, with an average value of 9.1%.

- it was a first monitoring experience for all involved training centres where they tested a new tool;
- both data collections were carried out in the pandemic period, which was an extreme condition with a lot of difficulties to organise laboratories

From the economic side the reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (i.e. saved food money indicator) is 3.95% for the VET centres for which a comparison was possible (see Table VII).

Country/Region	Vocational training center	BASELINE Average Ratio food waste amount/food amount for menu OUTPUT/INPUT	IN-ITINERE Average Ratio food waste amount/food amount for menu OUTPUT/INPUT	Reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (Save food quantity indicator)
Italy/Veneto	Conegliano	0,164	0,127	3,74
Italy/Veneto	Bassano del Grappa	0,155	0,060	9,5
Italy/Veneto	Dolo	0,133	*	-
Italy/Veneto	Isola della Scala	0,262	0,177	8,52
Italy/Veneto	Padova	0,236	0,234	0,22
Italy/Veneto	Porto Viro	0,113	0,046	6,72
Spain	Bilbao	0,237	0,12	11,7
Spain	Valencia	0,171	0,118	5,27
France	Stains	0,169	0,143	2,60
France	Colmar	0,151	0,129	2,20
France	Rennes	0,13	0,116	1,4
		<b>0,1788</b>	<b>0,1269</b>	<b>5,18</b>

Table VI: Ratio food waste amount/food amount for menu OUTPUT/INPUT comparison and calculation of the Save food quantity indicator

Country/Region	Vocational training center	BASELINE Average Ratio food waste COST/food cost for menu OUTPUT/INPUT	IN-ITINERE Average Ratio food waste cost/food cost for menu OUTPUT/INPUT	Reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (Save food money indicator)
Italy/Veneto	Conegliano	0,18	0,173	0,78
Italy/Veneto	Bassano del Grappa	0,160	0,09	7,20
Italy/Veneto	Isola della Scala	0,220	0,20	2,40
Italy/Veneto	Padova	0,295	0,21	8,95
Italy/Veneto	Porto Viro	0,156	0,20	-4,30
Spain	Bilbao	0,210	0,10	11,40
Spain	Valencia	0,180	0,148	3,18
France	Stains	0,200	0,130	7
France	Colmar	0,160	0,15	1,00
France	Rennes	0,190	0,17	2,00
		0,195	0,155	3,96

Table VII: Ratio food waste cost/food cost for menu OUTPUT/INPUT comparison and calculation of the Save food money indicator

Cross comparison of the results of the monitoring and reconstruction of the volumes and economic values related to the quantity of food processed during a year by each training centre also allowed estimating the amounts of saved food and its economic value. Although VET centres are very different in dimension and types of activities (ranging from vocational training to catering open to external customers), the estimated reduction is 444.513 kg/vocational training centre (table VIII), which, in economic terms, corresponds to an average saving of 3919.24 EUR/vocational training (Table IX). This result is slightly below what the project expected (450kg/VET centre).



Country/Region	Vocational training center	Reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (Save food quantity indicator)	Estimated reduction in the annual volume of food flow over the course of a school year in kg
Italy/Veneto	Conegliano	3,74	227,01
Italy/Veneto	Bassano del Grappa	9,5	62,06
Italy/Veneto	Isola della Scala	8,52	286,13
Italy/Veneto	Padova	0,22	16,03
Italy/Veneto	Porto Viro	6,72	293,07
Spain	Bilbao	11,70	2309,00
Spain	Valencia	5,27	142,21
France	Stains	2,6	830,09
France	Colmar	2,20	98,48
France	Rennes	1,4	181,04
Average value		<b>5,18</b>	<b>444,513</b>

Table VIII: Estimated reduction in the annual volume of food flow over the course of a school year in kg for VET center and at the aggregate level

Country/Region	Vocational training center	Reduction in percentage terms between the two periods calculated on the average waste values (OUTPUT/INPUT ratio) of the menus realized for the monitoring (Save food money indicator)	Estimated reduction in the annual volume of food flow over the course of a school year in EURO
Italy/Veneto	Conegliano	0,78	283,57
Italy/Veneto	Bassano del Grappa	7,2	281,780
Italy/Veneto	Isola della Scala	2,4	3760,61
Italy/Veneto	Padova	8,95	99,262
Italy/Veneto	Porto Viro	-4,30	-1130,020
Spain	Bilbao	11,40	24147,000
Spain	Valencia	3,18	223,810

France	Stains	7,00	10349,000
France	Colmar	1,00	133,760
France	Rennes	2,00	1044,069
Average value		<b>3,96</b>	<b>3919,284</b>

Table IX: Estimated reduction in the annual volume of food flow in EURO over the course of a school year in kg for VET center and at the aggregate level

### 3. FEEDBACKS FOR THE “EX POST” MONITORING”

This second monitoring, in addition to analyze the trend in food waste reduction from the baseline to the in-itinere campaign, has been used to test the web application and collect useful feedback on the monitoring activity for the third monitoring (ex-post). The results (aggregate and VET center for VET center) with respect to the baseline seem satisfactory and we expect a further reduction for the ex post monitoring in kg and Euro as a result of training and communication actions, especially for those centers that have shown that they still have a high rate of waste (with a Ratio food waste amount/food quantity OUTPUT/INPUT higher than 0,120). We will try to identify the difficulties related to the completion of the data upload in order to have an even more representative sample and to enhance the effort of collecting and uploading data.

Undeniably, the monitoring operation is a time-consuming activity and a positive correlation is increasingly emerging between the time and resources to be dedicated and the accuracy and precision of the data, especially if you want to keep under control both the variables relating to the quantity of waste produced and its economic value. It also emerges that the production of food waste is exposed to a high degree of variability, linked to the choice of dishes, ingredients and the conditions that are created in the storage, processing and consumption phase. It will therefore be relevant to understand what are the variables that the training centers can try in a preventive way to keep under control to limit the possibility of food waste being generated.

We will therefore try to verify how much the effect of a reduction in food waste is linked to the optimization of execution-consumption practices (reduce) or how much it can be further reduced as a result of planning aimed at minimizing waste (rethink).