Food waste prevention calculator and Food waste action planner

Interactive tools - technical documentation

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Contents

Abstract

This report describes the technical properties of two web applications developed by the Joint Research Centre in collaboration with the Directorate-General for Health and Food Safety and the European Consumer Food Waste Forum. The web applications are part of the Toolkit to reduce consumer food waste, which were created and maintained by the Knowledge Centre for Bioeconomy for use on the European Commission's Knowledge4Policy platform.

The Food waste prevention calculator is an interactive online tool based on Life Cycle Thinking to show the impacts and benefits of our food waste prevention action. It shares the environmental, nutritional, and cost benefits and trade-offs based on a number of choices of different food waste actions across the food supply chain. Users can identify and evaluate potential trade-offs when planning food waste prevention actions, which supports communicate about the actions results.

The Food waste action planner tool provides an easy guide of evidence-based, concrete solutions to reduce food waste at the consumer level. The aim of the tool is to inspire practitioners on concrete examples on how to prevent food waste. All the proposed best practices have been evaluated and have information and links for others planning to do something similar e.g. in a school canteens.

The two tools have been developed to serve practitioners in both public and private sectors, policy makers, businesses, schools, and other organisations engaged in food waste in EU Member States and beyond. They are developed using robust, stable applications and have proven to be user friendly and well appreciated by food waste experts. There is potential for further use and promotion of the tools that can contribute to the reduction of food waste in Europe.

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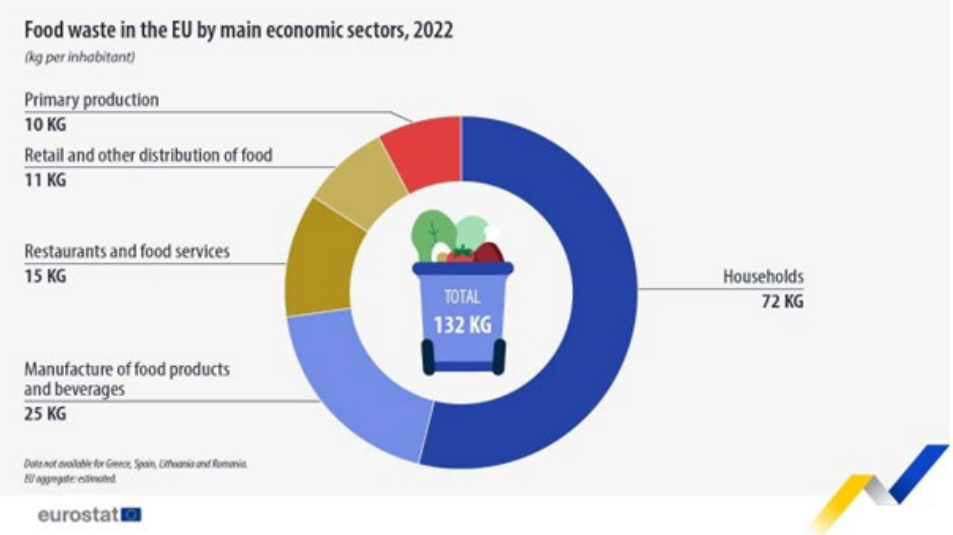
1 Introduction

This report describes the technical properties of the two web applications, namely the Food waste prevention calculator and the Food waste action planner. The two tools are developed by the Knowledge Centre for Bioeconomy as part of the European Consumer Food Waste Forum[1] project. The tools are part of the Toolkit to reduce consumer food waste[2], which were created and maintained by the Knowledge Centre for Bioeconomy. The target audience of the report are information scientists and developers that might need to replicate the tools or work further on them.

The Toolkit to reduce consumer food waste was developed to support practitioners in different countries to prevent food waste. The European Consumer Food Waste Forum identified the need to reach out to people that are actually implementing solutions and to have quick access to best practices and to the right, tested methodologies and thus to avoid wasting resources.

Food waste has significant environmental, climate, and social impacts. If EU food waste were considered a Member State, it would be the EU's 5th largest emitter of greenhouse gas emissions (Sala et al, 2023). Consumer food waste is essentially a behavioural issue and reducing waste is crucial to achieving the Sustainable Development Goal Target 12.3[3] of halving the amount of food waste per capita by 2030. The amount of food wasted during its production and consumption is staggering. Eurostat[4] has estimated that while around 20 percent of food produced in the EU is lost or wasted, some 33 million people cannot afford a quality meal every second day. In 2022, the EU generated 59 million tonnes of food waste (including both edible and inedible parts), which correspond to around 132 kilogrammes (kg) of food wasted per inhabitant per year. As much as 54 percent of the total amount of food waste is generated at household level, the equivalent of 72 kg per inhabitant (Figure 1).

Figure 1. Food waste in the EU by main economic sectors. Household waste alone accounted for 54 percent of the total amount of food waste, the equivalent of 72 kg per inhabitant in EU 2022[5].



Source: Eurostat webpage on Statistics explained.

[1] A network of experts and practitioners established in 2021, who developed the scientific resources on which the toolkit is based. For additional details, please consult: https://knowledge4policy.ec.europa.eu/projects-activities/european-consumer-food-waste-forum_en
[2] https://knowledge4policy.ec.europa.eu/bioeconomy/reduce-food-waste_en
[3] https://sdgs.un.org/goals/goal12#targets_and_indicators
[4] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates
[5] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates

The tools developed are part of the European Commission's work on reducing food waste for establishing sustainable food systems and developing a circular bioeconomy, where biological resources are used sustainably. In particular, the Farm to Fork Strategy[6] outlines a series of actions to enable the EU's transition to a sustainable food system. On 5 July 2023, the European Commission proposed setting legally binding food waste reduction targets for EU Member States to achieve by 2030, as part of the revision of the Waste Framework Directive[7]. Specifically, EU Member States are required to implement measures to reduce food waste by the end of 2030 by:

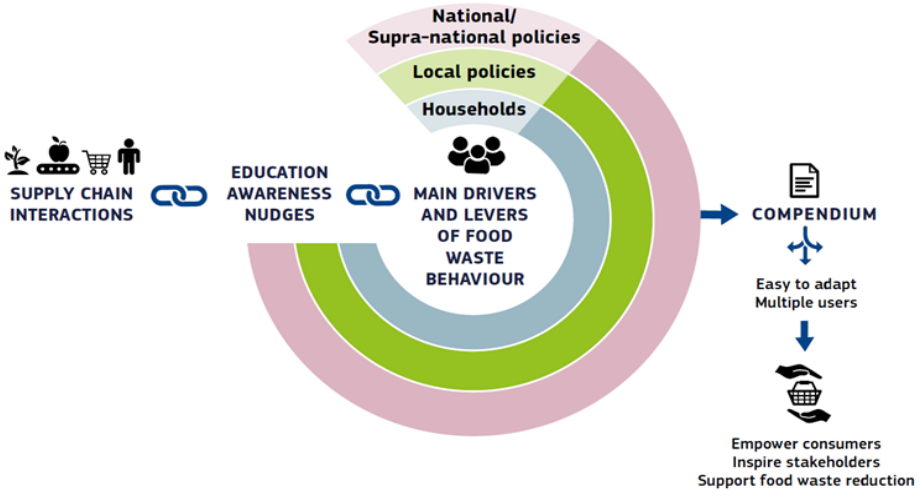
- 10 percent reduction in processing and manufacturing,
- 30 percent reduction (per capita), jointly at retail and consumption (restaurants, food services and households).

The Knowledge Centre for Bioeconomy contributed to the European consumer food waste project 2021 -2024 in collaboration with the Directorate-General for Health and Food Safety.

The Joint Research Centre, in collaboration with the Directorate-General for Health and Food Safety have set up the European Consumer Food Waste Forum in October 2021. This network of international practitioners and researchers identified a variety of evidence-based, practical solutions to reduce food waste at the consumer level. The result of their work was published as a Compendium of tools, best practices, and recommendations to help all key players engage in actions to prevent food waste (Candeal et al., 2023). In Figure 2 is an overview of the European Consumer Food Waste methodological framework shown.

The scientific recommendations and outputs from the Forum's work have been summarised in the Toolkit to reduce consumer food waste, to support decision makers in their actions towards food waste reduction, accessible from the Knowledge Centre for Bioeconomy. The Toolkit to reduce consumer food waste and the related resources were launched at the public event 5th of June 2024: Let's reduce consumer food waste! Solutions from the European Consumer Food Waste Forum[8].

Figure 2. Overview of the European Consumer Food Waste Forum methodological framework. The tools, Food waste prevention calculator and the Food waste action planner are part of the end product, empower consumers, inspire stakeholders and support food waste reduction.



Source: Candeal et al. (2023).

[6] https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en
[7] https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en
[8] For details about the event, please consult: https://knowledge4policy.ec.europa.eu/event/lets-reduce-consumer-food-waste-solutions-european-consumer-food-waste-forum_en

2 Toolkit to reduce consumer food waste

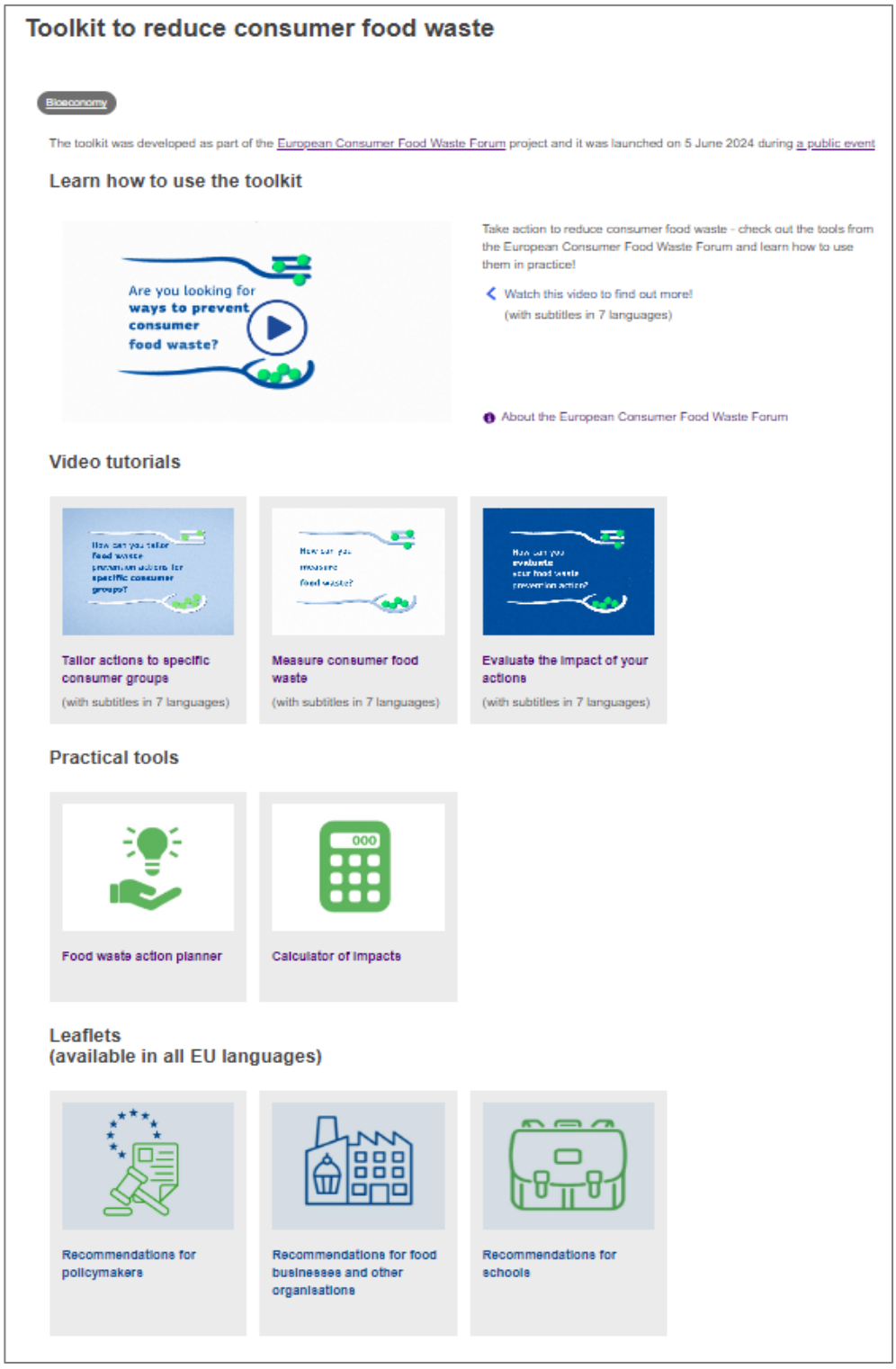
The Toolkit to reduce consumer food waste, addresses practitioners in both public and private sectors, policy makers (national, regional, local), businesses, schools, and other organisations engaged in food waste prevention (e.g. consumer and environmental NGOs, food banks and other charities etc.), in EU Member States and beyond.

The Toolkit to reduce consumer food waste (Figure 3) includes a wide set of tools, namely:

- The Food waste prevention calculator, an interactive online tool based on Life cycle thinking to understand the impacts and benefits of our food waste prevention action. It shares the environmental, nutritional, and cost benefits and trade-offs when the user inputs some information regarding the amount of food saved, not to be wasted in terms of mass. It is based on extensive JRC work published in 2020 (De Laurentiis et al., 2020) and refined by the Forum experts' feedback in 2023, published in Garcia Herrero et al. (2023).
- The Food waste action planner, an interactive online tool classifying more than 70 food waste prevention actions in different countries, initiated by the European Consumer Food Waste Forum experts to inspire policy makers and practitioners. This web-application works as a decision tree and can be navigated based on the place where the food waste prevention action happens, the audience targeted, the geographical scale and the type of action.
- A series of 4 videos designed to explain in dedicated sessions on how an intervention should be planned and implemented, as well as evaluated based on food waste quantification techniques and protocols. The videos are in English and subtitled in 6 languages.
- Informative leaflets in 24 EU languages for advice and best practices addressed at policymakers, food businesses and organisations, and schools.
- Scientific reports and communication material on the practical solutions described above.

In the following sections, the technical description of the two interactive tools is provided.

Figure 3. Toolkit for reducing consumer food waste. The entry point to the two interactive practical tools, the Food waste prevention calculator (calculator of impact) and the Food waste action planner. The webpage also holds links to videos, leaflets and key scientific reports, all developed within the European Consumer Food Waste Forum.



Source: Screenshot from the Toolkit webpage.

3 General overview of the two tools

The Food waste prevention calculator and Food waste action planner are web applications created by the Knowledge Centre for Bioeconomy (KCB), and published on the KCB website as part of the European Consumer Food Waste Forum project. They exist in two versions:

- A "developer" version called TESTPAGE which is used by the developers to test any and all changes to the applications. Only people with an EU Login (formerly ECAS) account can view and access this page. This is the Draft state on the K4P platform. The url for the developer versions are respectively:
  - Food waste prevention calculator: https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en
  - Food waste action planner: https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwr_en

- A "production" version which is accessible to anyone and is the final version of the application that is only updated after the developers have tested and confirmed that changes are stable from the TESTPAGE. It is in the Published state on the K4P platform. The url of the production pages are respectively:
  - Food waste prevention calculator: https://knowledge4policy.ec.europa.eu/visualisation/food-waste-prevention-calculator_en
  - Food waste action planner: https://knowledge4policy.ec.europa.eu/visualisation/food-waste-action-planner_en

The Food waste prevention calculator was initially an Excel-based tool developed originally as a spreadsheet using Microsoft Visual Basic in the context of Food Waste Prevention (Caldeira et al., 2019 and De Laurentiis et al., 2020). The calculator was then expanded with features from recommendations of the European Consumer Food Waste Forum (García-Herrero et al., 2023). The main limit identified by the experts from the forum of the version available in 2020 was its low user friendliness. To overcome this issue, it was developed as an online tool in 2024 by the KCB.

The Food waste action planner is the digital representation of the tools, best practices and recommendations to reduce consumer food waste listed in Candeal et al. (2023). In order to develop the Food waste prevention calculator, the minimum necessary data from the previous application was extracted and organised in a new excel spreadsheet (XLS format).

For both web applications, JavaScript was then used to create a custom and essential framework for simpler integration into the underlying K4P platform[9], and to integrate the ECLiPSe Constraint Logic Programming System (ECL) library of components. The ECL library provides a variety of components and guidelines which are fully compatible with the K4P platform, to which the code for specific visual components needed for the application was copied/pasted into the framework and tuned according to the project needs. The ECL Library can be found at https://ec.europa.eu/component-library/ec/.

In order for the applications to run correctly on the K4P platform, it is necessary to upload and replace specific files in the K4P backend, which the application will automatically run once the page is loaded. File creation and descriptions are described in detail in chapter 6. How to update the

[9] https://knowledge4policy.ec.europa.eu

webapps on K4P platform. There are also several sub-applications that can be used only within the TESTPAGE versions of the web applications by developers to help them with de-bugging or file generation – each sub-application and its use is described in detail in chapter 4.10, Sub-applications.

The source code for the applications for the two tools is tracked in git repositories, as follows:

- Food waste prevention calculator: https://citnet.tech.ec.europa.eu/CITnet/stash/projects/BEO/repos/food-waste-prevention-calculator/browse
- Food waste action planner: https://citnet.tech.ec.europa.eu/CITnet/stash/projects/BEO/repos/food-waste-action-planner/browse

4 Food waste prevention calculator

4.1 Aim

The aim of the Food waste prevention calculator tool is to assess the nutritional benefits, the net economic savings, and net environmental savings resulting from the implementation of food waste reduction interventions. Environmental savings are calculated using the life cycle assessment methodology. The tool allows users to identify and evaluate potential trade-offs that may arise during the implementation of food waste prevention actions.

In particular, the results provided by the calculator can support:

- The assessment of ongoing and concluded food waste reduction interventions, with a consistent and robust approach.
- The prioritisation of those food waste reduction interventions that are more effective in reducing the impacts related to food waste (e.g. embedded emissions).
- The identification, at early design stages, of trade-offs between environmental/economic/nutritional benefits and impacts caused/costs incurred when implementing an intervention.

The use of this tool can help in evaluating the impact of an action, which is an essential step to ensure it has the desired effect. Moreover, periodical evaluation of actions has shown to enhance their effectiveness in reducing food waste (Casonato et al., 2023).

4.2 Target audience

The target audience for the European Consumer Food Waste Forum outputs overall can be said to be Member States, in taking actions and engaging stakeholders to achieve the future EU food waste reduction targets. This to inspire practitioners, researchers and businesses to design, implement and evaluate actions and join forces.

Target users for the Food waste prevention calculator are:

- Schools
- Food businesses (e.g. supermarkets, restaurants)
- Policymakers
- Practitioners
- Researchers
- Businesses
- All players engaged in activities preventing food waste

4.3 Properties and aspects evaluated

The Food waste prevention calculator has been designed to facilitate a quick evaluation of the food waste prevention action. It is easy to use and based on readily available input data and provided proxy data to fill potential data gaps (i.e. information not known to the user). In addition, it is designed to present the results of the analysis in an easily understood way (Caldeira et al., 2019 and De Laurentiis et al., 2020). In Figure 4 the entry point of the tool is shown.

The main underlying properties of the calculations of the Food waste prevention calculator are described in Box 1. There are two different levels of detail of food products included in the calculator: food products and food groups. In case the exact composition of the avoided food waste

is known, users should input information on the avoided food waste at product level (e.g. bananas, apples). Alternatively, the user can select a broader food group (e.g. generic fruit, generic vegetables). In case no information is available on the composition of the food waste avoided, it is possible to select an "unspecified" food item. Further information on the content of the Food waste prevention calculator is described in De Laurentiis et al. (2020) and updates in Garcia-Herrero et al. (2023).

It is planned to update the underlying data on which the environmental, economic and nutritional values are based on a biannual basis, when updated datasets are made available.

Box 1. Key calculations in the Food waste prevention calculator.

How is the environmental assessment performed?

The calculator is based on Life Cycle Thinking. Environmental benefits from avoided food production and distribution are calculated considering the full life cycle of each food item saved from primary production up to the stage of the supply chain where it would have been wasted, taking into account all emissions released and resources used. Environmental benefits from avoided waste treatment are calculated considering the impact associated with the selected waste treatment technology and the amounts of waste that would have been treated. The environmental impact of the action is instead calculated considering the life cycle impact of the resources used to implement it, such as the paper used for printing or the electricity used. The life cycle assessment studies underlying these results are performed using the Environmental Footprint impact assessment method that considers 16 different impact categories plus a single weighted score obtained after aggregation. The calculator does not substitute an accurate life cycle analysis for the planned action. More information on the assumptions taken and data sources are provided in the following scientific publication and technical report: De Laurentiis et al., 2020 and Garcia Herrero et al., 2023.

How is the economic assessment calculated?

The implementation of a food waste prevention action has some associated costs and in return, if successful in achieving a food waste reduction, will bring some economic benefits related to not wasting food that has an economic value and not having to cover disposal costs. The purpose of the economic assessment is to evaluate if the savings outweigh the costs, in order to assess the economic feasibility of implementing an initiative. To do that, three elements are considered: A) The avoided costs of producing and distributing the food items saved up to the point of the food supply chain where the food waste is avoided, B) The avoided cost of disposing of the food waste, C) The cost of implementation of the action.

How is the nutritional value of saved food calculated?

Nutritional values are calculated considering the nutritional composition of the saved food which is based on the nutrients content of each food item before cooking. The selected nutritional indicators are those required in the food labels in the EU (Consolidated text: Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011). The calculation of the associated nutrients has been done by using the Norwegian Food Composition Database (2012). The values are calculated according to the food selected and the associated mass. From the total calories associated with the saved food, we also calculated the number of meals equivalent saved, by comparing them with one third of the daily average caloric requirement of an adult.

Source: Own elaboration.

4.4 How to use the Food waste prevention calculator?

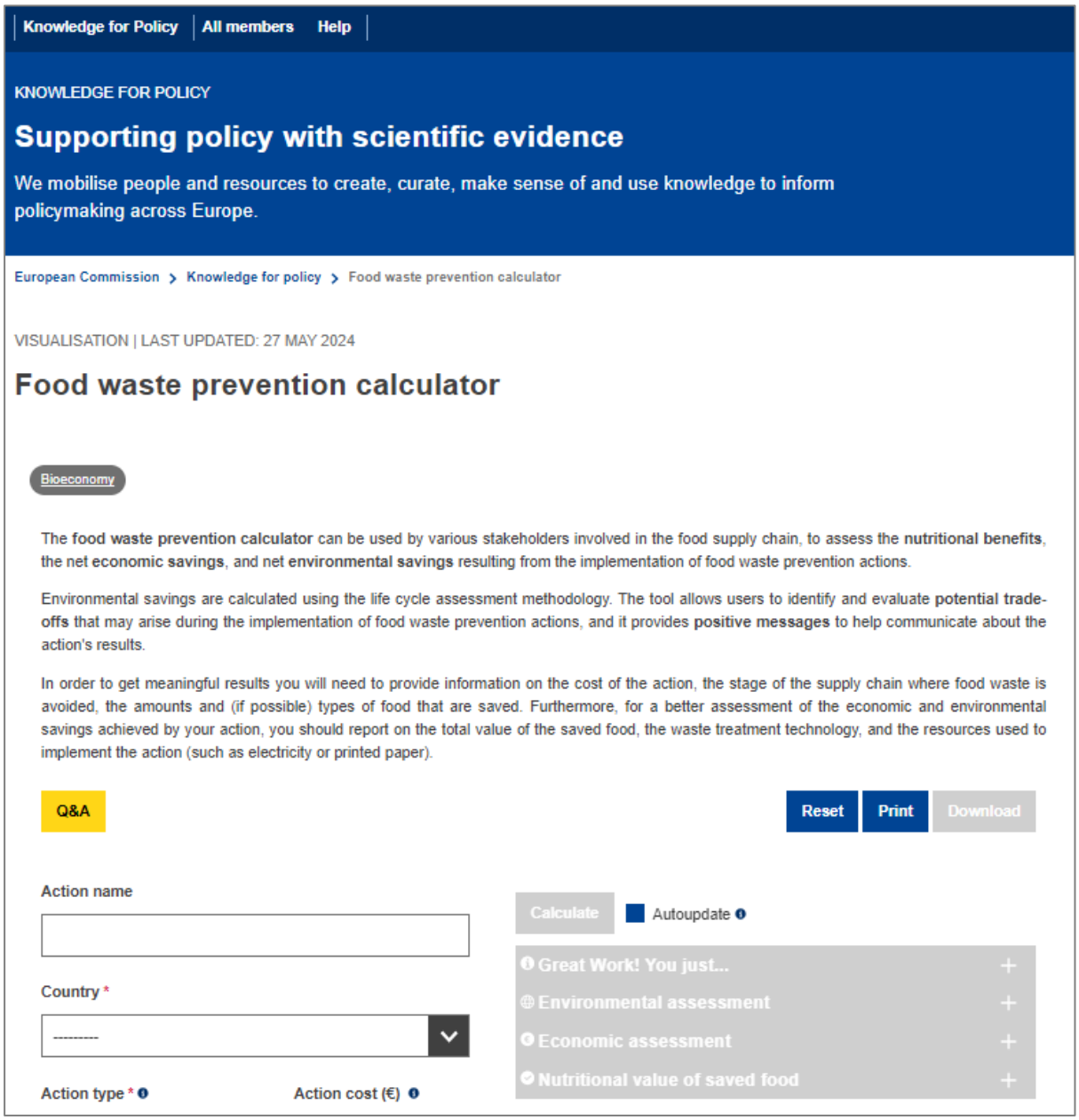
There is no need for an extensive user manual as the Food waste prevention calculator is self-explanatory.

The user is asked to provide the following inputs in the tool to perform the analysis:

- Country where the action takes place
- Type of food waste prevention action
- Stage of the Food supply chain where the food waste is prevented
- Cost of implementing the action
- Resources needed to implement the action (e.g. number of leaflets, kilometres of transport, electricity used)
- Waste treatment that would have been used if the food had been wasted
- Types and quantities of food items saved (choosing from a list of 32 food commodities)

The main advantages of the Food waste prevention calculator are that it enables the user with early identification of potential trade-offs (i.e. situations in which the costs, economic or environmental, outweigh the benefits).

Figure 4. Entry point for the Food waste prevention calculator. The tools is self-explanatory with boxes for further information. Required information to provide for input is selected on the left from drop-down menus and the results are shown on the right-hand side.

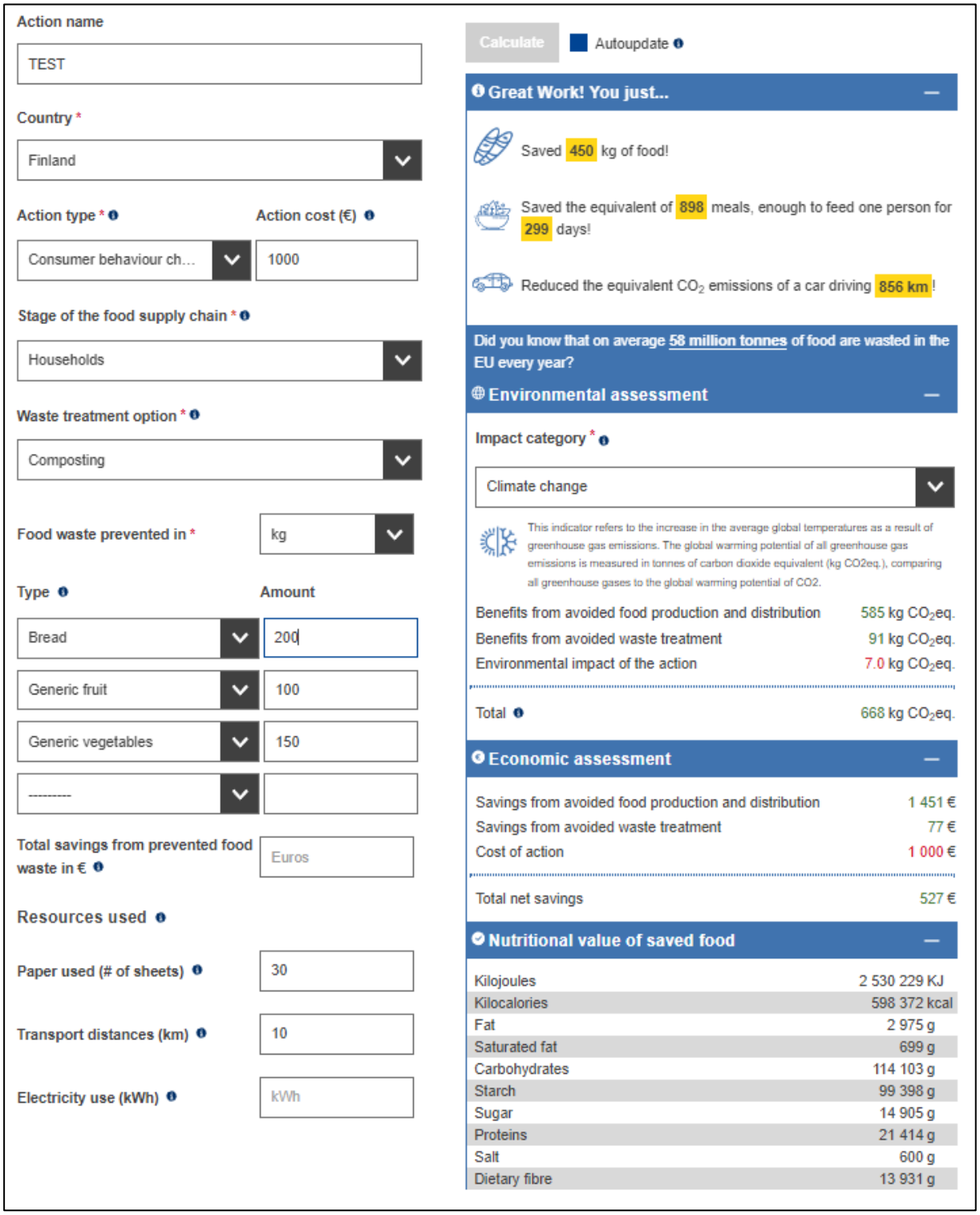


Source: Screenshot from the Food waste prevention calculator web tool.

4.5 Results

The results of the Food waste prevention calculator are displayed in a visual way for the user, showing the effects of the calculated action in terms of how much food it enabled to save, the related potential environmental savings, economic savings, and the nutritional value of the saved food (Figure 5). The need of providing positive messages was also stressed by European Consumer Food Waste Forum experts, as it has shown a more positive effect towards food waste reduction efforts at consumer level, when positive messages are provided to actions' implementers and targeted groups.

Figure 5. Food waste prevention calculator, example of results of a food waste prevention action.



Source: Screenshot from the Food waste prevention calculator web tool.

Figure 5 displays the results obtained by providing a hypothetical example of a prevention action. The action concerns menu planning and portion control at household level in Finland. Therefore, the action is classified as "consumer behaviour change", and it leads to preventing food waste at Household level. Self-monitoring of food waste levels for three categories: bread, vegetables, and fruit has been done by providing scales to targeted households. The action is estimated to cost 1 000 Euro, and to lead to a total saving of 1 527 Euro (calculated considering the value of the

avoided food waste and the cost of waste treatment), therefore estimated net savings are equal to 527 Euro. Regarding the environmental impacts, the climate impact savings is equivalent to 668 kg CO2eq, calculated considering the emissions saved by avoiding food waste minus the emissions caused by the paper used as well as transportation to run the intervention. The calculator user can also explore other impact categories beyond climate change (e.g. water use, acidification) based on the environmental assessment method recommended by the European Commission called Environmental Footprint[10] (EC, 2021). The savings on nutritional values amount to around 598 372 Kcal. These positive messages are disclosed at the top-right side of the calculator. They can encourage implementers, while also can be used to communicate the results of the action to decision makers such as policies or consumers.

4.6 Files published in Knowledge4policy

For the Food waste prevention calculator web application shown in TESTPAGE, five files are needed for the tool to run correctly, while the "production" version requires four. The difference is due to the presence of a functionality needed when developing and debugging, so it is only necessary for the TESTPAGE.

The files are named conventionally by describing the four key pieces of information for the respective file, divided by the dash and the dot characters (Table 1 and Table 2):

- a short version of the name of the web application to which the file belongs (e.g. "fwc" for Food waste prevention calculator);
- the version of the web application and so, indirectly, the web page using it ("develop" for TESTPAGE and "production" for the published page);
- the role of the file in the web application indicating the type of content, taken from the base file;
- the file extension, like "js" (JavaScript source code) or "json" (data).

Table 1. Files of Food waste prevention calculator on the Knowledge4Policy platform.

Filename (development)	Filename (published)	Short description
fwc-develop-app.js	fwc-production-app.js	contains all the JavaScript source code and stylesheets, in a compact version
fwc-develop-strings.js	fwc-production-strings.js	contains all the texts, short and long, shown to the user
fwc-develop-db.json	fwc-production-db.json	contains all the data presented to the user and used for the calculations
fwc-develop-test_data.js	not necessary	contains the information used by the auto-fill sub-app (it automatically fills the form presented to the user)
fwc-develop-impcat_infmsg_icons.xml	fwc-production-impcat_infmsg_icons.xml	some of the icons shown, while others come from the ECL icons library

Source: Own elaboration.

[10] https://green-business.ec.europa.eu/environmental-footprint-methods_en

Table 2. Detailed description of selected files of the Food waste prevention calculator.

Filename (development and published)	Extended description
fwc-develop-app.js fwc-production-app.js	The "-app.js" files are the ones containing the entire application composed by the JavaScript code and the Cascading stylesheets (injected into the web page using a "style" HTML entity). These files are generated by an automatised process, programmed in Python language, run by the developers on their development machines. All the JavaScript files, developed specifically for the project or added to it from a third-party supplier, are then put together and minified. The source for the list of files to be concatenated is an HTML file called "index.html" that lies within the Python script and all the rest of the source code in the git repository dedicated to this web application.
fwc-develop-strings.js fwc-production-strings.js	These files, "-strings.js", may have the same content because there may not be relevant differences between the two versions (e.g. production version may be the latest tested version in TESTPAGE). The source of this file is contained in the repository, inside "web/strings/" folder, as a "sample", but in case of changes it is possible to download it from K4P on a local PC, change it with a simple text editor and upload it again. More information about this process is in '4.7 - Update of static texts'.
fwc-develop-db.json fwc-production-db.json	The "-db.json" files contain all the data shown to the user and used to calculate the result. They are the result of the conversion of the spreadsheet created by hand at the time of the analysis of the original program written in Visual Basic. The conversion happens thanks to a sub-app that can be activated only in TESTPAGE and that is described later in this document.

Source: Own elaboration.

4.7 Update of static texts

In the Food waste prevention calculator every text or short phrase shown to the user can be changed without altering the source code of the web application thanks to the file "sample.js" found in the "web/strings/" folder, of which "-strings.js" are just the renamed versions uploaded in K4P. This file contains a JavaScript object structured in multiple levels between the round brackets where each key can be value of a single-line text, a multi-line text, a list, or another object where, respectively, these are enclosed between single (or double) quotation marks, backticks, square brackets or curly brackets. As a general rule, apart from the texts (single- or multi-line), nothing can be changed because brackets, quotation marks, semicolon and commas structure the code syntactically and are interpreted by the browser. What's inside the quotation marks and backticks is ignored by the interpreter of the code.

General rules for the use of static text to remember:

- multi-line texts can be written only between backticks;
- multiple spaces following each other are ignored by browsers and substituted by just one space (if the intention is to have a space repeated more than once, use the HTML entity "** **" multiple times to state this intention);
- in case there is the need to use single or double quotation marks or backticks inside a text delimited by the same symbol (e.g. a backtick in a text delimited by backticks) the symbol must be preceded by a backslash (****) otherwise it will mean that the text is terminated in that point and the remaining text will generate execution errors;
- texts can contain HTML tags like "<a>" for links to other pages and documents, "" to isolate words for styling, or "<p>" to create multiple lines of separated text.

The structure of the initial object, called root object or root, and of all the contained objects or lists can be changed by a developer following new needs.

Below is a description for some of the objects:

- "calculator_description" refers to the text at the top of the webapp;
- "qa" is the key for the multi-line text regarding the "Q&A" section of the webapp, containing everything, from the HTML structure to the text;
- "info" is an object containing the text shown in the "Great work" results area of the webapp and they contain four placeholders for the computed numbers: "$SFA" (saved food amount in kilograms), "$SF" (saved food to feed a person in days), "$SM" (saved meals), "$SCD" (saved carbon dioxide). It is important to keep these placeholders and change the text around it. If the numbers provided by these placeholders need to be changed, it is done outside of the file.

4.8 Update of data

For the Food waste prevention calculator data used to make the calculations, and the related math, was originally taken from the Microsoft Excel spreadsheet developed by De Laurentiis et al. (2020). The file was analysed after feedback provided by the European Consumer Food Waste Forum experts and the math has been re-written in JavaScript, while the data has been extracted and put into a simpler Excel spreadsheet. The aim of this chapter is to describe the structure and the content of this spreadsheet, not the meaning and sources of the data and math of the original spreadsheet.

The new spreadsheet is made of several sheets and, with the exception of the first one titled "_Considerations", they all have a common structure:

- the first four rows are organised as a table of two columns and four rows, in a key-value fashion (first column containing the meaning of the values in the second column);
- remaining rows are organised as a table of at least three columns and a variable number of rows, containing the data used by the application.

The names of the sheets have the following structure: the first uppercase letters (up to the dash) identify the context of the data stored in the sheet while the remaining is their specific identifier. The complete association of uppercase letters and contexts is the following:

- DD for dropdowns
- EE for eol_emissions
- FC for food_cost
- IFS for impacts_per_fsc_stage
- AI for action_impacts
- CN for calculation_nutritional

This association is visible in the JSON file containing the result of the conversion and should not be altered unless the behaviour of the webapp is changed.

The first “key-value” table is structured in the following way:

- "source” contains the coordinates to find the data in the original spreadsheet, with the name of the sheet and the interval of cells (e.g. “dropdown:{E2-F33}” or “Action impacts:{B22-R24}”)
- "description” defines what the numbers are, or how they were determined
- "comments” contains transitory information
- "type” is crucial on how the remaining rows will be interpreted during the conversion and it can contain just “list”, “dict” or “table”

None of these rows should ever be changed unless it is really necessary, like in the case of a change to the behaviour of the application.

The second table enforces the following rules:

- the first row contains the headers of the columns;
- the first column, “ignorable”, is common to each sheet and signifies if the row should be considered or not while converting the file into JSON;
- the quantity of columns and rows varies depending on the data;
- generally, there are no empty cells.

These tables are converted as JavaScript lists (with another list for each row) when type is “list”, as an object, when type is “dict”, and as a mix of the two when type is “table”. In all the sheets that have “DD” as a prefix, the value in column “code” must be unique, but the only table among them that may be altered by adding or removing rows is “DD-foods”, when there are new food types to be listed as a selection. In this case there is also the need to add coherent columns in “FC-cost_table_p” and “IFS-impacts”, and coherent rows in all the sheets with prefix “CN-nutritional_data_”. The only other values that can be modified are the texts like “name”, “unit” and “description” in the sheets prefixed by “DD” and the numbers in all the sheets. In sheet “DD-foods” there is the possibility to add special values in a row to group together the following options up to the next special value. This is done by adding in a new row “-” for “code” and a text for “name” and the new group will appear. Once the file is ready one can convert it using the sub-application https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?convert_data that is described in 6.3 - Data converter.

4.9 Structure of files and folders in repository

In Table 3 is a quick overview of the most important files and folders of the Food waste prevention calculator in the repository, starting from its root folder.

Table 3. Files and folders in the repository of the Food waste prevention calculator.

File / Folder	Description
bin/	contains the python script “minify.py” that generates the necessary for publishing the application in K4P
data/	contains an historical set of data used to test the application
web/	contains source code and configurations of the webapplication and its sub-applications
web/conf/	contains the configuration files
web/data/	contains the file providing the data used for local developments
web/k4p/	contains the most up-to-date “look and feel” of K4P, as cascading stylesheets and image files, for local developments
web/index.html	contains the minimum K4P’s HTML code to set up a page in the browser to develop the application
web/app.js	second JavaScript code to be executed that loads the required data from K4P initializing all the necessary data structures
web/main.js	first JavaScript code to be executed that prepares the page to host the application
web/style.css	contains the “look and feel” of the application

Source: Own elaboration.

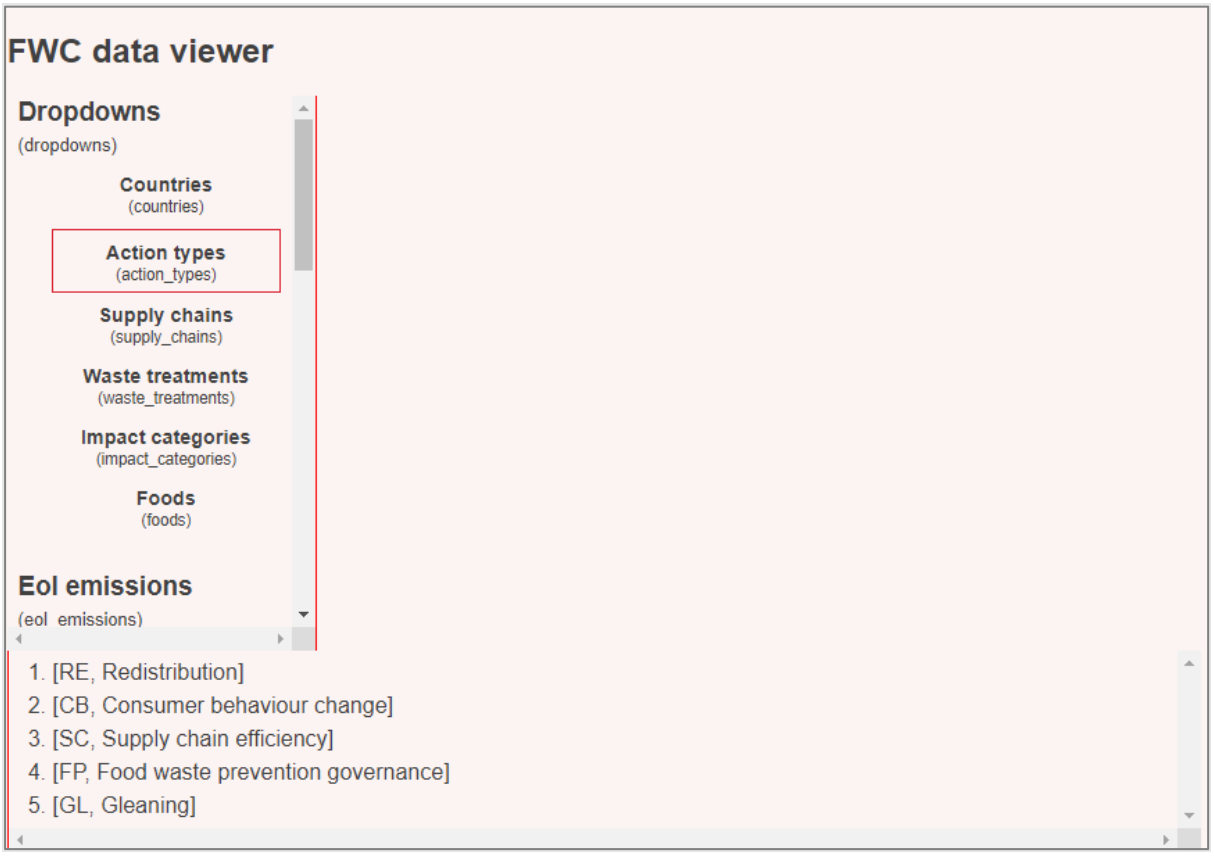
4.10 Sub-applications

There are four sub-applications of the Food waste prevention calculator available to the developer, only on the TESTPAGE, to aid in developing and updating of the tools, as well as with debugging issues and quality control. Each can be used by adding a parameter, with a "?" symbol, to the end of the URL of TESTPAGE. The sub-applications and their parameters are described in the following sections below, i.e. by data viewer, log viewer, data converter and autofill.

Data viewer

This functionality can be accessed adding the parameter "show_data" in the URL, i.e., https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?show_data. The user interface, displayed above the Food waste prevention calculator interface, is split into two parts (Figure 6).

Figure 6. Example of the data viewer of the Food waste prevention calculator. Here to see the data of the selected "action types" table, with its contents shown under the vertical menu. The left side displaying a vertical menu of specific tables, grouped into main categories, and the right side which displays the selected table data as they are stored inside the JSON file containing them.

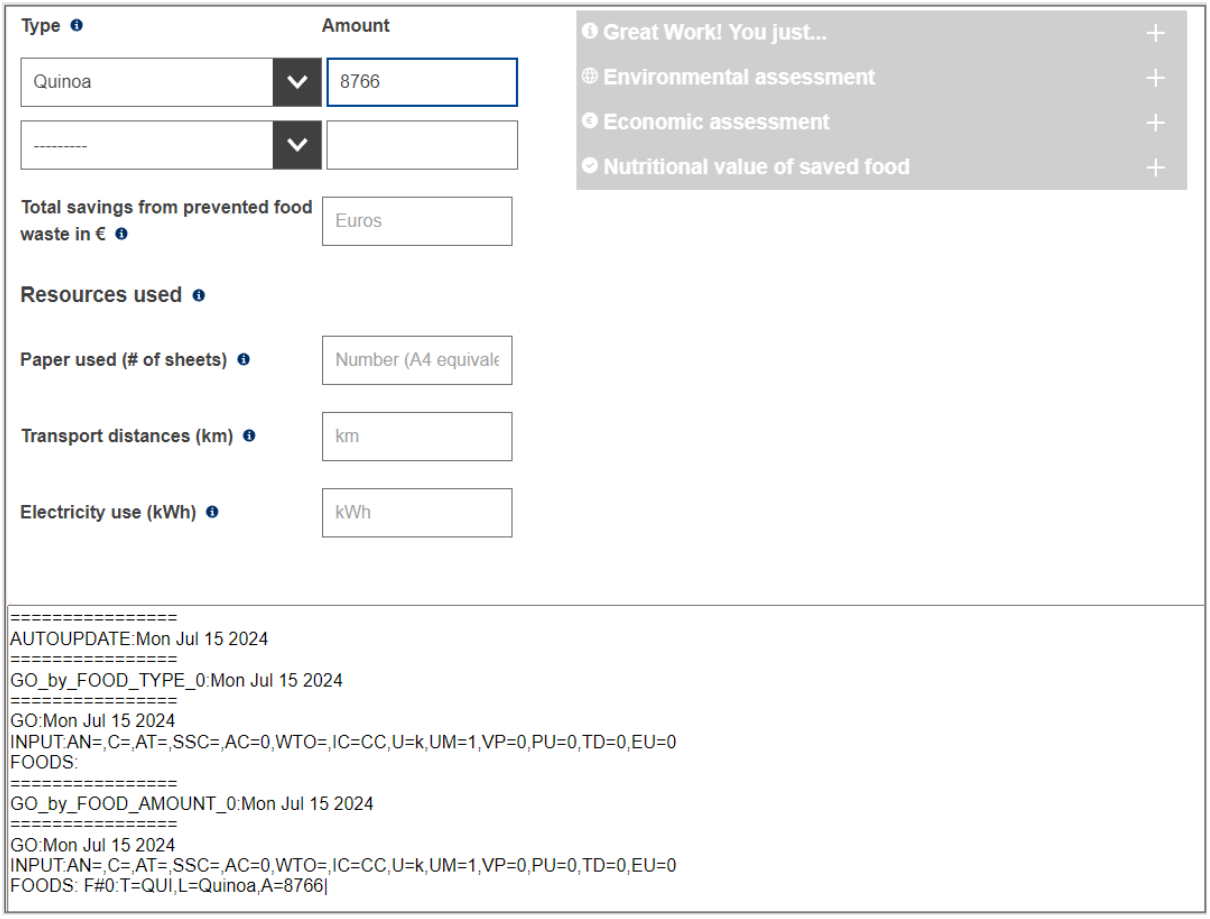


Source: Screenshot from the Data viewer sub-application of the Food waste prevention calculator.

Log Viewer

This functionality can be accessed adding the parameter “show_log” in the URL, i.e., https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?show_log 8 (Figure 7).

Figure 7. Log viewer of the Food waste prevention calculator. Here displaying log of user input for selection of food type and amount. The user interface, displayed at the bottom of the Food waste prevention calculator interface, consists of a text area where lines of text will be appended by the web-application based on the user’s selection(s).

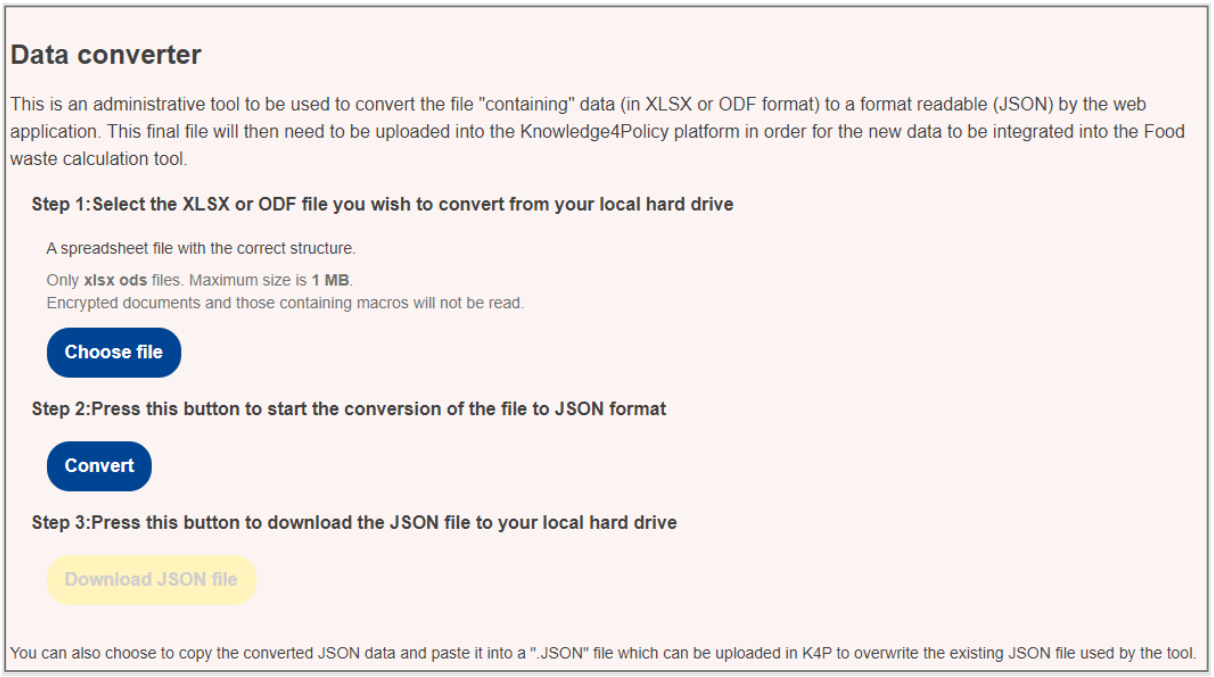


Source: Screenshot from the Log viewer sub-application of the Food waste prevention calculator.

Data Converter

This functionality can be accessed adding the parameter “convert_data” i.e., https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?convert_data. In Figure 8 the data converter interface is shown. This sub-application interface replaces that of the Food waste prevention calculator. This sub-application is necessary for updating both the Food waste prevention calculator and Food waste action planner in K4P, and described in more detail in chapter 6.3, Data converter.

Figure 8. Data converter interface of the Food waste prevention calculator. This sub-application is split into three steps: a button for uploading the spreadsheet file, a button for starting the conversion of the file into JSON, and a button for downloading the resulting JSON file.

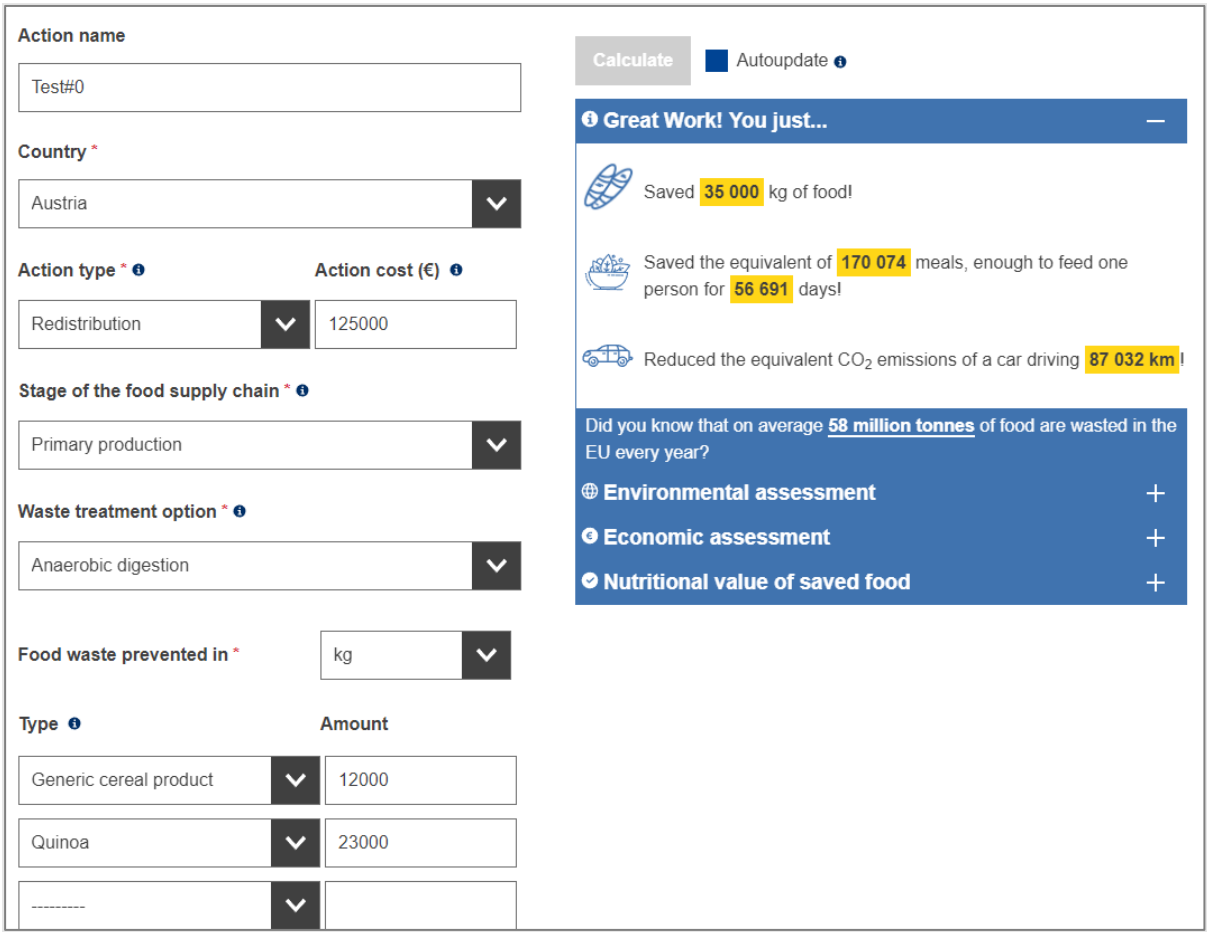


Source: Screenshot of the Data converter sub-application of the Food waste prevention calculator.

Auto-fill

This functionality can be accessed adding the parameter “test_data” in the URL, i.e., https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?test_data. This allows the Food waste prevention calculator (Figure 9) to have all relevant selections automatically completed upon page load: useful for the developer to see changes to the output section without having to make selections themselves.

Figure 9. Example of the Food waste prevention calculator. On the left-hand side there is an input sections pre-filled from the auto-fill sub-application.



Source: Screenshot of the auto-fill sub-application of the Food waste prevention calculator.

It is also possible to activate multiple, or all sub-application simultaneously, by separating the sub-application names within the URL with an '&' symbol, for example https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?show_log&show_data&test_data&convert_data would display all four sub-applications.

5 Food waste action planner

5.1 Aim

The main aim of the Food waste action planner is to provide a repository of best practices, which are suitable for various food waste prevention practitioners respective needs, from a supermarket owner or a school. The Food waste action planner is designed for the user to look for best practices in an easy way, by only clicking their way forward.

The aim of the tool is to inspire on how one can prevent food waste, but also to give qualitative and quantitative information, e.g. on budget, amount of food waste reduced, descriptions, links etc. on the actions used by others. By providing this additional information, the best practices are not only evaluated, but have information and links that can serve as a good base for others planning to do something similar or that are just looking for various types of initiatives and want to see what could work best for their needs and resources for preventing food waste.

5.2 Target audience

The target audiences for the European Consumer Food Waste Forum outputs overall can be said to be Member States, in taking actions and engaging stakeholders to achieve the future EU food waste reduction targets. This to inspire practitioners, researchers and businesses to design, implement and evaluate interventions and join forces.

Target users for the Food waste action planner are:

- Schools
- Food businesses (e.g. supermarkets, restaurants)
- Policymakers
- Practitioners
- Researchers
- Businesses
- All players engaged in activities preventing food waste

5.3 Content

The Food waste action planner was developed to transform the very detailed Compendium (Candeal et al., 2023) and the technical report by Swannell et al. (2023) and make it easily available online to the target audience by focusing on the key concepts, target users and type of actions planned. The types of actions developed within this work are shown in Figure 10.

These concepts are presented in the form of a decision tree, where the user is presented with a hierarchal set of questions, going from general to increasingly more specific as they progress through the tree, in order to provide them with increasingly targeted suggestions on how to reduce food waste from around the world. An example of how the tool works is shown in Box 2.

Figure 10. Identified types of interventions. Six types of interventions, either aiming to reduce food waste at home (no 1-3) or out-of-home (no 4-5) or both (no 6) were identified. These entry points where the basis and partly modified for the online tool, the Food waste action planner.

Source: Candeal et al. (2023)

5.4 How to use the Food waste action planner

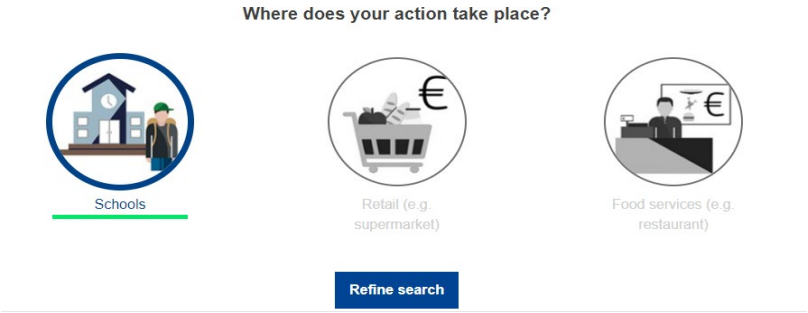
There is no need for an extensive user manual as the tool is self-explanatory and instead an example is shown here. The user is guided by a set of basic questions, and by easily clicking their way forward in a decision tree, one can explore various examples of Food waste prevention actions that have already been carried out, documented and selected as best practices by the European Consumer Food Waste experts. In Box 2, the different levels in the intervention logic are shown, displaying how the user selects where and how they plan to save food waste.

Box 2. Decision tree of the Food waste action planner. The user is guided through different choices of places or target groups. An example from the "path": Out of home – Schools – Students – Education and training, is shown.

Level 1:

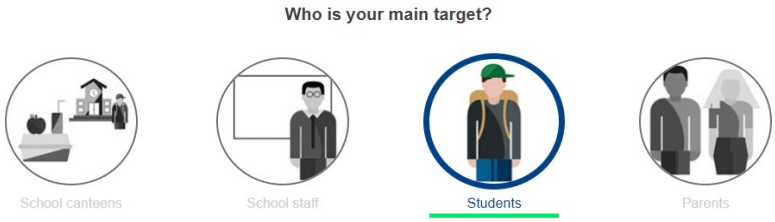
Upon selecting an option, the selection is highlighted with a blue outline and neon green underline, while the other options are put in greyscale in order to further help clarify the "path" the user is taking.

Level 2: Out of home



After the choice at level 2, suggestions already appear to the user, however they are much generalised. Thus, a "Refine search" button is presented to the user in order to continue through the decision tree and narrow their selections.

Level 3: Out of home - Schools



Similar to level 2, after making a selection, the user will be presented with the "Refine search" button to proceed to the final "level" of refinement. The list of results provided to the user will also be condensed to more specific suggestions.

Level 4: Out of home – Schools - Students

After making a selection at level 4 above, the users are presented with what are considered to be the best options to help them reduce food waste in their situation.

Source: Own elaboration

5.5 Results

There are roughly 70 different actions that can be provided to the user through the Food waste action planner. Each action, as seen above in Box 2, provides the name of the action, a very brief description, the country/ies of origin, and a Read more link that will provide the user with a printable PDF that outlines the action in greater detail. In Box 3 are the preview of the results shown appearing on the same online window and in Figure 11 is an example of one of these factsheets.

Box 3. Preview of the results in the Food waste action planner. The example of the "path": Out of home, Schools, Students, Education and training, is shown.

Preview of results: Out of home – Schools – Students

At any point, the user can select a different option in any level and the application will automatically adjust both the results provided, as well as the new options to further refine their results.

Source: Own elaboration.

Figure 11. Example of factsheet, practical examples for reducing food waste in Portugal. Prompts encouraging right portion consumption. This is one of the 70 examples that the Food waste action planner holds in the results.

NOOH6 Prompts encouraging right portion consumption

Intervention design

The Dose Certa Project is directed at catering establishments (canteens, restaurants, hotels, shopping centers, markets, and others) and combines food waste reduction with the adoption of sustainable food. With this project, in partnership with the Portuguese Association of Nutrition, we intend to create an improvement plan, by analyzing and assessing the practices of each establishment, reducing losses and consequently costs. Dose Certa raises awareness among partners and convince them to create more sustainable menus, using seasonal and local products whilst taking the variety, quantity and nutritional value of the food into account. The "Dose Certa" Project is being developed in restaurants and canteens. By accounting and characterizing (edible and nonedible food) the food waste produced it's possible to point out which type of food is wasted and correct the quantities that are served to the client thus reducing the food waste. Combining two paths - analysing food and waste produced and training chefs and workers for a more conscious planning of meals - it has been possible to reduce effectively the amount of food waste. The Dose Certa project methodology is divided in 4 moments: (1) Diagnosis phase (1 week): where food waste is weighted, and the number of meals sold is registered (2) Training in environmental and healthy practices, Sustainable purchasing, cooking and menus; (3) Evaluation phase (1 week): Food waste awareness campaign with a 2nd analysis on food waste production; (4) Certification; (5) Monitoring: an annual check-list of good practices is applied to each restaurant/canteen certificated.

Drivers: Motivating restaurants owners to join and get involved; demonstrate, in addition to the environmental, the economic benefit.
Levers: Free project; capacity to adapt the project to different realities and ambitions.
Effectiveness: Food waste reduction/quarter 326 kg - 53% for restaurants; 624 kg/quarter - 37%; average 38.8%
Efficiency: 1260€/restaurant
Sustainability of the intervention over time: During the time that the restaurant/canteen has de Dose Certa Certification - For the Dose Certa certification it is mandatory an annual check-list of good practices to applied to each restaurant/canteen certificated. If necessary, it is possible to repeat all the methodology.

Transferability and scalability:
Barriers: very difficult to convince Restaurants/Canteens.
Enablers: Be part of a sustainable restaurant network. The interests of the restaurant owner; Show the economic benefits; and the ability to adapt the methodology to the reality found in each restaurant/canteen.
Systemic effects: Opportunity to connect restaurants and canteens to a local food donation network.

COUNTRY
Portugal

IMPLEMENTED BY
LIPOR – Municipal Association for sustainable waste Management of Greater Porto

DURATION
2008-ongoing

Information sourced from:

Swannell, R., Bruns, H., Brüggemann, N., Candeal, T., Casonato, C., Diercxsens, C., Garcia Herrero, L., Gil Roig, J.M., Haglund, Y., Van Herpen, E., Kaptan, G., Kasza, G., Mikkelsen, B.E., Miranda Pires, I.M., Obersteiner, G., Vainioranta, J., Vittuari, M., Watanabe, K. and Sala, S., Evaluation of consumer food waste prevention interventions, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/224541, JRC133003

Source: Adapted from Swannell et al. (2023).

5.6 Files published in Knowledge4Policy

For the Food waste action planner, both versions, the one in TESTPAGE and the published one, use the same quantity of files. The files are named conventionally by describing the four key pieces of information for the respective file, divided by the dash and the dot characters (Table 4 and Table 5):

- a short version of the name of the web application to which the file belongs (e.g. “fwr” for Food waste action planner);
- the version of the web application and so, indirectly, the web page using it (“develop” for TESTPAGE and “production” for the page published);
- the role of the file in the web application and so an indirect hint about the content (e.g. data or code);
- the file extension, like “js” (JavaScript source code) or “json” (data).

Table 4. Files of Food waste action planner.

Filename (development)	Filename (published)	Short description
fwr-develop-app.js	fwr-production-app.js	contains all the JavaScript source code and stylesheets, in a compact version
fwr-develop-strings.js	fwr-production-strings.js	contains all the texts shown to the user, except for questions, answers and suggestions
fwr-develop-db.json	fwr-production-db.json	contains all the data of the decision tree
fwr-develop-res_dectree-set.jpg	fwr-production-res_dectree-set.jpg	some of the images shown with the answers

Source: Own elaboration.

Table 5. Description of selected files of the Food waste prevention calculator.

Filename (development and published)	Description
fwr-develop-app.js fwr-production-app.js	The "-app.js" files are the ones containing the entire application composed by the JavaScript code and the cascading stylesheets, that are then injected into the web page using a "style" HTML entity. These files are generated by an automatised process, programmed in Python language, run by the developers on their development machines. All the JavaScript files, developed specifically for the project or added to it from a third-party supplier, are then put together and minified. The source for the list of files to be concatenated is an HTML file called "index.html" that lies within the Python script and all the rest of the source code in the git repository dedicated to this web application.
fwr-develop-strings.js fwr-production-strings.js	These files, "-strings.js", may have the same content because there may not be relevant differences between the two versions (e.g. production version may be the latest tested version in TESTPAGE). The source of this file is contained in the repository, inside "web/strings/" folder, as a "sample", but in case of changes it is possible to download it from K4P on a local PC, change it with a simple text editor and upload it again. More information about this process is in '5.7 - Update of static texts'.
fwr-develop-db.json fwr-production-db.json	The "-db.json" files contain all the data shown to the user in the decision tree and in the answers. They are the result of the conversion of the spreadsheet created by hand extracting the useful information from the [COMPENDIUM]. The conversion happens thanks to a sub-app that can be activated only in TESTPAGE and that is described later in this document.

Source: Own elaboration.

5.7 Update of static texts

Every text or short phrase shown to the user can be changed without altering the source code of the web application thanks to the file "sample.js" found in the "web/strings/" folder, of which "-strings.js" are just the renamed versions uploaded in K4P. This file contains a JavaScript object structured in multiple levels between the round brackets where each key can be value of a single-line text, a multi-line text, a list, or another object where, respectively, these are enclosed between single (or double) quotation marks, backticks, square brackets or curly brackets. As a general rule, apart from the texts (single- or multi-line), nothing can be changed because brackets, quotation marks, semicolon and commas structure the code syntactically and are interpreted by the browser.

What's inside the quotation marks and backticks is ignored by the interpreter of the code, but there are some rules to remember:

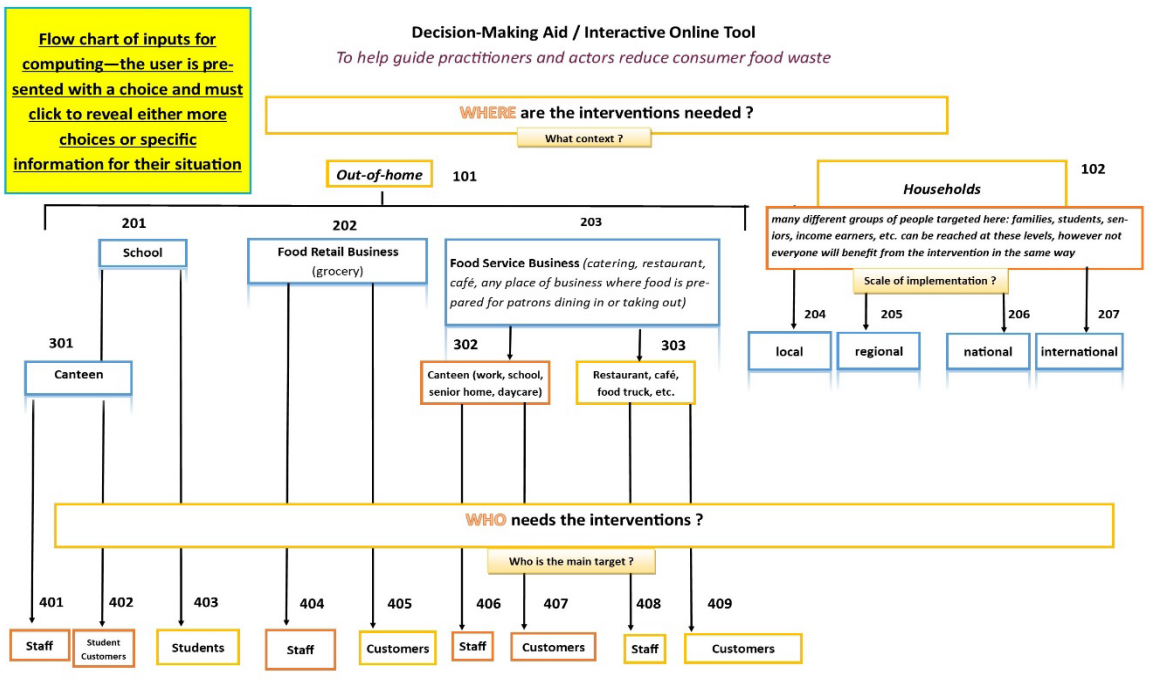
- multiple-line texts can be written only between backticks;
- multiple spaces following each other are ignored by browsers and substituted by just one space (if the intention is to have a space repeated more than once, use the HTML "** **" multiple times to state this intention);
- in case there is the need to use single or double quotation marks or backticks inside a text delimited by the same symbol (e.g. a backtick in a text delimited by backticks) the symbol must be preceded by a backslash (****) otherwise it will mean that the text is terminated in that point and the remaining will generate execution errors;
- texts can contain HTML tags like "<a>" for links to other pages and documents, "" to isolate words for styling, or "<p>" to create multiple lines of separated text.

The structure of the initial object, called root object or root, and of all the contained objects or lists can be changed by a developer following new needs.

5.8 Structure of decision tree

In Figure 12, an early version of the decision tree in the Food waste action planner is presented. This early version was the basis for which the final structure of the tree was created. It is composed of several levels, with each level, aside from the first, or "ROOT" level, containing the "children" of the level above it. These children are represented by both a unique identifier code, used to connect parents to create a "path" and a name which is displayed to the user as a selection. For example, School has the unique identifier of 201. How this was synthesised into data, and an explanation of how to update this data, is described below in the next chapter.

Figure 12. Decision tree structure used to create the Food waste action planner. User interface is shown in Box 1.



Source: Own elaboration.

5.9 Updating the tree structure data

The data that constitutes the decision tree in the Food waste action planner has been extracted from the Candeal et al. (2023) and Swannell et al. (2023) and collected into an Excel spreadsheet composed of four sheets, namely:

1. "**Tree**", contains the overall structure of the tree, ie: the connection between a question and its answers (with the associated next question, and so on up to the suggestions). It may be changed in the following cases:
    a. there is the need to change the structure of the decision tree like changing the connections among questions posed to the user;
    b. there is the need to add new "suggestions" (in columns with the header starting with "leaf").
2. "**Header**", that states the role of the columns in "Tree". It is generally not needed to alter it unless the quantity of possible suggestions (in one or more rows) in "Tree" exceeds ten (the quantity currently supported). In this case add as many rows as necessary naming them "leaf" with new indexes;
3. "**Nodes**", that contains questions, which divide the tree in levels, and the corresponding answers;
4. "**Data**", that contains the best practices/actions (suggestions) provided to the user based on their selections.

An answer is always connected with the question for the next level, and they are stored together in a row of "Nodes", defining a "node" of the decision tree. The most important columns in this sheets are:

1. "**code**", that contains the unique identifier of the node that is used in "Tree"
2. "**label**", that contains the text of the answer shown to the user
3. "**question**", that contains the text of the question shown to the user.

Note that the first row identified by "code" "000" with "label" "ROOT" represents the first node of the tree, called root, and contains the first question posed to the user when the web-application starts. "label" and "question" are precisely the columns that can be changed freely, checking for coherence with the question of the step before and the answers of the following step using "Tree" sheet.

In case there is the need for new questions these must be added into "Nodes", choosing a unique code among them. Then it is necessary to add new images for each of them when representing them to the user in the visual representation of the decision tree. The new images must be added to "dectree-set.jpg", that contains all the images in a grid where each tile is a square of 150 pixels in length. The grid, and so the file, can be enlarged when more and more questions are added. After the file is renamed and uploaded correctly the positions, in pixels, of the new images must be noted into "Nodes" sheet, in two specific columns named "offset_x" and "offset_y". The code of the question and its offsets will be used to generate new cascading stylesheets rules added at runtime to the page.

Suggestions are stored in "Data", one row for each one. The connection with previous questions is stored in "Tree", as for the nodes. In a tree, intended here as a data structure, these final nodes are called "leaves". The structure of this sheet is the following:

- "code", as for "Nodes";
- "label", unused;
- "name", "description", "country" and "link" (to the factsheet in PDF file format) are the information shown to the user;

- “highlighted”, that gives priority to highlighted suggestions showing them before the not highlighted one.

A tree can be represented in different ways and this spreadsheet has been designed considering the needs of the web-application (ease of reading) and the needs of the humans compiling it (ease of changing). In this sheet the alterable columns are:

- “name” and “description”, with a text;
- “country”, with a text where countries should be separated by a comma and a space;
- “link”, that should point to a file in this web folder: http://jeodpp.jrc.ec.europa.eu/ftp/jrc-opendata/ECFWF-Best-Practices/factsheets/. For adding new factsheets, contact the KCB team through email: EC-Bioeconomy-KC@ec.europa.eu
- “highlighted”, with a “Yes” / “No” value.

Once the file is ready it can be converted using the sub-application https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwr_en?convert_data described in Chapter 6, How to update the web-application on Knowledge4Policy platform.

5.10 Structure of files and folders in repository

A quick overview of the most important files and folders in the repository of the Food waste action planner, starting from its root folder is shown in Table 6.

Table 6. Files and folders in the repository of the Food waste action planner.

File / Folder	Description
bin/	contains the python script “minify.py” that generates the necessary for publishing the application in K4P
data/	contains an historical set of data used to test the application
web/	contains source code and configurations of the webapp and its sub-apps
web/conf/	contains the configuration files
web/data/	contains the file providing the data used for local developments
web/k4p/	contains the most up-to-date “look and feel” of K4P, as cascading stylesheets and image files, for local developments
web/index.html	contains the minimum K4P’s HTML code to set up a page in the browser to develop the application
web/app.js	second JavaScript code to be executed that loads the required data from K4P initializing all the necessary data structures
web/main.js	first JavaScript code to be executed that prepares the page to host the application
web/style.css	contains the “look and feel” of the application

Source: Own elaboration.

6 How to update the web-applications on Knowledge4Policy

Below is a practical guide on how to update the Food waste prevention calculator and Food waste action planner, created and maintained by the EC Knowledge Centre for Bioeconomy (KCB). The tools are available at the Knowledge Centre for Bioeconomy website, hosted on the Knowledge4Policy (K4P) platform. The guide is valid for all updates on the K4P for which an EU Login account is required. One also needs to undergo a training thorough the K4P support to become either a Contributor or Editor for a Knowledge Service; in the case of these web applications, the Knowledge Service would be Bioeconomy. If one is already a Contributor/Editor for a Knowledge Service, a request to access to the Bioeconomy Knowledge Service through the K4P Support team can be made.

In simple terms, the process of updating the web-applications on K4P can be broken down into the following steps:

1. Make changes to the web-application code locally and test changes on the local environment;
2. Once deemed that the changes correct and are not generating errors, create the "-app.js", "-strings.js", and "-db.json" files. This process is described below in '6.2 How to create files';
3. The files names will either begin with "fwc-develop" or "fwr-develop" for the TESTPAGE, or "fwc-production" or "fwr-production" for the PUBLISHED page. Ex: To view changes to the strings file on the TESTPAGE of the Food waste prevention calculator, you would generate "fwc-develop-strings.js";
4. Upload and overwrite the "fwc-develop" or "fwr-develop" files into K4P – described in '6.3 Uploading files in K4P' - and check the TESTPAGE that the changes made have been applied correctly;
5. if changes are not seen or there are issues with the code, repeat steps 1 and 2 and re-upload the relevant -develop files until the changes are displayed.

Once the changes are confirmed to be working correctly on K4P through the TESTPAGE, upload and overwrite the "fwc-production" or "fwr-production" files in K4P and check the PUBLISHED page that the same changes have appeared.

6.1 How to create files

The three main files used (app.js, db.json, and strings.js) for the web-applications are each created in different ways.

The "-strings.js" file is the simplest, where, after making changes and saving them, one can create a copy of the file and rename it fwc-develop-strings.js or fwr-develop-strings.js to use on TESTPAGE. After this, create another copy named with the word 'production' in place of 'develop' to use on PUBLISHED, once the changes are deemed correct from TESTPAGE.

The "-app.js" file, since it is a file containing the minified code of several different files concatenated together, is generated by a Python script called 'minify.py', which is found in the bin/ folder of the repositories of the two web applications. Generation of this file is necessary whenever there is a change made to the CSS, JavaScript, or HTML of the application. Executing the minify.py function requires the developer to run a command inside of a command prompt or terminal.

This command is composed of four parts:

- calling the function to run, with the working directory of the prompt or shell in bin/: ./minify.py

- the type of environment, called with '-e', with either "develop" or "production" added depending on which file is needed to be generated. Thus, it would be –e develop or –e production
- the location of the input files, which will always be in the web/ folder. In this case a relative path is necessary: ../web/
- the location of the output file. This can vary by developer, and can be a folder of their choice, or as a freely existing file. For example, if a developer wants to create this file into the current working directory it should be ./output.js

Thus, the complete command would be **./minify.py -e develop ../web/ ./output.js** in the terminal, and this would generate a –develop-app.js file inside the "output.js" folder. To create the production file, the developer would simply run this command again, but with the word production in place of develop.

The db.json file is a file generated by converting the excel file containing all the data required for the web-application to function into a json file, using the data converter sub-application. This process is detailed in '6.4 Data converter'

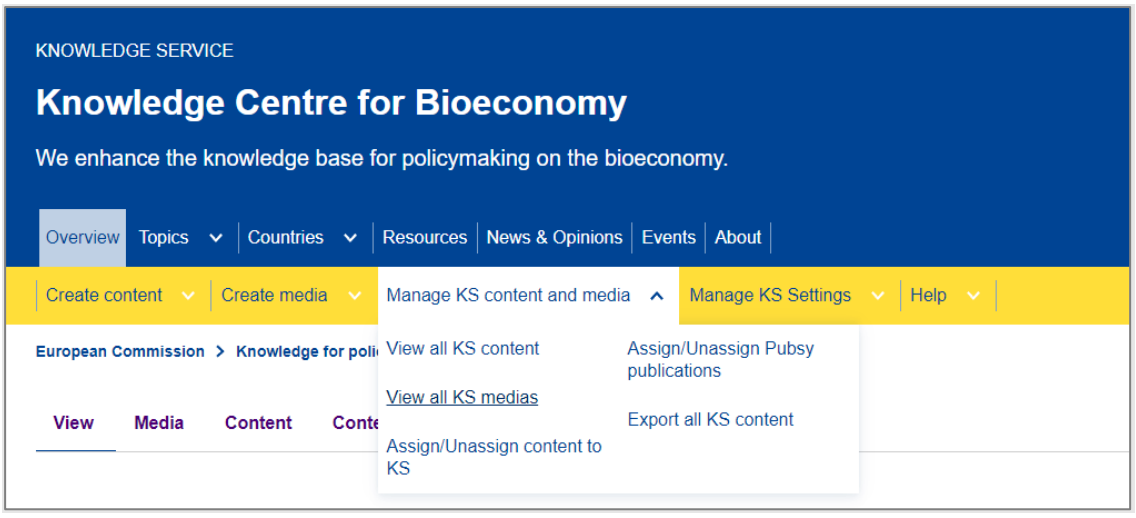
Generally speaking, it is not required to update all files when making changes to the web-application, just to the file(s) that have changes; i.e., if one makes a change to only the strings.js file, it is not necessary to generate and upload the app.js and db.json files.

6.2 Uploading files

Since the K4P platform is a robust Content Management System (CMS), it supports the use and interaction of a variety of media and file types to augment created content. Provided in this section is both a general overview of file management on K4P, and in specific relation to the two web-applications

When a developer has the proper K4P permissions to edit files for their specific Knowledge Service, they will see a yellow media bar below the main menu of the Knowledge Service (Figure 13). In that yellow bar, under the 'Manage KS content and media' menu item, is an option to 'View all KS medias', and it is here that a developer would go to find the relevant files to edit. The same content can also be found under 'View all KS content', but this Knowledge Service media is a more filtered selection allowing greater ease in navigating files.

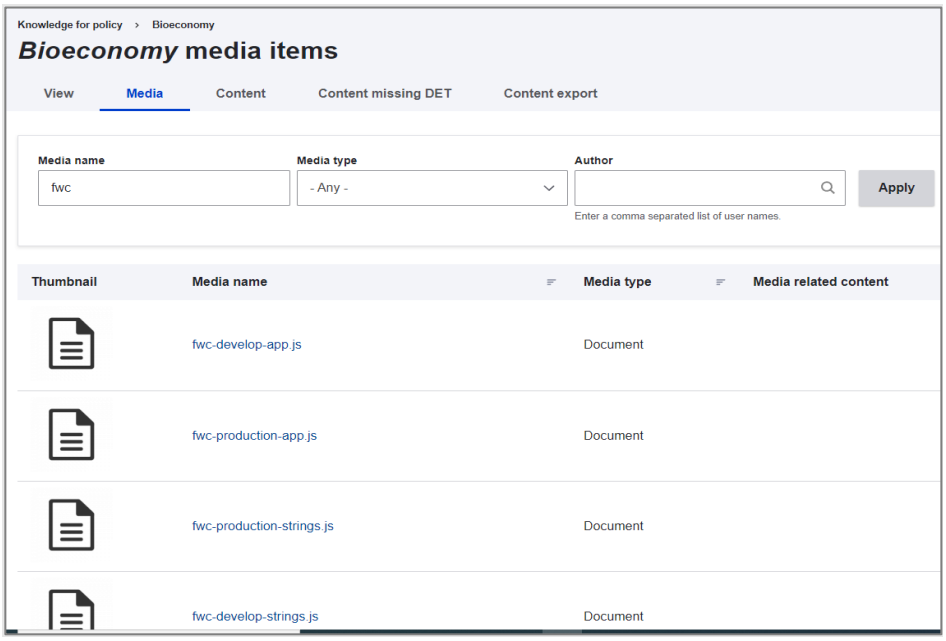
Figure 13. Location of the menu item on the Knowledge Centre for Bioeconomy homepage.



Source: Screenshot from the KCB homepage when logged into K4P.

Once on this file manager page of the K4P, a developer will be able to see all files on this Knowledge Service. To simplify things, it is recommended to search for the term 'fwc' or 'fwr' in the search bar, since all files pertaining to the Food waste prevention calculator and the Food waste action planner web-application begin with fwc or fwr, respectively (Figure 14). This will provide the developer with the necessary results to make changes.

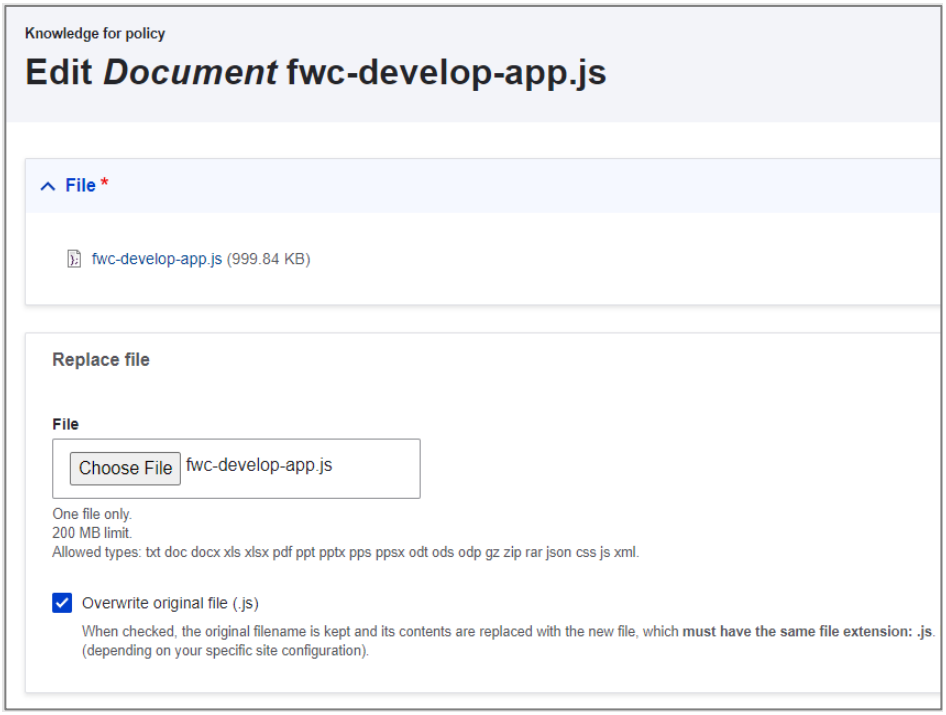
Figure 14. Bioeconomy media item. Examples of some of the Food waste prevention calculator web-application files after searching with the term fwc.



Source: Screenshot from K4P content manager.

Once the files are retrieved, the developer will click on the file they would like to change, and they will be presented with a new page that allows them to upload a file (Figure 15). To update the file, the developer is simply overwriting the existing file with a new one. To do this, the file uploaded MUST have the same file type, or it will create a separate file and will not link to the web-application properly. It is also generally best practice to use the same file name as well.

Figure 15. Content editor, example one. Example of changing the app.js file on the TESTPAGE by overwriting it with another file with the exact same file type and name



Source: Screenshot from the K4P content editor.

Once the developer has chosen the filename with the EXACT file type as the file they are looking to overwrite, they can scroll to the bottom of the page and click on the Save button. The process for updating all other files for the TESTPAGE and PUBLISHED page is the same.

Due to cookies and caching issues with K4P, it can sometimes take several minutes to an hour for changes to appear on either TESTPAGE or PUBLISHED, when updating the app.js file. To circumvent this, a version control has been added to the pages, and it is strongly recommended that this is updated AFTER making a change to the app.js file. To do this, hover over the yellow media bar, navigate to Manage KS content and media > View all KS content, and search for the title of the page you updated – either 'TESTPAGE 4 FWC' for the TESTPAGE, or 'Food waste prevention calculator' for the PUBLISHED page. In the case of the Food waste action planner, the titles would be 'TESTPAGE 4 FWR' and 'Food waste action planner' for the TESTPAGE and published page, respectively. Once there, a text box will be present with some code in it, with the url: https://knowledge4policy.ec.europa.eu/sites/default/files/fwc-develop-app.js?release=Xth, where the X is a number that would be increased by 1 (Figure 16). Note that the part of the url before the '?release' will differ depending which app.js file is being edited. After this, save the page as either Draft, if updating TESTPAGE, or PUBLISHED, if updating the PUBLISHED page. The changes made by the developer should then appear immediately. This procedure is not necessary when updating strings.js or db.json files, **only** app.js.

Figure 16. Content editor, example two. Example of the Food waste prevention calculator TESTPAGE with version control URL. In this case, after updating the file: app.js, the number at the end would increase to 93th.

Source: Screenshot from K4P content editor.

6.3 Data converter

As previously mentioned in section 4.10 Sub-applications, the use of the Data converter sub-application is necessary for both the Food waste prevention calculator and Food waste action planner in order to feed the web-application with the data for the food calculations (for the Food waste prevention calculator) or the description of the decision tree (for the Food waste action planner) (Figure 17).

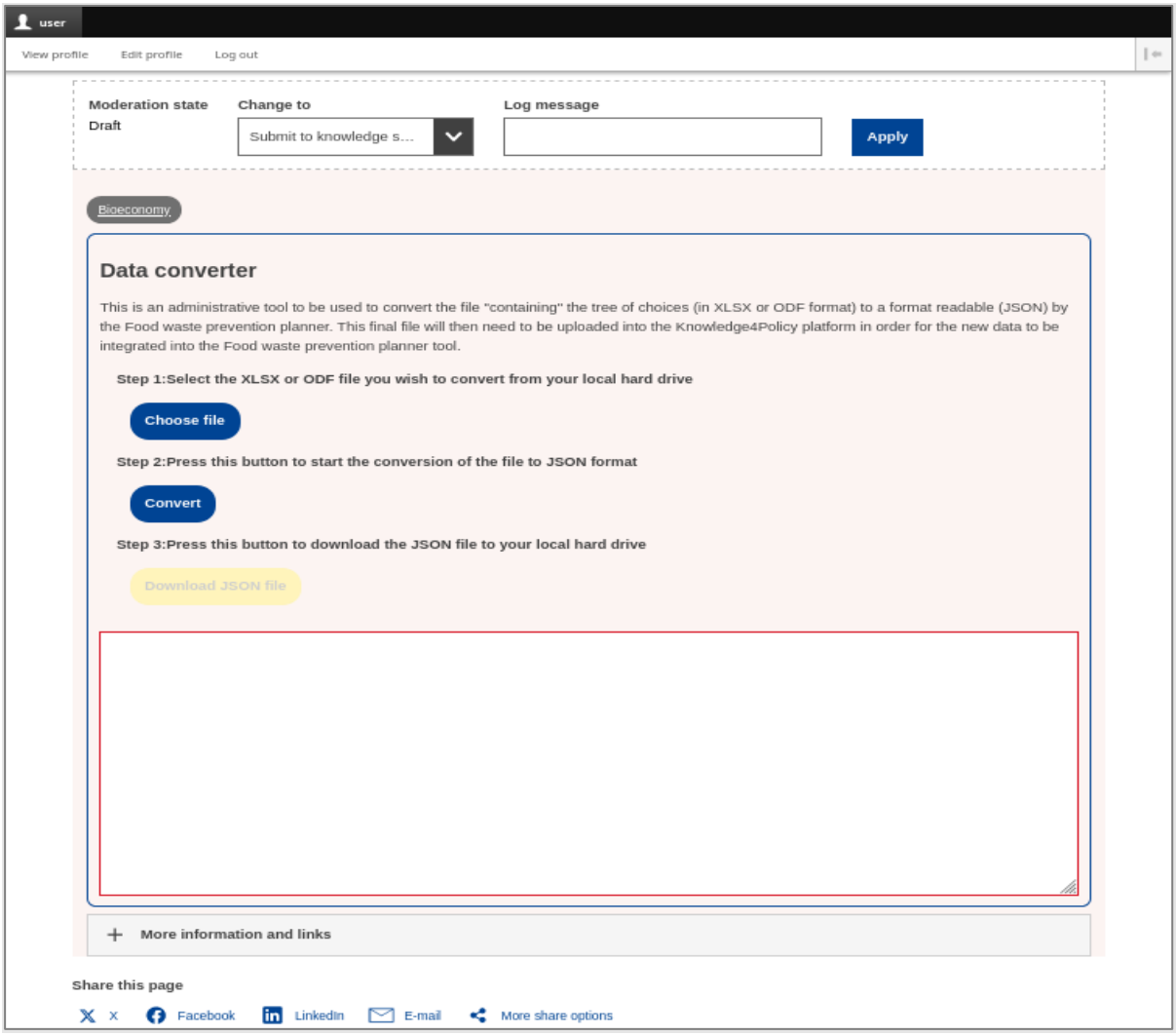
The output of this process is a file that can be uploaded into K4P as one of the "-db.json" files, depending on the web application for which is asked the conversion and of the K4P page in which the file will be used. The output is the conversion of an Excel file into a json, both of which have been described in the previous sections. Any change to the Excel files requires this process to be executed and then the output json file to be published.

As stated earlier, this sub-application can only be used in the TESTPAGE of the two web applications, adding "?convert_data" to the end of their URLs:

- Food waste prevention calculator: https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwc_en?convert_data
- Food waste action planner: https://knowledge4policy.ec.europa.eu/visualisation/testpage-4-fwr_en?convert_data

Once there, the main interface of the application is replaced with that of the Data converter. Its usage is quite simple and the overall conversion process consists of just three steps explicated in the interface by numbers.

Figure 17. Data converter interface. It is displayed in place of standard web-application interface on TESTPAGE.



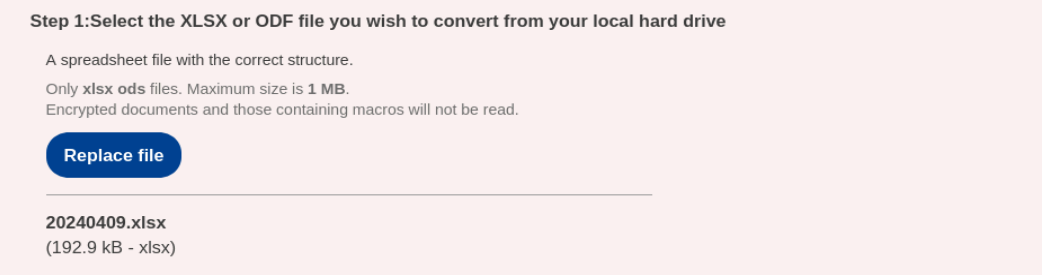
Source: Screenshot from the Data converter sub-application of the Food waste prevention calculator.

Conversion steps

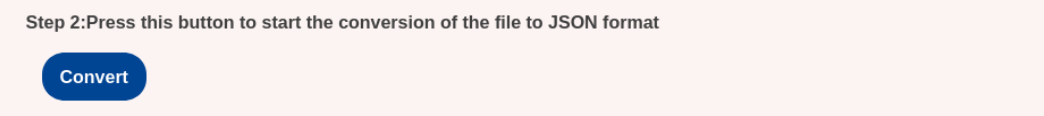
Converting the Excel file into json format requires only three simple steps, and is the same process for both web-applications (Box 4).

Box 4. Data converter steps. There are three steps for converting the excel file into json format on the K4P platform.

Step 1 requires the user to select a spreadsheet file containing data from the local hard drive. After selecting a file, the file name is shown, and the button changes from 'Choose file' to 'Replace file', in case the user made a mistake with their original selection.

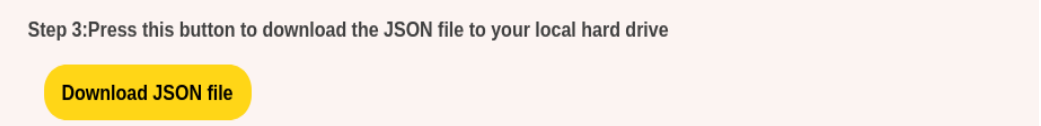


Step 2 is simply clicking the 'Convert' button after choosing the correct file in Step 1.



In step 3, after clicking the Convert button, the yellow 'Download JSON file' that was previously unclickable will now be activated, allowing the user to download the required file. When naming the file, the user will have to provide a name like the ones explicited in the tables shown in previous chapters:

- "fwc-develop-db.json" or "fwc-production-db.json" for FWPC;
- "fwr-develop-db.json" or "fwr-production-db.json" for FWAP.



Source: Own elaboration.

7 Conclusions

In conclusion, the two tools developed by the Knowledge Centre for Bioeconomy: Food waste prevention calculator and Food waste action planner have shown to be both valuable and appreciated tools for reducing consumer food waste by promoting best practices, providing insights into the environmental, nutritional and cost benefits of various food waste prevention actions.

The added value of the tools was especially shown at the public event *"Let's reduce consumer food waste! Solutions from the European Consumer Food Waste Forum"* the 5th of June 2024. Here participants acknowledged the practicability, user-friendliness and showed an interest for knowing more about the tools. In particular, participants were interested in the scientific data on which the calculations that the Food waste prevention calculator was based on. Participants recognised its value when planning new food waste prevention actions as the environmental impacts and cost, as well as nutritional value of saved food was shown. In the case of the calculator, moving the tool from an Excel to a web tool was particularly appreciated by actors in order to facilitate the use and understanding of the results. Several practitioners also showed an interest to contribute with concrete examples, asking if they could contribute with further examples to be included in the Food waste action planner, currently holding 70 examples of actions.

Since the launch of the toolkit at the June 5th event, there has been over 2 000 unique page views of the Toolkit, further indicating that there is a strong interest across the EU in looking for guidance on ways to reduce food waste on a variety of levels.

The European Consumer Food Waste Forum project has finished and thus there is a potential for other networks and policy files on food waste to further promote and use the developed tools, along with the other extensive materials, such as video tutorials and leaflets in all EU languages, developed within the Forum to reduce food waste. JRC will provide support in maintaining both tools and the Toolkit for reducing food waste along with promoting the tools when possible. For the Food waste prevention calculator, it is planned to update the underlying data on which the environmental, economic, and nutritional values are based on a biannual basis, when updated datasets are made available.

8 Future recommendations

There is an untapped potential for the use of the two tools as they reach out to a wide audience in the EU Member States, from someone in charge of the school canteen to national and regional programs. Both the Food waste prevention calculator and the food waste action planner as well as the material of the Toolkit for reducing food waste would benefit for further promotion to inform practitioners about these resources. A major promotion was done before and after the event on 5th July. However, these are tools that are fit for purpose for a wide audience, with a robust science behind them and examples from many members. For example, further promotion could be done by:

- Showcasing the tools at various meetings related to the policy file of food waste.
- To post on social media, clear examples of how the tools work targeting different practitioners.
- To make sure the Toolkit for reducing food waste are included on the major EC web resources of Food waste.

Both the tools are built on technical solid stable applications in line with the Knowledge4Policy requirements and have proven to be user friendly and well appreciated by food waste experts. There is potential for further use and promotion of the tools that can contribute to the reduction of food waste in Europe and reach the target of the Farm to fork strategy.

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