



Valorisation of food surpluses and side-flows and citizens' understanding

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List of abbreviations

CJ	Citizens' juries
DCE	Discrete choice experiment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
IFAD	International Fund for Agricultural Development
UNICEF	United Nations International Children's Emergency Fund
WFP	World Food Programme
WHO	World Health Organization
WP	Work Package

1 Executive Summary

Food security is the global challenge of the 21st century; the world population is expected to reach 9 billion by 2050 (United Nations, 2017) requiring an increase in global food production by 70% from the average of 2005/7 (FAO, 2009). Ensuring food security requires sustainable use of natural resources and reducing food waste and losses. Food waste occurs at each stage of the food supply chain (Gustavsson et al., 2011). Many food products discarded by farmers, food-processing industries, or distributors are products that are aesthetically imperfect, surplus produce, by-products, etc. Many of these are still edible products which may be recovered and recycled into the food system as edible foods, ingredients or animal feed. In general, they consist of products with no commercial value but they are very rich in nutrients with a great potential for reuse in the food chain. Therefore, the valorisation of food surpluses and side-flows is also a very attractive opportunity for the processing industries. The challenge consists in valorising food surpluses or side-flows by converting them into products with commercial value, either as new foods, as supplies for secondary processes, as ingredients, or as animal feeds.

This report is part of an EU Horizon 2020 funded project "Resource Efficient Food and dRink for the Entire Supply cHain" (REFRESH) taking action against food waste. 26 partners from 12 European countries and China work towards the project's goal to contribute towards the objectives of reducing food waste across Europe by 30% by 2025, reducing waste management costs, and maximizing the value from unavoidable food waste and packaging materials. This work identifies the relevant factors that encourage the acceptance or rejection of valorisation methods of food surpluses and side-flows. In particular, it considers four valorisation processes: (i) gleaning vegetables and converting them into foods such as soups or creams; (ii) extracting ingredients (vitamins) from product surpluses and using them for food enrichment; (iii) converting food-processing by-products to feed and feed supplements for animals intended for human consumption; and (iv) converting catering food surpluses to liquid feeds for pigs intended for human consumption (currently banned in the EU).

Furthermore, it informs public food policy related to citizens' acceptance of valorised foods from food surpluses or side-flows, and it provides important information for processing industries, current food valorisation initiatives and decision makers who make catering service choices for schools or public purchase in general. It also assesses the potential of food valorisation in preventing and reducing food waste (or increasing food security) and therefore in the promotion of the environmental sustainability.

A social experiment was carried out in collaboration with the Regional Council of Vallès Oriental (Barcelona) in the context of parents' choices of their children's school meals. A group of parents were tested to determine whether they would be open the Council favoring catering companies that integrate valorised foods from food surpluses or side-flows when hiring school caterings services. In particular, parents heard evidence from experts about the four different food valorisation methods, discussed them and decided the valorised foods to be

considered for school caterings' menus. They chose between hypothetical menus which included conventional foods, and the following different valorised foods:

- i) a pumpkin cream made with gleaning pumpkins from leftover production;
- ii) a pork steak from a pig fed with food-industry by-products;
- iii) a pork steak from a pig fed with liquid feed (ecofeed) from caterings food surpluses (currently banned in the EU);
- iv) a yogurt fortified with vitamin C extracted from food surpluses and side-flows.

We find that the acceptance or rejection of valorised products by consumers depends on a number of relevant factors. These factors include familiarity, knowledge, perceived risks, perceived benefits, experiences on food processes, involvement, trust between consumers and producers, information, naturalness, local origin, levels of processing, trust in food regulatory institutions, sustainability, safety, complexity, moral considerations, traceability, and transparency.

Results show that although gleaning-based valorised products were deemed acceptable to be used within the setting of school lunches, the other valorisation methods were not, however, the participants did not view them as unsuitable for adult consumption. In contrast to their stated perception of valorised products as safe for health, presented with the option of giving these products to their children it evoked a negative response, 'just in case'.... To increase the confidence in the safe use of valorised food products, it can therefore be recommended to first focus on adult consumption on the short term.

We find that informational strategies are needed to increase the acceptance of valorised products by consumers. The provision of information has a larger likelihood for success, if it is continued until these kinds of food become familiar to the public. The outcomes of the experiments suggest that the acceptance of the studied valorisation methods is complex and needs time because it requires removing any existing negative perceptions towards such methods.

The findings suggest that a focus on framing the message in a positive way, pointing out the potential benefits for the consumer (such as taste, naturalness, local origin, environmental friendliness, animal welfare, social inclusion, etc.), creates more positive motivations towards acceptance.

The findings of this study are based on a very specific sample. Therefore, we recommend further research to investigate these preliminary results in the context of other settings and EU Member States.

2 Introduction

While around 815 million people suffer from food insecurity (FAO, IFAD, UNICEF, WFP and WHO, 2017), one third (1,300 million tons per year) of the food produced in the world for human consumption is lost or wasted (FAO, 2011). In the EU, about 88 million tons of food are wasted per year (20% of all food produced), which is equivalent to economic losses amounting to around 143,000 million euros (Stenmarck et al., 2016). In addition to the economic losses (losing the food itself, and the cost of waste treatment), large losses are generated in natural resources (stress on the use of water, land, energy, labour and capital), social repercussions (price increases), and greenhouse gas emissions. It is estimated that the food system is responsible for 19-29% of the total greenhouse gases emitted in the world (Vermeulen et al., 2012).

In addition to the need to adapt a sustainable production system and eating practices (Dagevos and Voordouw, 2013), the use of food surpluses or side-flows from the original food supply chain as a newly valorised food product or ingredient may be part of the solution; however it is subject to consumers' acceptance of the valorised foods. Convincing consumers to accept these food products is not an easy task because this food category is not well known. In this context, Frewer and Gremmen (2007) suggested that consumers are not familiar with valorised foods and they may perceive them as unhealthy. Indeed, consumers are increasingly interested in sustainability, but also in food safety and quality, especially after the Bovine Spongiform Encephalopathy crisis in the early 2000's (Frewer and Gremmen, 2007).

This research investigated the consumer understanding and acceptance of different valorisation methods for food surplus and side-flows. Of particular interest was the extent to which consumers accept and even appreciate products resulting from innovative waste valorisation processes. Understanding consumers' positions with respect to the use of food surpluses or side-flows as newly valorised food product or ingredient is also key for the food industry to respond to its increasing ambitions related to sustainability. The valorisation of food surpluses or side-flows needs to be accepted by consumers before authorities adopt it as a solution to the problem of food waste.

Recent studies investigated consumers' preferences for foods that present physical imperfections related to appearance, date labelling, or damaged packaging (de Hooge et al., 2017; Loebnitz et al., 2015). A few studies (Bhatt et al., 2017; Henchion et al., 2016; Sasaki et al., 2011; Lease et al., 2014) have examined consumers' acceptance or preferences for new valorised products from food surpluses and side-flows. Bhatt et al. (2017) examined the role of three different product cues (descriptions, labels, and benefits) on consumers' acceptance of value-added surplus products. They found that consumers perceive value-added surplus products, when labelled appropriately, as different from conventional foods, and similar to organic foods. Henchion et al. (2016) investigated consumer acceptance of food products containing ingredients derived from beef by-products. They found that consumer acceptance depends on the ingredients' physical state and naturalness. In particular, they found that the level of acceptance increases with factors like perceived naturalness, alignment

between ingredients and existing culinary practices, knowledge of potential benefits and sensory properties, knowledge of the nature or origin of the ingredient, and trust in product safety oversight. Sasaki et al. (2011) assessed Japanese preferences for pigs fed with eco feeds, and found that most of them did not have specific preferences for this kind of meat due to their little knowledge of pig farming. Lease et al. (2014) checked whether consumers would accept meat products produced with recycled water, and found that consumers were willing to accept foods containing recycled water when that water was produced within a food factory according to drinking water standards and supported by credible and trustworthy information. Menegaki et al. (2009) compared consumers' acceptance for products irrigated with recycled water when this water is described as "recycled water" or "treated wastewater". They found that consumers' acceptance was higher with the "recycled water" label. This work elicits and compares citizens' preferences for different new valorised food products or ingredients created from food that otherwise would have gone to waste. In our review, we did not find any study that analyses and compares citizens' acceptance for four different food-reprocessing methods at the same time.

For these reasons, an experiment was conducted in collaboration with the Regional Council of Vallès Oriental (Barcelona) to assess citizens or consumers' attitudes and preferences towards valorised food products from food surpluses and side-flows. This work identifies the relevant factors that influence the acceptance or rejection by consumers. The experiment combined a citizens' jury (participatory method) and a DCE (stated-preference method) and was applied in the context of parents' choices about school menus. The case of school canteens was chosen because of risk aversion of the parents, so that a food accepted within this context is likely to be accepted in other context where risk aversion is lower. Govindasamy et al. (1998) suggested that parents with kids are more likely to be risk averse than those without kids. A group of citizens listened to expert talks about production processes of different valorised foods from food surpluses and side-flows and chose the menus suitable for school catering services. The school menus consist of a three-course meal (a starter, a main meal, and a dessert) as is usual in Spain. In addition to conventional foods, different valorised foods elaborated via four distinct food valorisation methods were included in the menus:

- i) a pumpkin cream made with gleaning pumpkins from leftover production;
- ii) a pork steak from a pig fed with food-industry by-products;
- iii) a pork steak from a pig fed with liquid feed (ecofeed) from caterings food surpluses (currently banned in the EU);
- iv) a yogurt fortified with vitamin C extracted from food surpluses and side-flows.

3 Methodology

3.1 Introduction

This work combined a citizens' jury (participatory and qualitative technique) and a DCE (quantitative technique) approach. Citizens' juries (CJ) are a deliberative and democratic method that involves citizens in public decision-making. CJ consist of gathering a group of citizens who are representative of the community to debate and deliberate upon a public issue (Stewart et al., 1994). The method assumes that if diverse and common citizens without any previous knowledge on the issue in question have access to detailed information and a sufficient time, they are able to discuss, share their opinions, learn and provide relevant recommendations to inform public decision-makers (Coote and Lenaghan, 1997). In addition to the information they receive from experts, jurors can ask questions to the experts to clarify their doubts. Citizens' juries were developed in the mid-1970s in the United States (US) and now they are often used by the US's Jefferson Center, the UK's Institute for Public Policy Research (IPPR), and elsewhere. CJ are often used to address questions of health policy (Menon and Stafinski, 2008, Moretto et al., 2014; Scuffham et al., 2014; Street et al., 2017). However, their use to address environmental (Aldred and Jacobs 2000, Garnett et al., 2017, Kenyon et al., 2001) and food policy (Henderson et al., 2013; Withall et al., 2016) questions is still very limited. The present citizens' jury is the first one to examine citizens' acceptability for different valorised foods from food surpluses and side-flows to inform public health and environment policy.

DCE is a quantitative stated-preference method used to assess individual preferences for market and non-market goods. The theoretical basis of this approach combines the theory of value (Lancaster 1966) and the theory of random utility (Thurstone, 1927, Manski, 1977). This approach consists of presenting individuals with a series of hypothetical goods defined by a common set of attributes with different levels, and asking them to choose the most preferred alternative in each set. Under the assumptions of economic rationality and utility maximization, an individual chooses the alternative that gives him/her the maximum satisfaction. Individuals compare the levels of the attributes among the different alternatives and then choose the option that is most satisfactory. In this way, individuals reveal the relative importance of attributes and their willingness to renounce or accept a quantity of one attribute for another. The satisfaction provided by an alternative will depend on the satisfaction generated by each of the attributes and levels that define it (Lancaster, 1966). It is a common practice to include the cost or the price among the attributes used to define the alternatives in order to convert participants' valuations for the attributes and alternatives into their willingness to pay for them (Bennett and Blamey, 2001). DCEs are widely used to elicit consumers preferences for environmental (Adamowicz, 2004), health (de Bekker-Grob et al., 2013; Dannenberg, 2009) and food (Ghvanidze et al., 2017; De Marchi et al., 2016) goods.

Álvarez-Farizo and Hanley (2006) referred to such a combination of CJ and DCE as a "valuation workshop." Combining both techniques in this study addresses the

DCE's problems (see Álvarez-Farizo et al., 2009) related to the understanding of the information provided (Fishkin, 2003; Luskin et al., 2002), task complexity (Swait and Adamowicz, 1996; Mazzotta and Opaluch, 1995), and the context of collective versus personal perspectives (Sagoff, 1988). In particular, participants will make informed decisions after learning from experts and discussions. This approach allows observing how the learning process affects the formation or the change of consumers' preferences. The present approach will explore individual and group preferences for different menu options. There are very few studies that combined both approaches (Álvarez-Farizo and Hanley, 2006; Álvarez-Farizo, et al., 2009; Scuffham et al., 2014). Álvarez-Farizo and Hanley (2006) carried out the first integration of DCE and CJ to estimate the values people place on water quality improvements. They revealed a significant shift in preferences and values (implicit prices) when measured by a conventional survey or a valuation workshop and when assessed individually or collectively. Álvarez-Farizo, et al. (2009) opted for this participatory approach to assess the social and environmental impacts derived from the implementation of restoration strategies resulting from spills. They confirmed that debate and deliberation change participants' opinions and shift them to collective values. Due to parents' sensitivity to the diet quality of their children and the lack of knowledge of the participants in the study about the issues in question, it was decided that it was necessary to provide them with enough information. For these reasons, we used this combination of techniques starting with CJ followed by DCE.

3.2 Citizens' jury

The present citizens' jury was carried out in two sessions with a ten-day interval (see annex). The **first session** was held on May 3, 2018 and lasted three hours (4:30pm to 7:30pm). This session started with expert talks to provide information to juries about the issues in question. Jurors listened to four experts in the field of food valorisation and asked them questions to clarify their doubts. Then, an individual deliberation was carried out privately, followed by a short debate and ending with a collective deliberation. At the end of this first session, jurors were asked to discuss the issues in questions with their family and friends to prepare for the next session. The **second session** was held ten days later (on May 14, 2018) and lasted two hours (5:00pm to 7:00pm). This session opened with a reminder about the first session and a short presentation of some results of the latter. Afterwards, an individual deliberation was carried out, followed by a workshop and finally a collective deliberation. Although citizens' juries may be carried out over several days (Álvarez-Farizo and Hanley, 2006; Aldred and Jacobs, 2000), there are many made in a single day (Henderson et al., 2013; Mitton et al., 2009). We decided to meet the jurors on two occasions because it was difficult for parents to commit to more days.

The approach provided information to the jurors about each of the considered valorisation processes, so that they had extensive knowledge about the valorised products before deliberating. In this citizens' jury, the deliberation consisted of answering the DCE. To be able to verify the effect of the learning on the jurors' decisions, the jurors completed the same DCE in the first and the second session.

3.2.1 Recruitment

A total of 24 citizens or consumers were recruited for the experiment through the platform "Aprofitem Els Aliments"¹. This platform was only used as a mean to recruit, but recruited citizens or consumers were not part of it. The recruited citizens or consumers were parents of schoolchildren who eat at school canteens. Childrens' food choice decisions are generally made by their parents, thus parents seemed to be the most suitable to give their opinions about the food that their children should eat at school canteens. We chose to carry out the experiment with school lunch menus to see the reaction of parents to the idea that their children eat recycled foods. Our participants are consumers or, buyers adopting the decisions about what their children are going to eat at primary schools, but also, they participate as citizens as their decisions have policy implications. In Spain, the food eaten at primary schools is supplied by companies that have won a public closed auction. Normally, one company wins for a specific town or a county. The decision makers decide the conditions of the future contract. Parents participated providing information as citizens to policy makers.

Several associations of parents were approached to recruit 24 different profiles of parents of school children for the experiment. Recruitment was conducted to get a sample of different and diverse jurors' profiles. In particular, the platform "Aprofitem Els Aliments" selected jurors with different profiles through different associations of students' mothers and fathers. Previous citizens' juries used different recruitment strategies (Street et al., 2014). Our strategy aimed to incorporate diverse voices (Bennett and Smith, 2007; Gooberman-Hill et al., 2008). In particular, we focused on obtaining profiles with different educational levels and belonging to households with different monthly income. The platform "Aprofitem Els Aliments" asked different associations of students' mothers and fathers to randomly select citizens or consumers with different incomes and studies from their databases. The number of jurors used can be very different from one place to another. In the UK, the IPPR uses between 12-16 members, while in the US, the Jefferson Center uses between 18-24 members. To be able to estimate the main effects of a DCE it is required to have at least 20 respondents (Lanscar and Louviere, 2008). At the end of the experiment, participants received €60 from the recruitment platform as an economic compensation for participating in the present research. The recruitment operation was not easy due to several factors. At the beginning an amount of €40 was proposed as compensation for participation in both sessions but very few people signed up and we were forced to increase the amount to €60. The fact that it was a two-session experiment carried out on two different days complicated the process quite a bit. We also offered to take care of the jurors' children during the experiment.

Most (21) jurors were women. This is due to the fact that women are more involved in associations of students' mothers and fathers than men. Nord et al. (1997) found that fathers' involvement in their children's schools is substantially less likely than mothers. Tippett and Cleveland (2001) showed that women

¹ "Aprofitem Els Aliments" is an association formed by people and entities related to the prevention of food waste. They bring together all the agents involved in the food chain (producers, companies, entities, consumers) to find common solutions to food waste. http://aprofitemelsaliments.org/#pll_switcher

remain primarily responsible for feeding children. Jurors were aged between 30 to 52 years with an average age of 41 years. Slightly more than half (13) were aged between 40 to 52 years. The levels of education of the jurors were quite diverse, including primary studies or bachelor's degree (3), professional training (3), higher post-secondary education (7), and university studies (11). Regarding the monthly income of households, only 19 jurors answered this question. The average number of people per household was four persons (ranged from two to six persons). Monthly incomes of households were quite different. The jury included almost half (10) with low incomes (less than €1,500); one fifth (5) with medium incomes (€1,500 to €2,500) and the rest (4) with high incomes (€2,500 to €4,000). The recruitment was a success because we got participants with different incomes and educational level. The school canteen prices that jurors paid monthly ranged from €40 to €180 with an average of €122. Most jurors (91.7%) reported that they were responsible for food purchase in their households, while the rest (8.3%) made food purchases occasionally.

Experts in the field of valorisation of food surpluses and side-flows were selected from the Refresh network. They are professionals from companies specialized in food valorisation, invited to explain each of the processes of food valorisation considered in this work to the jurors. An expert was recruited for each valorisation option and each one gave a fifteen minute talk including questions and answers. Experts explained the whole food production chain starting from the origin of the products, collection, transport, treatment, elaboration, and distribution. They also explained how they fit to regulations and the compliance with food safety and quality requirements.

Four facilitators with experience moderated the debate. The role of the facilitators was to maintain the discussion focused on the issues in question, but without influencing jurors' opinions. The facilitators ensured that all jurors gave their point of view avoiding the domination of the debate by one juror.

3.2.2 Dynamic of the present citizens' jury

As we mentioned above, the experiment was carried out in two sessions (see the details in the annex). We carried out the experiment in one public building, and the politicians were informed about the objectives of the experiment and were asked for permission. They came at the second session.

First session

Upon arrival, jurors were gathered in a room reserved by the Regional Council of Vallès Oriental (Barcelona). A moderator from the Creda research team welcomed the jurors and introduced the event. The same moderator oversaw the entire session. The Council of Vallès Oriental offered technical support to the event. Before starting, jurors signed a consent form to participate in the present citizens' jury. Another researcher from Creda started the session by presenting briefly some figures on food waste. The first step lasted an hour and a half; where the jurors heard evidence from experts about four different food valorisation methods:

- **i) Gleaning:** An expert from a non-profit organization that fights against food waste started the informative step explaining how products are recovered in the field and turned into creams.
- **ii) Recycling ingredients:** An expert from a company dedicated to the manufacture of fruit derivatives explained to jurors how they extract ingredients (vitamin C or fibers) from fruit surplus production to use them for enrichment of yogurt.
- **iii) By-product feeds:** An expert from a company dedicated to the recycling and recovery of food-processing by-products for the production of animal feeds explained the process to convert food-processing by-products (bread, pastries and chocolates) to animal feeds.
- **iv) Ecofeeds:** An expert from a campaign group that fights against food waste described how to convert hospitality (catering) food surpluses to liquid animal feeds called ecofeeds (Japanese model currently banned in the EU).

After jurors heard evidence about each issue, a question and answer session was opened between the jurors and the corresponding expert. It was observed that jurors were very involved through their multiple questions to each of the experts. Presented below are the jurors' questions by topic:

i) Gleaning

- Do new products meet quality standards?
- Does this method generate waste?
- Do you think about expanding the initiative elsewhere?
- Where do you sell the new products?
- Do farmers receive something in return?
- Are new products organic?
- Do new products lose organoleptic properties?

ii) Recycling ingredients

- Does this process need many resources (energy and water)?
- What are its environmental impacts?
- Do you have stocks?
- Do you process all the fruit you received or store a part?
- If the new products are not sold afterwards, is it a problem?
- Who buys your products?
- Do you use recyclable packaging?

iii) By-product feeds

- Do you use chocolate to feed animals?
- Who buys your products?
- Are your feeds also for dogs and cats?
- Do farmers receive something in return?

iv) Ecofeeds

- Does the use of these feeds imply that antibiotics are not necessary?
- Do these feeds improve the pigs' defense?
- Are ecofeeds cheap?
- Will companies that do not take advantage of their food surpluses be fined?

- Do the Japanese have fines for these companies?
- What kind of food surpluses are used?
- Do heat treatments eliminate diseases?
- Changing the European law is your intention?
- Why is soy used to feed animals?
- Are ecofeeds organic?

Before finishing the first step, a plenary debate of circa 10 minutes was opened for a full discussion of the issues raised in the questions. In the second step, jurors individually completed the DCE. First, the moderator used slides to explain the task with examples, and then he described the hypothetical menus included in each choice occasion and asked jurors to choose the menu they would buy for their children. In step three, the jurors collectively completed the same DCE. Again, the moderator explained each choice set and asked jurors to vote openly the option they would buy for their children in school canteens (catering services). The selected alternative in each choice occasion is the most voted by the jurors. Step four consisted of a survey (see the whole survey in annex) collecting information on jurors' food shopping behaviours, motivations to reduce food discards, environmental attitudes, and socio-economic characteristics. Moreover, the survey included two questions related to health risks (F1) and environmental benefit perceptions (F2). In the first question, the jurors were asked to what extent they thought that consuming foods produced through each of the explained four valorisation processes would harm the health of consumers. In the second question, jurors were asked to what extent they thought that recycling foods through each of the explained four valorisation processes would decrease the environmental impact of food waste. To answer both questions, respondents used a scale going from 0 (not at all) to 10 (a lot). At the end of this first session, jurors were asked to discuss the issues in the questions with their family and friends, in preparation for the next session.

Second session

The moderator started the second session with a short summary about the first session, and presented the results of the two questions related to health risk and environmental benefit of each of the four valorisations methods. Next, jurors individually completed the same DCE as in the first session. This was conducted so that jurors could see their answers from the first session on each choice set (see annex). It was done in this way, so that any change in individual answers (choices) between the two sessions would be the result of learning rather than forgetting previous answers. After completing the DCE, jurors were randomly divided into four small groups (six participants each), each with a facilitator, to discuss the pros and cons of each of the valorisations methods considered. Each small group debated the four issues but with a different order so that the groups never discussed the same issue at the same time. For each issue, the debate lasted 10 minutes. By group, jurors agreed on a verdict and the moderators collected the pros and cons of each of the considered food valorisation methods. Figure 1 shows the notes stated by one of the small groups.

produced in a conventional way and items elaborated via four different valorisation methods:

- (i) gleaning pumpkin surplus production and converting them into creams;
- (ii) extracting ingredients (vitamin C or fibers) from fruit surplus production and use them for enrichment of yogurt;
- (iii) converting food-processing by-products (bread, pastries and chocolates) to animal feeds;
- (iv) converting hospitality food surpluses and side-flows to liquid animal feeds called ecofeeds (currently banned in the EU).

Moreover, menus were presented to jurors with different prices; real prices paid by students in Catalan schools for the 2017/2018 academic year were used, and these prices were presented to jurors per day and per month (see annex).

Combining the four menu attributes (starter, main course, dessert, and price) and levels resulted in a total of $2 \times 3 \times 2 \times 4 = 48$ possible hypothetical menus (combinations). Ngene design software was used to generate a D-efficient design with twelve choice sets.

The resulting design enables the estimation of the main effects and included the most efficient combinations. Each choice set contains three generic hypothetical menus (Menu A, Menu B, Menu C) an opt-out option (no-choice) added in order to make the choice more realistic. An example of a choice set is shown in figure 2.

As it can be seen, each choice set includes an opt-out reminder and a follow-up certainty question. The opt-out reminder serves to remind jurors that if they do not like any of the experimentally designed menus or they find them too expensive, they should choose the option "none".

The follow-up certainty question allows further understanding of whether jurors are sure of their decisions. To check the consistency of the participants' decisions across the choice tasks we present the same card twice, at the beginning and at the end. Therefore, the total number of choice sets presented to each juror is thirteen.

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C.1. which of the menus, shown here, would you buy for your child?

	Menu A	Menu B	Menu C	None						
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Conventional pumpkin cream	None of the three menus						
Main course	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds							
Dessert	Valorised Yogurt	Yogurt conventional	Valorised yogurt							
Price	€7 per day (€154 per month)	€5 per day (€110 per month)	€4 per day (€88 per month)							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
<i>Please, how certain you are about your choice?</i>										
<i>Totally uncertain</i>										
<i>Totally certain</i>										
0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2: Example of choice set.

3.3.2 Choice modelling

Choice experiments are based on Lancaster's individual utility maximisation theory (Lancaster, 1966). Lancaster suggested that the utility (U_{nj}) that an individual (n) obtains from a given good (j) may be decomposed into the utilities provided by each of its attributes. He divided such utility into a deterministic and a stochastic component. The deterministic component ($\beta'X_{nj}$) is the part of utility known by researcher and the stochastic component (ε_{nj}) is the part of utility unknown by researcher.

$$U_{nj} = \beta'X_{nj} + \varepsilon_{nj} \quad (1)$$

where,

β : is a vector of parameters associated with the good attributes (X).

According to Lancaster, an individual will always choose the alternative (or good) that provides him the maximum utility. Since the utility function contains a random part, it is not possible to exactly know the utility of an individual attribute to a given good. However, it is possible to know the probability to choose a given good. To estimate such probabilities it is necessary to assume a given distribution for the random terms. The conditional logit model (McFadden, 1974) solves this problem assuming that random terms are independently and identically extreme value type I distributed (i.i.d.). In this case, the probability that an individual n chooses an alternative j may be written in the following way:

$$P_{nj} = \frac{e^{\beta'x_{nj}}}{\sum_j e^{\beta'x_{nj}}} \quad (2)$$

In order to test whether participants' purchasing intentions shifted across sessions, the results of a conditional logit model estimated using data from the first and the second sessions were compared. It commenced with a conditional logit model without controlling for sociodemographic variables (sex, age, and income), environmental involvement (Hinv), food waste behaviour (Waste) and motivation to reduce food wastage (Save), and then this was expanded. The dependent variable is a dummy variable which takes a value "1" if the menu is chosen and "0" otherwise. Table 1 shows the independent variables (Female, Age, Linc, Hinv, Waste and Save) included in the estimated models.

In addition to the menu's attributes, we specified a no-choice constant. Moreover, we estimated a logit model to assess the profile of participants who were more likely to change opinion between first and second session and to be affected by others' opinions. The dependent variable, in this case, is a dummy variable which takes a value "1" if citizen changed his/her decision between first and second session and "0" otherwise. The independent variables (Female, age, Linc, Univ, Hinv, Waste and Save) included in the estimated logit model are described in Table 1.

Table 1: Description of variables included in the estimated models.

<i>Variable</i>	<i>Description</i>
<i>Price</i>	<i>Price of the menu.</i>
<i>Gleaning</i>	<i>Is a dummy variable, it takes a value "1" if starter was a valorised pumpkin cream and "0" otherwise.</i>
<i>Byproducts_feeds</i>	<i>Is a dummy variable, it takes a value "1" if main course was a steak of pork fed with feed made from by-products of food industry and "0" otherwise.</i>
<i>Ecofeeds</i>	<i>Is a dummy variable, it takes a value "1" if main course was a steak of pork fed with ecofeeds and "0" otherwise.</i>
<i>Recycling_ingredients</i>	<i>Is a dummy variable, it takes a value "1" if dessert was a yogurt enriched with vitamin C valorised from surplus food and "0" otherwise.</i>
<i>ASC</i>	<i>Is a no-choice constant.</i>
<i>Female</i>	<i>Is a dummy variable, it takes a value "1" if juror was a woman and "0" otherwise.</i>
<i>Age</i>	<i>Age of jurors in years</i>
<i>Linc</i>	<i>It takes a value "1" if household monthly incomes were lower than €1,500 and "0" otherwise.</i>
<i>Univ</i>	<i>Is a dummy variable, it takes a value "1" if juror had university studies and "0" otherwise.</i>
<i>Hinv</i>	<i>It takes a value "1" if juror's environmental involvement score was higher than 55 and "0" otherwise.</i>
<i>Waste</i>	<i>It takes a value "1" if juror reported that they discarded something and quite or a lot of food and "0" otherwise.</i>
<i>Save</i>	<i>It takes a value "1" if saving money as motivation to reduce food discards received a score >5 and "0" otherwise.</i>

4 Results

This section is presented as follows:

- The results of participants' perceptions related to health risk of the different food valorisation processes (see question F1 in annex).
- The results of perceived environmental benefits of the different food valorisation processes (see question F2 in annex).
- The amount of food discarded in participants' households (see question F3 in annex).
- The importance attributed by participants to different motivations for reducing food discards (see question F4 in annex).
- The frequency of performing some food shopping behaviours by participants (see question F5 in annex).
- Participants' environmental involvement (see question F7 in annex).
- The results of the workshop (see section I in annex) and finally,
- The results of the DCE (see sections C and H in annex).

4.1 Health risk perceptions

Table 2 compares the scores of the perceived health risk of food valorisation methods in the first and the second sessions. According to the results, each of the four valorisation processes of food surpluses and side-flows had low scores in both sessions, implying that jurors did not perceive them as harmful to health, which is a relevant result for the European Circular Economy Action Plan. Scores attributed to gleaning are statistically lower² than those of the other methods in both sessions. Gleaning leftovers after a harvest and converting them to new foods (creams) is perceived as the safest method, while by-product feeds are perceived as the most harmful to human health in both sessions. In the first session, recycling ingredients was the second most harmful to human health, followed by ecofeeds, while in the second session ecofeeds were considered as more harmful than recycling ingredients. According to jurors' comments in the workshop, by-product feeds and recycling ingredients involve a lot of manipulation of the foods (denaturation). Results show also that all the scores have gone up a bit in the second session. The change in the scores attributed to gleaning between the two sessions is not statistically significant; while the rise of

² *First session: scores attributed to gleaning are statistically lower than those of recycling ingredients [diff = -1.25; t= -17.04, p-value = .00], by-product feeds [diff = -2.83; t= -36.18, p-value = .00], and those of ecofeeds [diff = -1.20; t= -20.71, p-value = .00]. Second session: scores attributed to gleaning are statistically lower than those of recycling ingredients [diff = -2.41; t= -26.96, p-value = .00], by-product feeds [diff = -4; t= -42.04, p-value = .00], and those of ecofeeds [diff = -2.54; t= -26.10, p-value = .00].*

the scores of the rest of the methods is statistically significant.³ This means that after discussing with friends and relatives, jurors perceive the products as more harmful. However, they are still low scores, therefore it can be concluded that participants perceived valorised foods from food surpluses and side-flows as safe but actions are needed to improve their knowledge and trust.

Table 2: Perceived health risk of food valorisation methods.

	First session		Second session	
	Mean	Std. Dev.	Mean	Std. Dev.
<i>Gleaning</i>	1.69	2.23	1.83	2.12
<i>Recycling ingredients</i>	3.04	2.83	4.25	2.83
<i>By-product feeds</i>	4.61	2.92	5.83	2.12
<i>Ecofeeds</i>	2.87	2.32	4.38	2.45

4.2 Environmental benefits perceptions

Table 3 compares the scores of perceived environmental benefits of food valorisation methods in the first and the second sessions. Scores attributed to gleaning are statistically larger⁴ than those of the other methods in both sessions. Jurors perceived gleaning and ecofeeds as the two powerful methods to minimize the environmental impact of food waste, while they reported that the two other methods would not have a big impact. The scores of the last three processes (recycling ingredients, by-product feeds, and ecofeeds) decreased after the debates and the discussions with friends and relatives, while it increased a little bit for the first one (Gleaning). The change in the scores attributed to gleaning between the two sessions is not statistically significant; while the shift of the scores of the rest of the methods is statistically significant.⁵ In summary, participants thought that each of the four processes can prevent and reduce food waste but with different degrees, with Gleaning being the most effective.

³ The change in the scores attributed to gleaning between the two sessions is not statistically significant [diff = .12; t= 1.48, p-value = .13], while the shifts in those of recycling ingredients [diff = 1.29; t= 15.21, p-value = .00], by-product feeds [diff = 1.29; t= 17.47, p-value = .00], and those of ecofeeds [diff = 1.45; t= 17.40, p-value = .00] are statistically significant.

⁴ *First session*: scores attributed to gleaning are statistically larger than those of recycling ingredients [diff = 2.33; t= 36.11, p-value = .00], by-product feeds [diff = 2.16; t= 28.89, p-value = .00], and those of ecofeeds [diff = 1; t= 16.14, p-value = .00]. *Second session*: scores attributed to gleaning are statistically larger than those of recycling ingredients [diff = 3.54; t= 39.69, p-value = .00], by-product feeds [diff = 3.75; t= 39.06, p-value = .00], and those of ecofeeds [diff = 2.12; t= 23.15, p-value = .00].

⁵ The change in the scores attributed to gleaning between the two sessions is not statistically significant [diff = .08; t= 1.38, p-value = .16], while the shifts in those of recycling ingredients [diff = -1.12; t= -12.10, p-value = .00], by-product feeds [diff = -1.5; t= -19.58, p-value = .00], and those of ecofeeds [diff = -1.04; t= -16.43, p-value = .00] are statistically significant.

Table 3: Perceived environmental benefits of valorisation methods.

	First session		Second session	
	Mean	Std. Dev.	Mean	Std. Dev.
<i>Gleaning</i>	8.13	2.45	8.21	2.60
<i>Recycling ingredients</i>	5.73	2.23	4.67	2.38
<i>By-product feeds</i>	5.82	2.09	4.46	1.92
<i>Eco-feeds</i>	7.04	2.61	6.08	2.60

4.3 Households' food waste

Jurors were asked about the amount of food discarded in their households. Table 4 shows the results. Most of the jurors (66.7%) reported nothing or a bit, 25% something, and 8% quite or a lot. Most (83.3%) of the households discarded at least a bit of food implying that efficient strategies are also needed to avoid food wastage in households.

Table 4: Perceived amount of food discarded in households.

Amount of food discarded	Percentage of households
Nothing	16.7%
A bit	50%
Something	25%
Quite	4.2%
A lot	4.2%

4.4 Importance of motivations for reducing food discards

Jurors were also asked about the importance of different motivations for reducing food discards. We used the five items of Neff et al. (2015)'s scale. We favoured the 10-item Likert scale rather than the original scale (4-point). Table 5 shows the results. All the five motivations are important (>6) for jurors to reduce food waste, although environmental motivations are a little more important (8.5), followed by setting an example for children (8.4). Scores attributed to environmental motivations are statistically larger than those of all the rest of motivations⁶. Saving money received the lowest score (6.8) and more than 20% of the jurors reported that saving money is not an important motivation to reduce

⁶ Scores attributed to environmental motivations are statistically larger than those of saving money [diff = 1.66; $t = 21.16$, $p\text{-value} = .00$], setting an example for children [diff = .12; $t = 2.58$, $p\text{-value} = .00$], managing my household efficiently [diff = .62; $t = 8.72$, $p\text{-value} = .00$], and thinking about hungry people [diff = .54; $t = 7.20$, $p\text{-value} = .00$].

food discards. It is true that what is lost daily is perhaps not much, but over the years it becomes more significant. Therefore, awareness is needed to better understand the economic, social, and environmental implications of food wastage mitigation.

Table 5: Importance of motivations to reduce food waste.

	Mean	Std. Dev.
Saving money	<u>6.83</u>	<u>2.86</u>
Setting an example for children	<u>8.37</u>	<u>1.88</u>
Managing my household efficiently	<u>7.87</u>	<u>2.06</u>
Thinking about hungry people	<u>7.96</u>	<u>2.44</u>
Reduction of greenhouse gases, use of energy, water, and land	<u>8.50</u>	<u>2.10</u>

4.5 Food shopping behaviours

We also used the five items of Neff et al. (2015)’s scale related to food shopping behaviours. Jurors were asked about the frequency of performing four waste-reducing and one waste-promoting food shopping behaviours. Figure 3 shows the results. Most of the jurors reported that they often or always estimate quantities needed, make a shopping list and check fridge and cupboards before shopping. However, most of them do not often plan meals before shopping. Moreover, most of them never or rarely buy too much food due to sales.



Figure 3: Reported frequency of shopping behaviours.

4.6 Jurors' environmental involvement

We also measured jurors' environmental involvement using Harland et al. (1999)'s scale. Jurors were asked to rate how much they agree or disagree with six items on 10-point scale ranging from 0 (strongly disagree) to 10 (strongly agree). Scores were recoded such that higher scores are associated with more environmental involvement. Table 6 shows that jurors' environmental involvement was very high with an average of 51.75 (Std. Dev.=6.95). Most jurors (66.4%) had scores higher than 55, while 33% of them did not exceed 50. Environmental involvement is important to improve food shopping behaviours and the sustainability of food choices.

Table 6: Scores of jurors' environmental involvement.

Items	Average Scores	Std. Dev.
The condition of the environment forms a threat to my health	8.46	2.12
I am worried about the condition of the environment	8.21	2.12
The degradation of the environment is a risk for the future of my children	9.42	1.08
The degradation of the environment has consequences for my own life	8.58	1.68
I find all the fuss about the environment exaggerated (reverse coded)*	0.92	1.41
I can see with my own eyes that the environment is worsening	8	1.98

*Average environmental involvement score is estimated aggregating the scores attributed to each of the six items. * The score attributed to this item was reverse coded.*

4.7 Results of the workshop

Jurors highlighted some common points for the four different valorisation processes of food surpluses and side-flows. They required a good food traceability system to detect any safety problem. They had little confidence in the legislation and required guarantees. They agreed that the valorisation of food surpluses and side-flows is a non-preventive solution to waste and that a prevention of the surplus production is needed. They also reported that valorised foods should be organic products.

4.7.1 Pros and cons of gleaning leftovers and converting them to new foods

Without doubts, the preferred food valorisation method of the jurors is gleaning leftovers and converting them to new foods (creams, jams, etc.). Table 7 shows jurors' perceived pros and cons of this method. Jurors perceived it as morally right, healthy and profitable. For jurors, this valorisation process is an effective way to prevent and reduce food waste, therefore reducing water, land, energy usage and air pollution. Further, jurors indicated that this method does not generate waste so it improves agricultural performance. Moreover, it creates local circuits with benefits for producers, consumers and environment. Participants

stated that this method let them buy fresh, nutrient-rich, additive free and local products (with less handling) and farmers save the costs of clearing their land. Jurors appreciated the contribution of Gleaning on feeding and social inclusion of the most deprived persons. They also highlighted the role of Gleaning in the field of environmental education and awareness. In summary, jurors considered this food valorisation method as a good initiative and apt for school consumption.

Jurors argued that newly elaborated products are expensive, not organic and contain skins of vegetables and fruits. Jurors assumed that new products should be sold at low prices since the raw materials are free and the employers are volunteers. Jurors supposed that this method is not sustainable and not feasible at a large scale since it depends on volunteers.

Table 7: Pros and cons of gleaning leftovers and converting them to new foods.

Pros	Cons
<ul style="list-style-type: none"> - morally right, healthy, and profitable - It does not generate waste - Improve agricultural performance - Socially beneficial (feeding, inclusion) - Local circuits - Take advantage of foods at the farm - Educational process (awareness) - Reduces waste - Symbiosis: producers and consumers - Use of few or no additives - Freshness and nutrients - Good initiative - Suitable for school consumption 	<ul style="list-style-type: none"> - Products are not organic - It is not sustainable given that it is based on volunteers. - It is not feasible at a large scale - Use of vegetables and fruits skins - New products are expensive

4.7.2 Pros and cons of recycling ingredients from surplus foods to enrich new foods

Table 8 shows the pros and cons of recycling ingredients. Jurors reported that converting food surpluses and side-flows into nutritious ingredients reduces waste and optimizes food-chain efficiency. Jurors assumed that food enrichment based on recycled ingredients optimizes the use of resources and creates value-added products. Further, jurors thought that recycling ingredients gives an additional solution for farmers’ surplus production. Moreover, jurors appreciated the contribution of this process to job creation.

However, for jurors, this method is very complex with excessive food manipulation. They thought that this method encouraged denaturation of foods and loss of food nutritional value. For them, it was not an environmentally-friendly method because it generates high levels of pollution. This is due to the fact that the processed fruits are brought from all over Spain and the carbon footprint is not taken into account. Jurors also reproached the use of chemicals to treat fruits, use of plastic packaging, waste generation, and the excessive use of resources (energy and water) in this method. Moreover, jurors assumed that some companies with these kinds of initiatives prioritize their economic benefits before environmental benefits (Greenwashing). Summarizing, for jurors, this food

valorisation method is not morally right and it is not necessary for school canteens where the diet is already balanced.

Table 8: Pros and cons of converting food surpluses and side-flows into nutritious ingredients.

Pros	Cons
<ul style="list-style-type: none"> - Optimize food-chain efficiency - Supports farmers - Creates value-added products - Reduces waste - Generate Jobs - Optimization of resources and nutrients - Enrichment of other foods - Good intention to recycle 	<ul style="list-style-type: none"> - It's not morally right - Generates a lot of waste - Excessive use of resources (energy and water) - Very complex process - Excessive manipulation and denaturation of foods - Loss of food nutritional value after so much manipulation - Does not respect the carbon footprint since the fruit comes from many places - High levels of pollution - Use of chemicals to treat fruits - Company profits before environmental benefits - Greenwashing - Use of plastic packaging - It is not necessary for the school canteen where the diet is already balanced.

4.7.3 Pros and cons of feeding animals with food-processing by-product feeds

Table 9 shows the pros and cons of feeding animals with food-processing by-product feeds. Jurors agreed that feeding animals with by-product feeds reduces cereals’ consumption and therefore reduces deforestation. For them, this process takes advantage of food surpluses and side-flows that are usually wasted in large quantities and hence it prevents and significantly reduces food waste. They assumed that by-product feeds are better than conventional feeds because they significantly reduce the cost of meat production. Moreover, jurors highlighted the fact that by-product feeds are for both herbivores and carnivores. Regarding social aspects, jurors reported that feeding animals with by-product feeds contributes to creating new jobs. Summarizing, jurors considered this process as a good intention to recycle food surpluses and side-flows.

However, jurors considered that this process is based on excessive handling and processing of foods, which consumes a lot of resources (energy and water). They thought that submitting foods to severe heat treatments leads to the loss of nutrients. They also agreed that this process is technologically complicated (expensive). For jurors, using pastries, chocolate and sweets to feed animals is unhealthy and alters the taste of meat. They assumed that if companies bring food surpluses and side-flows from distant areas and companies’ economic

interest is a priority to environmental problems, this process could worsen the environmental degradation. They concluded that meats of animals fed with by-product feeds are not suitable for school consumption.

Table 9: Pros and cons of feeding pigs with food-processing by-product feeds.

Pros	Cons
<ul style="list-style-type: none"> - Reduce cereals’ consumption - Take advantage of food surpluses and side-flows that are usually wasted in large quantities - Create jobs - Significantly reduce food waste - Reduce feed cost - They are better than conventional feeds - They are feed for herbivores and carnivores - Good intention to recycle 	<ul style="list-style-type: none"> - Excessive handling of foods - Excessive use of resources (energy and water) - Company’s interest before environmental benefits - The process does not prioritize local circuits - Complicated technological process - Use of unhealthy industrial pastries, chocolate and sweets - It's not very healthy - Increases the environmental impact - Affects the taste of meat - Severe heat treatments leads to the loss of nutrients - Not suitable for school consumption

4.7.4 Pros and cons of feeding pigs with ecofeeds

Table 10 shows pros and cons of feeding pigs with ecofeeds. Jurors agreed that feeding pigs with ecofeeds reduces feed prices, cereals’ consumption, use of antibiotics, meat prices, food waste, and deforestation. They assumed that the use of ecofeeds lead to tender, richer and healthier meat. For jurors, feeding with ecofeeds reduces the environmental impact of food waste and promotes investments in animal welfare. Jurors thought that ecofeeds are a good recycling intention and one of them considered the meat of animals fed with it apt for school consumption.

However, jurors though that this method implies complex processes and needs too much energy and water. They were preoccupied by the lack of information and transparency. Jurors did not trust the food industry on safety. They assumed that the food industry could not meet all the requirements of the Japanese model. They also expressed their worry about the fact that this process is still little tested in the EU and prohibited by some religions. Most of them agreed that pigs fed by ecofeeds are not suitable for school consumption.

Table 10: Pros and cons of feeding pigs with ecofeeds.

Pros	Cons
<ul style="list-style-type: none"> - Reduces feed prices - Reduces the consumption of cereals - Reduces the use of antibiotics - Reduces food surpluses and side-flows - Take advantage of all kinds of foods - Leads to tender and richer meat - Healthier meat - Cheaper meat - Low environmental impact - Possibility of investment in animal welfare - Reduces the price of meat - Reduces deforestation - Good recycling intention 	<ul style="list-style-type: none"> - Highly processed method - Lack of information and transparency - Generates more waste - Distrust - Use of resources (electricity and water) - It is not sufficiently tested (lack of time) - Lack of knowledge of the origin of the products - Prohibited by some religions - Not suitable for children

4.8 Choice Experiment Results

Regarding task complexity (see question C14 in the annex), jurors reported that the DCE was very easy (average score = 8 in a 0-10 point scale). This may be due to the explication provided by the moderator. They also reported a high degree of certainty (average score = 8 in a 0-10 point scale) when they made the decisions in both sessions. As mentioned above, the first choice set was presented twice (choice set number 1 and 13 are the same) to test the consistency of jurors responses. In the first session, 17 jurors made the same election in the choice sets 1 and 13 (repeated choice set); while in the second session only 13 jurors elected the same option in choice set 1 and 13.

Results for the conditional logit model estimated with data from the first and the second sessions are shown in Table 11. The constant of the no-choice option (ASC) is significant in both sessions but with different signs. Its positive sign in the first session reveals that participants preferred the no-choice option over any valorised food, *ceteris paribus*. In fact, the no-choice option was selected in 45.1% of the total number of decisions made by jurors. However, in the second session, the constant shows a negative sign implying that participants preferred selecting any menu to the no-choice option, *ceteris paribus*. In this case, this option was selected in 35.0% of the total number of decisions made by jurors. This statistically significant⁷ change is due to participants' learning from debates and discussion with friends and relatives. Only 16.0% of the jurors maintained the same decision in both sessions. Price (Price) effect is negative and significant, being much higher in the second session. This result reveals that participants preferred the cheapest menus. In both sessions, participants preferred the

⁷ [diff = .10; t= 3.57, p-value = .00]

valorised pumpkin cream (Gleaning) over conventional cream. This result confirms those of the workshop showing again that this valorisation way is very appreciated by jurors. In the first session, participants preferred pigs fed with food-processing by-product feeds (Byproduct_feeds) to those fed with conventional feeds, while in the second session they did not show any specific preference for them. This shift in jurors' purchasing intentions is due to the debates and jurors interactions with relatives or friends. We can say that the effect of the information provided by the experts has not lasted long. Moreover, ecofeed pig (Ecofeeds) was preferred to conventional pig in both sessions. This relevant finding supports the growing interest in changing EU law to permit feeding pigs with caterings food surpluses and side-flows. Participants did not have a special preference for a yogurt enriched with vitamin C valorised from food surpluses (Recycling_ingredients), but neither is significantly less accepted than conventional yogurt. This is due, in part, to the fact that jurors considered that this valorisation process involves too much manipulation and processing of foods.

After experts' talks (first DCE), jurors showed positive and significant preferences for the valorisation processes gleaning, by-product feeds, and ecofeeds, thus excluding the valorisation of food ingredients; however, ten days later (second DCE), those particular preferences decreased (eco-feeds) or disappeared (by-product feeds).

In the first plenary deliberation (vote), jurors voted to buy none of the hypothetical menus in nine occasions (choice sets). They voted to buy menus only in three occasions. In these three occasions, jurors selected the cheapest (€4 or €5) menus. These three menus contained valorised pumpkin cream, pork steak fed with ecofeeds, and conventional or valorised yogurt. The only option they did not vote to buy was the pork fed with food-processing by-product feeds. In the second plenary deliberation (vote), jurors voted to buy none of the menus in eight occasions. They voted to buy menus in four occasions. In these four occasions, jurors selected the cheapest (€4 or €5) menus. These four menus contained conventional or valorised pumpkin cream, pork steak fed with conventional or ecofeeds, and conventional or valorised yogurt. Again, jurors did not vote to buy pork fed with food-processing by-products in any of the twelve occasions.

In summary, when jurors decided as a group, in general they did not select any of the menus. Group decisions are not in favour of valorised foods from food surpluses and side-flows. In the workshop jurors concluded that valorised foods (except foods from gleaning) are not suitable for school consumption, but they did not view them as unsuitable for adult consumption. Thus, guarantees from authorities, companies and specialists are needed to inform and convince citizens or consumers. Public policies should support food valorisation initiatives improving citizens or consumers' confidence in valorised foods.

Table 11: Results of the conditional logit model.

CHOICE	First session			Second session		
	Coeff.	Std. Error	Z	Coeff.	Std. Error	Z
Price	-.18**	.08	-2.20	-.46***	.07	-6.06
Gleaning	1.11***	.20	5.59	.73***	.18	4.05
Byproduct_feeds	.64***	.24	2.65	.14	.20	.74
Ecofeeds	1.30***	.23	5.54	.33*	.20	1.65
Recycling_ingredients	-.14	.18	-.77	-.07	.16	-.44
ASC	1.30***	.49	2.68	-1.33***	.43	-3.09
<i>Goodness of fit</i>						
<i>Number of observations</i>		288			288	
<i>Number of individuals</i>		24			24	
<i>Choice sets per individual</i>		12			12	
<i>Log likelihood function</i>		-336.85			-361.67	
<i>Number of factors (K)</i>		6			6	
<i>Akaike information criterion (AIC)</i>		685.7			735.3	
<i>R-squared</i>		.09			.07	
<i>Adjusted R-Squared</i>		.08			.07	

***, **, * refer to significance at 1%, 5%, and 10% level, respectively; coeff. refers to coefficient; Std. Error refers to standard error.

We extended the conditional logit model controlling for several socio-economic characteristics (Female, age and income), and environmental involvement (Hinv) of the jurors. We also included the reported amount of food discarded in participants' households (Waste) and the importance attributed by jurors to saving money as a motivation for reducing food discards (Save). We linked these variables with the no-choice constant (ASC) to identify the profile of jurors who rejected the valorised menus. Results are shown in Table 12. Results showed that the purchasing intention of menus containing valorised foods is lower among women (Female) than among men, maybe because women are more protective about their children's diet than men and more risk averse. Weber et al. (2002) found that women were more risk-averse than men in health and safety risks. Older (age) jurors were less likely to reject the menus. They preferred any of the hypothetical menus to the no-choice option. They may have more knowledge and experience about food valorisation than young jurors. However, they did the opposite in the second session. The results also showed that jurors with low monthly incomes (Lhinc) were less likely to reject purchasing valorised foods in the first session; however, these differences related to the income did not appear in the second session. They were more attracted by valorised foods in the first than in the second session. We do not observe heterogeneity in jurors' purchasing intentions with respect to their environmental involvement (Hinv). Moreover, participants who reported that they discarded something and quite or a lot of food (Waste) preferred any of the hypothetical menus to the no-choice option. Maybe because they were more sensitive to the issue of food waste problem than participants who reported that nothing or a bit. Finally, jurors who reported that saving money is an important motivation to reduce food discards (score>5) preferred any of the hypothetical menus to the no-choice option. We suppose that the lowest importance score (6.8) attributed to saving money compared to the rest of motivations was affected by social desirability bias.

It is important to know the profiles of participants who are in favour or against valorised products from food surpluses and side-flows, to be able to design adequate strategies to improve these perceptions.

Table 12: Results of the conditional logit model controlling for several participants' characteristics.

CHOICE	First session			Second session		
	Coeff.	Std. Error	Z	Coeff.	Std. Error	Z
Price	-.18**	.08	-2.21	-.46***	.07	-6.06
Gleaning	1.12***	.20	5.61	.73***	.18	4.05
Byproduct_feeds	.64***	.24	2.66	.14	.20	.73
Ecofeeds	1.31***	.24	5.54	.33*	.20	1.65
Recycling_ingredients	-.13	.18	-.76	-.07	.16	-.43
ASC	2.96**	1.18	2.50	-5.33***	1.32	-4.04
ASC * Female	1.77***	.51	3.47	2.36***	.77	3.06
ASC * Age	-.05**	.02	-2.02	.06**	.02	2.24
ASC * Lhinc	-.93***	.29	-3.17	.41	.28	1.47
ASC * Hinv	-.32	.31	-1.05	-.46	.31	-1.49
ASC * Waste	-.55*	.29	-1.91	-.50*	.30	-1.66
ASC * Save	-.77**	.32	-2.43	-.56*	.32	-1.78
<i>Goodness of fit</i>						
<i>Number of observations</i>	288			288		
<i>Number of individuals</i>	24			24		
<i>Choice sets per individual</i>	12			12		
<i>Log likelihood function</i>	-316.33			-347.81		
<i>Number of factors (K)</i>	12			12		
<i>Akaike information criterion (AIC)</i>	656.7			344.8		
<i>R-squared</i>	.14			.12		
<i>Adjusted R-Squared</i>	.13			.11		

***, **, * refer to significance at 1%, 5%, and 10% level, respectively; coeff.: coefficient; Std. Error: standard error.

We also estimated a logit model to assess the impact of participants' characteristics on the difference between first and second session. The objective was to see which groups were more likely to change opinion and to be affected by others' opinions. Table 13 shows the results of the relationship between the change and the participants' characteristics. Older (Age) jurors were less likely to change opinion between first and second session, while jurors with low monthly incomes (Lhinc) or who reported that they discarded something and quite or a lot of food (Waste) were more likely to change their choices. Regarding the rest of characteristics, there was no significant difference between first and second session.

Table 13: Results of the relationship between the change and the participants' characteristics

Change	Coeff.	Std. Err.	z	P>z
Female	-.24	.42	-0.57	0.57
Age	-.07**	.03	-2.56	0.01
Univ	.24	.28	0.85	0.40
Lhinc	.85**	.32	2.63	0.01
Hinv	.20	.31	0.63	0.53
Waste	.62**	.29	2.16	0.03
Save	-.39	.31	-1.28	0.20
_cons	2.03*	1.14	1.78	0.07
<i>Goodness of fit</i>				
<i>Number of observations</i>		288		
<i>Number of individuals</i>		24		
<i>Choice sets per individual</i>		12		
<i>Log likelihood function</i>		-176.71		
<i>Pseudo R2</i>		0.06		

5 Discussion

Research on public acceptance for valorisation methods of food surpluses and side-flows is still scarce (Bhatt et al., 2017; Henchion et al., 2016; Sasaki et al., 2011). Our findings indicated that the familiarity of the method was a relevant factor driving participants' food acceptance, which is in line with previous findings (Henchion et al., 2016; Frewer and Gremmen, 2007). This finding indicates that the adoption of these valorisation methods needs time because it is subjected to changes in public' perception.

Participants' acceptance increased for more familiar methods (Gleaning), whereas it decreased for unfamiliar techniques (recycling ingredients, by-product feeds, and ecofeeds). This result was expected because previous study (Henchion et al., 2016) showed that public acceptance increases when the process is aligned with the existing culinary practices (Henchion et al., 2016). Henchion et al. (2016) showed that life experiences on food processes influence the degree of consumer acceptance for food products that incorporate meat by-products.

The process of gleaning and converting them to new foods explained by an expert in this experiment was done by a non-profit organization that helps people at risk of social exclusion in a transformative, participatory, inclusive and sustainable manner. In this case, consumers or citizens are involved in the whole valorisation process (collection, transformation, packaging, etc.). Public' involvement and interaction with producers improves their perceived risks, benefits and concerns relating to the valorisation method (Frewer, et al., 2007) and the trust between consumers and producers. However, citizens or consumers are not involved in the process of recycling ingredients or producing by-product feeds. This unfamiliarity and lack of interaction with producers and policy makers could lead to lack of trust between them (Frewer, et al., 2007).

The same happened with pig meat produced with ecofeeds which is not available in the EU. The low purchasing intentions for pig meat produced with ecofeeds were similar to Japanese consumers' intentions (Sasaki et al., 2011). In this context, Sasaki et al. (2011) found that Japanese purchasing intentions for pork products produced with ecofeeds were lower than other pork products. They found that most of Japanese consumers were unfamiliar and without purchasing experience regarding pork products produced with ecofeeds.

However, the fact that participants were more likely to buy pig meat produced with ecofeeds than meat produced with by-product feeds or foods enriched with recycled ingredients was not expected. We supposed that feeding pigs with ecofeeds would be the least accepted method due to public fears regarding food safety (Jensen and Sandoe, 2002). In part, participants' acceptance to the use of ecofeeds was due to the information provided by experts, which improved participants' knowledge regarding this valorisation method and its benefits for consumers, citizens, environment and pigs. For participants, this method is more effective to prevent food waste than producing by-product feeds or foods recycled ingredients.

The naturalness of the products was very important for participants, which is in accordance with previous findings (Henchion et al., 2016). Henchion et al. (2016) showed that public acceptance of food products containing ingredients derived from beef by-products depends on the ingredients' naturalness. Generally, consumers associate naturalness with healthiness, freshness, and organic or locally produced foods (see review of Román et al., 2017).

Moreover, higher levels of handling and processing of foods in the processes of recycling ingredients and feeding animals with by-product feeds resulted in lower levels of participants' acceptance for these methods. This is in accordance with Henchion et al. (2016) who indicated that acceptance of food products containing ingredients derived from beef by-products depends on the ingredients' physical state. Freshness and minimal processing are highly desirable food attributes (see review of Román et al., 2017).

Also in line with previous research (Henchion et al., 2016; Jensen and Sandoe, 2002), we found that trust in food regulatory institutions may have an important effect on public' acceptance. Part of the distrust towards regulatory institutions may be a protest attitude due to the current political context in Catalonia.

Furthermore, our findings showed that participants' acceptance may also depend on sustainability, safety, complexity, moral considerations, traceability, transparency, local origin and the effectiveness of the valorisation methods. Henchion et al. (2016) indicated that informing public regarding benefits, nature or origin of the product, necessity, influence public acceptance or rejection of valorised food.

Experts' information led to positive participants' response towards valorised food. This means that information is an important factor affecting participants' purchasing intentions. The short duration of the effect of the information on the purchase intentions was not expected and it suggested that time is a determinant factor in the adoption of these valorisation methods, which is in line with previous findings (Henchion et al., 2016). This means we cannot change the negative perceptions towards valorised food in one day.

Participants' intentions to buy valorized food also depended on their sociodemographic characteristics and attitudes. Women were less likely to buy valorised food than men, which is in keeping with previous findings (Henchion et al., 2016). This means that women were more risk averse in safety risks and they will need more communication efforts.

Also in line with previous work (Henchion et al., 2016), older participants were more likely to accept valorized food due to their life experiences with these processing methods. This confirmed again the relevant role of time in the adoption of these valorisation methods.

Other participant characteristics (income, attitudes and motivations) were key factors in the acceptance of valorised food. This means that targeted marketing strategies are needed to increase the consumption of valorised food.

Based on our findings, we drafted some conclusions and proposed some recommendations to increase public' acceptance for valorised foods.

6 Conclusions

This research investigated the consumer understanding and acceptance of different valorisation methods for food surplus and side-flows. Of particular interest was the extent to which consumers accept and even appreciate products resulting from innovative waste valorisation processes. This work identified the relevant factors that influence the acceptance or rejection by consumers. These factors include familiarity, knowledge, perceived risks, perceived benefits, experiences on food processes, involvement, trust between consumers and producers, information, naturalness, local origin, levels of processing, trust in food regulatory institutions, sustainability, safety, complexity, moral considerations, traceability, and transparency.

Based on the evidence from the experiments performed in the study, we find that informational strategies can contribute to the acceptance of valorised products by consumers. The provision of information has a larger likelihood for success, if it is continued until these kinds of food become familiar to the public. The outcomes of the experiments suggest that the acceptance of the studied valorisation methods is complex and needs time because it requires removing any existing negative perceptions towards such methods.

The findings suggest that a focus on framing the message in a positive way, pointing out the potential benefits for the consumer (such as taste, naturalness, local origin, environmental friendliness, animal welfare, social inclusion, etc.), creates more positive motivations towards acceptance. For example, the ecofeeds valorisation method has the potential to improve the quality of pork fed on surplus food, and can have significant environment and animal welfare benefits. Within the context of this study, the requirements were identified for Spaniards to accept the use of pork fed with ecofeeds. This information is useful for policy makers, producers, farmers and consumers to stimulate the integration and scaling of ecofeeds in the food system.

Furthermore, different consumer segments could be identified according to the levels of acceptance. As a first outcome, we suggest to focus attention to the potential adopters who are more open to the use of valorised food (such as elderly people, men, and those who are familiar/have experience with valorised food products). This will make these products more present in the market (enhancing familiarity) and will be providing living examples that these products are safe to use.

We also recommend using celebrities (chefs, athletes, etc.) to translate the message of using valorised food products to consumers. This will show that valorised foods are socially acceptable and reduce consumer potential concerns and fears.

In order to build consumer trust in the use of valorised food products and the production chain, we recommend transparency and inclusion of social concerns of consumers by the producers, within all stages of the valorisation process.

This approach is exemplified by the non-profit gleaning organisation involved in the study. Their way of involving all the stakeholders in the valorisation (producers, consumers, and local authorities) has led to a high acceptance level by the participants in the study. Non-profit organisations often build trust and strong relationship with the public, which approach can be utilised by companies as well. Therefore, we recommend food processing industry and governments to connect with non-profit organisations and to use their networks to get nearer to the public and to provide information (e.g. through workshops, visits to the factory, conferences, taste tests, etc.). The present work is a successful example of cooperation between industry, a non-governmental organizations and government to assess public concerns regarding food valorisation.

Our findings suggest that an effective risk communication should be developed by stakeholders and policy makers. However, risk-assessment analysis and communication alone are not enough to convince the public to accept the use of valorised food. Public acceptance depends also on other consumer concerns. We recommend all stakeholders interested in furthering food valorisation at national, regional and EU level to take the following suggestions into account:

- Perception of naturalness and freshness of valorised products: the study pointed towards consumers' concern and a preference of natural food products. Valorised products with higher levels of processing were perceived as less natural. Further research is needed to establish what consumers perceive as natural within the context of valorised products. In order to gain consumer acceptance, this consideration should be addressed within the development and commercialisation processes.
- Closer alignment to existing practices and familiar products increases acceptance by consumers.
- Environmental and quality benefits should be integral part within the development of valorised products, in combination with low(er) environmental impact of the production processes.
- Local sourcing of surplus or side-flows used within valorisation methods was seen to contribute positively to consumer appreciation, as well as limited use of chemical additives, simple processes, and the use of recyclable packaging.
- Transparency on the valorisation/production process also contributes to consumer acceptance. The same holds for addressing consumers' moral considerations and animal welfare issues.

Evidence has shown that feeding products produced with by-product flows or ecofeeds, or products enriched with ingredients extracted from surplus products to school children, are not always greeted with enthusiasm or support by the public. On the other hand, food products derived from gleaned crops, showed to be more acceptable to the participants of the study.

A remarkable result from the study is that although gleaning-based valorised products were deemed acceptable to be used within the setting of school lunches, the other valorisation methods were not. However, the participants did not view them as unsuitable for adult consumption. In contrast to their stated perception of valorised products as safe for health, presented with the option of giving these products to their children evoked a negative response ('just in case'...). To increase the confidence in the safe use of valorised food products, it can therefore be recommended to first focus on adult consumption on the short term.

It is recommended that potential legal barriers for studied valorisation methods, including gleaning, ingredients enrichment, by-products used as animal feed, and catering food surpluses as animal feed (ecofeeds), are investigated and where necessary addressed and/or explained with further guidelines. The potential for upscaling should be supported through financial and organisational support from various stakeholders.

The findings of this study are based on a very specific sample, which is not representative to the Spanish population (overrepresentation of women, specific age cohort, etc.).

The results regarding trust towards stakeholders, including governmental and regulatory institutions may be influenced by the current political situation in Catalonia, but the researchers cannot attribute its extent. Also, the purchasing intentions for valorised food behaviours of the studied group may differ from those of the rest of Spain or other European countries. Therefore, we recommend further research to investigate these preliminary results in the context of other settings and EU Member States.

Finally, in the present experiment public purchasing intentions for hypothetical valorised food products were assessed. However, sensory factors also could influence the acceptance for valorised food and could be studied in future research, including consumer taste and texture appreciation in experimental settings or action-based piloting studies using existing valorised food products.

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8 Annex

Protocol for citizens' experiment

First session (May 03, 2018)

A. Introduction

This experiment is part of the EU Horizon 2020 funded project "Resource Efficient Food and dRink for the Entire Supply cHain" (REFRESH) which takes action against food waste. Within this project 26 partners from 12 European countries and China work towards the project's goal to contribute towards the objectives of reducing food waste across Europe by 30% by 2025, reducing waste management costs, and maximizing the value from unavoidable food waste and packaging materials. REFRESH runs from 2015-2019. The Center for Agro-food Economy and Development (CREDA-UPC-IRTA) is one of the project partners.

Informed consent to participate in the experiment

This research is conducted by the Center for Agro-food Economy and Development (CREDA-UPC-IRTA). The objective of this study is to know your opinion about valorisation of food surpluses and side-flows.

If you agree to participate in this study, you will be asked to complete a survey and discuss the issues in question with the rest of participants. This study has two sessions: the first session takes place today (May 3, 2018) and lasts 3 hours (4:30pm to 7:30pm) and the second session will be held on May 14, 2018 and will last about 2 hours (5pm to 7pm). Participating in this study is strictly voluntary. The collected information will be confidential and will not be used for any other purpose other than those of this investigation. Your answers to the questionnaire will be coded using an identification number and will therefore be anonymous.

I, Mr/Mrs I have been informed about the objectives of this study and that my data will be treated confidentially, and in such conditions, I CONSENT to voluntarily participate in this experiment.

Signature of the Participant

Date / /

B. Experts' talks

Now, a researcher from Creda will present you some data on food waste levels and its environmental and socioeconomic impacts.

How many foods are thrown away? (8 min)

Presented by a researcher from Creda

Next, you are going to hear four experts speaking about four different solutions (valorisation methods) to prevent the problem of food waste.

Topic 1: Creams and marmalades from surplus production (10 + 5 min)

Presented by an expert from a non-profit organization that fights against food waste

Topic 2: Extracting ingredients from surplus production for food enrichments (10 + 5 min)

Presented by an expert from a company dedicated to the manufacture of fruit derivatives

Topic 3: Animal feeds from food-processing by-products (10 + 5 min)

Presented by an expert from a company dedicated to recycle and recover food-processing by-products for the production of animal feeds

Topic 4: Ecofeeds for pigs from caterings' food surpluses (10 + 5 min)

Presented by an expert from campaign group that fights against food waste

C. Exercise (40min)

Imagine that the Regional Council decides to review the terms of contracting the services of caterings in the schools to favor companies that incorporate meals based on foods valorised via the valorisation processes previously explained by the experts. Would you buy valorised meals for your child?

You will shortly be presented with a series of thirteen questions about purchase decisions for a school lunch menu (starter, main course, and dessert) for your child. Each purchase occasion that you are going to see corresponds to a different purchase moment (for example, a day). All the menus have at least one valorised item. In each of these thirteen questions, we would like to ask you which menu you would prefer to buy for your child. We will not ask you to actually purchase any of the meals you select. We are simply interested in the decisions you would take. Please indicate your answers in the lines with a *green background*.

The menus that we will show you in the thirteen choice questions are defined by the following characteristics:

A Starter: consists in a pumpkin cream which may be:

- Conventional
- Or valorised from surplus pumpkins collected from farmers' fields (gleaning)

A main course: contains a steak of a pig fed by:

- Conventional feeds,
- By-product feeds produced from food-processing by-products,
- Ecofeeds produced from recycled caterings food surpluses.

A dessert: contains a yogurt which may be:

- Conventional,
- Or enriched by vitamin C extracted from surplus fruits

Price: is the cost of the school menus expressed per day and per month. The prices of the menus may vary and take the following values:

- €4 per day (€88 per month),
- €5 per day (€110 per month),
- €6 per day (€132 per month),
- €7 per day (€154 per month).

Please compare all the characteristics of the menus, including their price, and choose the one you would prefer to buy for your child. Please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

According to previous similar studies we know that People often respond in a given way but act differently. In hypothetical studies (like the present study) people overestimate their preferences and willingness to pay. It's easy to be generous when you do not really have to pay for it. **So please respond to each of the following thirteen questions just exactly as you would if you were in a real school restaurant and had to pay for your choice.**

Day 1

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C1. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None						
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Conventional pumpkin cream	None of the three menus						
Main course	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds							
Dessert	Valorised Yogurt	Conventional yogurt	Valorised Yogurt							
Price	€7 per day (€154 per month)	€5 per day (€110 per month)	€4 per day (€88 per month)							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
<i>Please, how certain you are about your choice?</i>										
<i>Totally uncertain</i>								<i>Totally certain</i>		
0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Day 2

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C2. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Valorised pumpkin cream	Conventional pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds	A pork steak fed with conventional feeds								
Dessert	Valorised Yogurt	Conventional yogurt	Conventional yogurt	None of the three menus							
Price	€7 per day (€154 per month)	€5 per day (€110 per month)	€4 per day (€88 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>											
0	1	2	3	4	5	6	7	8	9	10	<i>Totally certain</i>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Day 3

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C3. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with by-product feeds	A pork steak fed with conventional feeds	A pork steak fed with eco-feeds								
Dessert	Valorised Yogurt	Conventional yogurt	Conventional yogurt	None of the three menus							
Price	€4 per day (€88 per month)	€6 per day (€132 per month)	€7 per day (€154 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 4

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C4. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with ecofeeds	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds								
Dessert	Conventional yogurt	Conventional yogurt	Valorised Yogurt	None of the three menus							
Price	€6 per day (€132 per month)	€4 per day (€88 per month)	€7 per day (€154 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 5

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C5. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Valorised pumpkin cream	Conventional pumpkin cream	Conventional pumpkin cream								
Main course	A pork steak fed with conventional feeds	A pork steak fed with eco-feeds	A pork steak fed with by-product feeds								
Dessert	Valorised yogurt	Valorised yogurt	Conventional yogurt	None of the three menus							
Price	€7 per day (€154 per month)	€4 per day (€88 per month)	€6 per day (€132 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 6

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C6. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None						
Starter	Valorised pumpkin cream	Conventional pumpkin cream	Conventional pumpkin cream							
Main course	A pork steak fed with ecofeeds	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds							
Dessert	Conventional yogurt	Valorised yogurt	Valorised Yogurt	None of the three menus						
Price	€5 per day (€110 per month)	€7 per day (€154 per month)	€4 per day (€88 per month)							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
<i>Please, how certain you are about your choice?</i>										
<i>Totally uncertain</i>										<i>Totally certain</i>
0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Day 7

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C7. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with ecofeeds	A pork steak fed with by-product feeds	A pork steak fed with conventional feeds								
Dessert	Valorised yogurt	Valorised yogurt	Conventional yogurt	None of the three menus							
Price	€6 per day (€132 per month)	€5 per day (€110 per month)	€5 per day (€110 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 8

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C8. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds	A pork steak fed with conventional feeds								
Dessert	Conventional yogurt	Conventional yogurt	Valorised Yogurt	None of the three menus							
Price	€4 per day (€88 per month)	€7 per day (€154 per month)	€6 per day (€132 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 9

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C9. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Valorised pumpkin cream	Conventional pumpkin cream	Conventional pumpkin cream								
Main course	A pork steak fed with ecofeeds	A pork steak fed with by-product feeds	A pork steak fed with conventional feeds								
Dessert	Valorised yogurt	Conventional yogurt	Valorised Yogurt	None of the three menus							
Price	€4 per day (€88 per month)	€7 per day (€154 per month)	€6 per day (€132 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 10

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C10. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with conventional feeds	A pork steak fed with eco-feeds	A pork steak fed with by-product feeds								
Dessert	Valorised yogurt	Valorised yogurt	Conventional yogurt	None of the three menus							
Price	€5 per day (€110 per month)	€6 per day (€132 per month)	€5 per day (€110 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Day 11

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C11. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Valorised pumpkin cream	Conventional pumpkin cream	Valorised pumpkin cream								
Main course	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds								
Dessert	Conventional yogurt	Valorised yogurt	Valorised Yogurt	None of the three menus							
Price	€5 per day (€110 per month)	€6 per day (€132 per month)	€5 per day (€110 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>											
0	1	2	3	4	5	6	7	8	9	10	<i>Totally certain</i>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Day 12

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C12. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Valorised pumpkin cream	Valorised pumpkin cream	Conventional pumpkin cream								
Main course	A pork steak fed with by-product feeds	A pork steak fed with conventional feeds	A pork steak fed with eco-feeds								
Dessert	Conventional yogurt	Valorised yogurt	Conventional yogurt	None of the three menus							
Price	€6 per day (€132 per month)	€4 per day (€88 per month)	€7 per day (€154 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>											
0	1	2	3	4	5	6	7	8	9	10	<i>Totally certain</i>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Day 13

Reminder: please remember that if you do not like any of the three menus or the prices seem very high, you should choose the "None" option.

C13. Which of the menus, shown here, would you buy for your child?

	Mena A	Menu B	Menu C	None							
Starter	Conventional pumpkin cream	Valorised pumpkin cream	Conventional pumpkin cream	None of the three menus							
Main course	A pork steak fed with conventional feeds	A pork steak fed with by-product feeds	A pork steak fed with ecofeeds								
Dessert	Valorised yogurt	Conventional yogurt	Valorised Yogurt								
Price	€7 per day (€154 per month)	€5 per day (€110 per month)	€4 per day (€88 per month)								
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>I buy:</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>							
<i>Please, how certain you are about your choice?</i>											
<i>Totally uncertain</i>										<i>Totally certain</i>	
0	1	2	3	4	5	6	7	8	9	10	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

C14. Please, indicate how easy was the exercise?

Difficult for me											Easy for me
	0	1	2	3	4	5	6	7	8	9	10
	<input type="checkbox"/>										

D. Plenary session (10min)

Now we open a plenary session to comment and share your opinions about the topics commented by the experts.

E. Exercise (30 min)

Next, you are going to repeat exercise (Section C) but collectively. In particular, you are going to vote the answer (purchasing intention) in each of the thirteen purchasing occasion. The selected menu in each day will be the one that will receive the most votes.

Survey

F. Perceptions, attitudes and buying behaviour

F1. To what extent do you think that consuming foods valorised via the following valorisation processes would harm consumers' health?

Not at all											Yes, a lot
	0	1	2	3	4	5	6	7	8	9	10

a) gleaning vegetables and converting them into foods such as soups or creams	.....
b) extracting ingredients (vitamins) from surplus products and use them for food enrichment	.....
c) converting food-processing by-products to animal feed and feed supplements	.....
d) converting catering food surpluses to liquid feeds for pigs	.....

F2. To what extent do you think that recycling food via the following recovery processes would reduce the environmental impact of food waste?

Not at all Yes, a lot
 0 1 2 3 4 5 6 7 8 9 10

a) gleaning vegetables and converting them into foods such as soups or creams	.....
b) extracting ingredients (vitamins) from surplus products and use them for food enrichment	.....
c) converting food-processing by-products to animal feed and feed supplements	.....
d) converting catering food surpluses to liquid feeds for pigs	.....

F3. Could you indicate how many foods are thrown in your home because they were not consumed or expired?

- Nothing
- A bit
- Something
- Quite
- A lot

F4. Could you indicate how important would be for you each of the following motivations to reduce food waste?

Not at all Very
 important important
 0 1 2 3 4 5 6 7 8 9 10

Saving money	.....
Setting an example for children	.....
Managing my household efficiently	.....
Thinking about hungry people	.....
Reduction of greenhouse gases, use of energy, water and land	.....

F5. Could you indicate how often you perform the following behaviours related to food shopping?

Never	Rarely	Sometimes	Often	Always
1	2	3	4	5
Check fridge and cupboards before shopping			
Estimate quantities needed before shopping			
Make a shopping list			
Plan meals before shopping			
Buy too much food due to sales			

F6. How often do you buy foods in your home?

- Regularly
- Occasionally
- Never

F7. Regarding your relationship with the environment, we would like to ask you to what extent you agree with the following statements.

Strongly agree									Strongly disagree	
0	1	2	3	4	5	6	7	8	9	10
The condition of the environment forms a threat to my health									
I am worried about the condition of the environment									
The degradation of the environment is a risk for the future of my children									
The degradation of the environment has consequences for my own life									
I find all the fuss about the environment exaggerated									
I can see with my own eyes that the environment is worsening									

G. Sociodemographic characteristics

G1. Please indicate your gender?

- Female
- Male

G2. Please indicate your year of birth?

19..

G3. What is the highest level of education you have achieved?

- Without studies
- Primary Education
- Secondary Education
- Higher post-secondary education
- Vocational Education and Training
- University intermediate level
- University superior level

G4. How many people live in your home?

.....

G5. How many people are within the following age ranges?

0 – 6 years	.....
6 – 12 years	.....
12 – 16 years	.....
16 – 18 years	.....
18 – 40 years	.....
40 – 60 years	.....
More than 60 years	.....

G6. How much do you pay monthly for your child's school meals?

.....€

G7. Only for classification purposes, please indicate which of the following ranges best describes the monthly income of your household?

- Less than €1500
- Between €1500 and €2500
- Between €2500 and €4000
- More than €4000

G8. Where do you live?

Municipality: _____ CP: _____

G9. What is the place of your birth?

- Catalonia
- Rest of Spain
- Rest of the European Union (UE)
- Rest of the world

Task for next session

To prepare the next workshop, please talk with your friends or/and relatives about the issues in question.

