WaysTUP!

VALUE CHAINS FOR DISRUPTIVE TRANSFORMATION OF URBAN
BIOWASTE INTO BIOBASED PRODUCTS IN THE CITY CONTEXT

D4.4: Evaluation methodology for measuring the change

WP4 – A behavioural change approach for the collection of urban biowaste and acceptance of biowaste derived products with citizens and communities

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Lexicon

Concept	Definition	Source
Circular Economy	A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.	Kirchherr et al. (2018)
Waste	Any substance or object which the holder discards or intends or is required to discard.	European Parliament (2008)
Biowaste	Biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants.	European Parliament (2008)
Self-reported participation rates	The extent to which the respondent takes part in recycling, generally on a frequency scale from never to always, as reported by the respondent him/herself.	Authors' own definition
Participation rates	The percentage of households which put out their recyclables at least once over a period of time (e.g. 4-8 weeks).	Wang et al. (1997)
Recycling tonnages	Absolute amount of waste selectively sorted, independently of its purity.	Authors' own definition
Capture rate	The capture rate of a specific type of waste refers to the percentage of this waste that is being correctly sorted in regards to the total amount of this waste that has been discarded (independently of where it has been discarded).	Authors' own definition
Source separation ratio	Amount of biowaste selectively sorted compared to other type of selectively sorted waste, independently of its purity.	Authors' own definition
Purity of waste	Percentage of waste in the (...) recycling bins which is the [correctly sorted waste].	Dai et al. (2016)
Experimental design	An experimental design is a plan for assigning experimental units to treatment levels and the statistical analysis associated with the plan (Kirk, 1995, p.1).	Kirk (2012)
Control group	Group of participants not exposed to the treatment.	Authors' own definition
Experimental group	Group of participants exposed to the treatment.	Authors' own definition

Executive summary

This deliverable is the fourth report of Work Package 4 "A behavioural change approach for the collection of urban biowaste and usage of biowaste derived products with citizens and communities". In this report, the **evaluation methodology** measuring the change associated with the behaviour change intervention (consisting of the implementation of the toolkit for behaviour change in the three pilot cities: pilot 1 – Valencia, 5 – Athens and 6 – Barcelona) is described.

The intervention will be launched in two phases, lasting each three months: phase 1 from October to December 2021 - followed by an intermediate testing and possible adjustment of the behaviour change toolkit - followed by phase 2 from May to July 2022.

The goal of the evaluation is therefore to assess to what extent the behaviour change toolkit is successful in reaching the three predefined behavioural targets:

(1) improved biowaste perception >80%
(2) improved participation in selective biowaste sorting >60%
(3) improved acceptance of biobased products >75%

The success will be evaluated on the **five dimensions of change** (reliability, speed of change, particularism, generality, and durability). To do so, the study is designed as an experimental study through the use of **randomized control trials**, where participants are randomly assigned to the control or experimental group. The evaluation methodology will make use of a modified pre-test posts-test plan where **four testing periods** are included: (1) a pre-testing in September 2021, (2) an intermediate testing in January 2022, (3) a first post-test in August 2022 and (4) a second post-test in November 2022.

The evaluation method encompasses the use of self-reported data through an online survey and qualitative data. The online survey consists of two parts: (1) a general survey that participants take once for each testing period (pre-test, intermediate test, post-test 1 and post-test 2); (2) a daily survey composed of two questions (question 3 and 4) that participants take every day for 7 days for each testing period. Together, they will assess the attitude regarding the use of biowaste as a local resource, the active participation in selective biowaste sorting, the acceptance of urban biobased products, the spill-over to other types of behaviours and the profiles of the participants. The qualitative inquiry will be developed to answer more in-depth questions based on the analysis of the online survey.

Finally, to ensure a sufficient participation rate, the use of incentives (email reminders and monetary "lottery" incentive) is foreseen and their costs are estimated.

Introduction

This deliverable is the fourth report of Work Package 4 "A behavioural change approach for the collection of urban biowaste and usage of biowaste derived products with citizens and communities". The goal of this work package is to investigate the motivations and barriers related to the separate collection of urban biowaste of citizens and communities, as well as the customer acceptance of biowaste derived products. Therefore, a behaviour change campaign is designed and executed in close collaboration with the pilots (pilot 1, 5 and 6 – WP3), with the aim to achieve the following objectives:

- to improve the current **perception** of citizens and local communities on urban biowaste as a local resource – target goal: improved perception > 80%
- to enhance the **active participation** of citizens in the **separate collection** of urban biowaste – target goal: enhanced participation > 60%
- to improve **customer acceptance** of **urban biowaste derived products**, including food and feed ingredients – target goal: improved customer acceptance > 75%

To understand the dynamics of these behaviours, a close collaboration is set up with the following pilot partners:

Table 1: Participating pilots in the behaviour change study

	Pilot 1 - VALENCIA	Pilot 5 - ATHENS	Pilot 6 - BARCELONA
Pilot coordinator	SAV	NTUA	IMECAL
Processing partners	SAV	NTUA, TUC, DRAXIS	IMECAL
Community coordinator for WP4	VAL / SAV	SUST	AMB

The three pilots are involved in the behaviour change study through the Modular Behavioural Analysis Approach (**MBAA**). The MBAA entails several steps: from the initial scoping of the study (reported in D4.1) and the design of the behaviour change interventions to the the analysis of the behavioural change results. This model was specifically developed by IMEC and builds upon the principles of community-based social marketing.

This deliverable is part of the **Phase 3 of the MBAA: "intervention and test"**. In this phase, the behaviour change interventions are designed and implemented among the target groups (see D4.3), based on the conceptual inquiry (see D4.1) and the first empirical inquiry (D4.2). In each of the pilot studies, the behaviour change interventions specifically focus on reducing barriers but also on increasing change-promoting benefits that matter to the target communities, reflecting the unique value proposition of the social marketing approach in promoting societal good. The behaviour change interventions developed in D4.2 "Toolkit: Intervention for change" include: environmental restructuring through stickers and posters, persuasion through social media posts; behavioural modelling through video-clips; incentivisation through badges; and enablement through provision of bags and bins. Finally, "Join the loop" events are also planned to be organised, especially as "kick-off events". To ensure that the behaviour change intervention is

successful, a specific methodology and evaluation plan is needed. **The purpose of this deliverable is therefore to define how the behaviour change will be monitored and evaluated.**

This deliverable lays down the evaluation methodology for measuring the change targeted by the behaviour change intervention. **Chapter 1** describes the purpose of the evaluation and the design of the experimental intervention, **chapter 2** defines the different methods that will be used to measure the change, **chapter 3** provides a timeline for the different measure points and **chapter 4** touches upon the foreseen incentives needed to attract and retain participants in this process.

1. Purpose and results to be measured

The purpose of the evaluation plan is to **assess the success** of the behaviour change interventions in reaching the three behavioural target goals:

1) improved biowaste perception >80%
2) improved participation in selective biowaste sorting >60%
3) improved acceptance of biobased products >75%

The effectiveness of behaviour change interventions is a multi-dimensional question. The WaysTUP! evaluation methodology will assess the success of its behaviour change interventions on five dimensions, as described in De Young (1993):

(1) **Reliability**: the effect of the intervention when used for the first time and when used after many presentations to the same individual.
(2) **Speed of change**: the measure of time between the intervention and the observed change.
(3) **Particularism**: the effect of the intervention regarding specific target audiences.
(4) **Generality**: the specificity of the effect of the intervention (i.e. spill-over to other behaviours).
(5) **Durability**: the measure of time between the end of the intervention and the maintenance of the change.

In order to assess the effectiveness of the toolkit for change, an **experimental research design** will be implemented through the use of **randomized control trials**[1] in all three pilots cities: participants will be randomly assigned to a "control group" (which will not be presented with the intervention) or an "experimental group" (which will be presented with the intervention). The intervention will be presented to the experimental group through the platform "Mailchimp[2]". To do so, participants will be asked to wilfully register to the intervention by providing their email address – as this was one of the preferred communication channels reported by the communities (see D4.2). During the intervention period, participants from the experimental group will be contacted on their email address via Mailchimp and presented with the tools of the toolkit (social media posts, video, request of a badge, etc.). Mailchimp has been selected as it allows the research team to control which participants have opened their emails and click on the included links (if relevant), enabling us to be more precise in our conclusions on the success of the intervention.

The evaluation of the randomized controlled trials will be done through a combination of qualitative and quantitative methods, such as a quantitative survey and open-ended survey/interviews/focus groups, and this through different points of measure in time. Within WaysTUP!, it is foreseen to perform a **modified pre-test post-test design** through a pre-test, an

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[1] Depending on the success in reaching out to participants, non-randomized control trials might have to be carried out, resulting in a quasi-experimental research design.
[2] Mailchimp is a diverse marketing services platform. It includes tools for marketing automation, email marketing, postal marketing and text marketing. See also: https://mailchimp.com/

intermediate test and two post-tests (see Figure 1). In this regard, the goal of the evaluation methodology is three-fold:

(1) **the pre-test** will provide **a baseline** for the target populations (citizens and businesses) in regards to our three 'behavioural objectives' (perception of biowaste; active participation in selective biowaste sorting; acceptance of biobased products).

(2) **the intermediate test** will provide **a monitoring** of the change for the target population. This will enable us to observe whether the interventions implemented are working towards our goals in the three 'change areas' or if course corrections are needed. If we observe that the goals are unlikely to be met, a modification to the intervention and engagement plan might be undertaken.

(3) **The two post-tests** will provide **the final evaluation** of the success of the behaviour change intervention, comparing the observed results to the predefined targets.
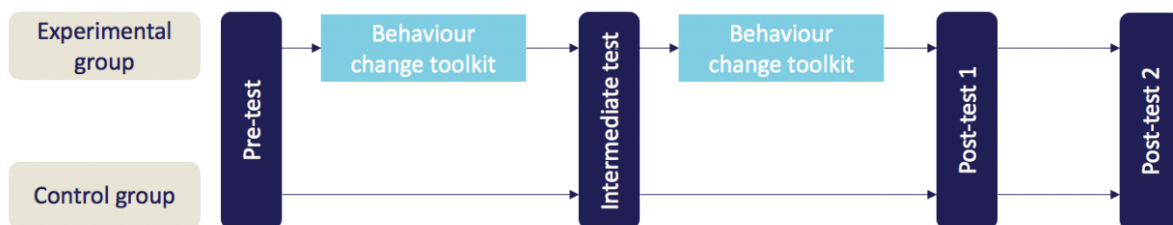

Figure 1: WaysTUP! experimental design

Through this modified pre-test post-test design, the **reliability** of the intervention will be measured by comparing the change in the collected data over time (from pre-test, to intermediate test and post-test). This evaluation plan will also allow us to measure the **speed of change** (esp. for the "active participation in selective biowaste sorting") by observing the first sign of change in the behaviour, as well as the **durability** of the effect of the intervention, through a last point of measure several months after the end of the intervention (the second post-test).

By analysing the difference between profiles based on the data collected in the quantitative survey, the research team will be able to investigate the **particularism** of the intervention, based on the effect of the intervention on different audience. Through the same data, it will also be possible to investigate the **generality** of the intervention by studying the changes on other behaviours (e.g. plastic recycling).

2. Methods

The methods of the evaluation plan aim to **measure the effect of the intervention on the three behavioural objectives**: (1) improved perception of biowaste as local resource, (2) active participation in selective biowaste sorting and (3) improved acceptance of biobased products.

2.1   Online survey

A survey is a systematic method that gathers information from a (sample of a) population with the aim to construct quantitative descriptors (i.e. statistics) of a phenomenon for the target population (Groves et al., 2011). Although surveys can encompass many activities, the survey implemented in this evaluation plan consists of a **self-administered web-based (online) survey**. It consists of (1) gathering information through a web platform (i.e. Qualtrics) by asking questions to individuals; (2) collecting information by having the individual him/herself record the answer, after having read the questions; (3) collecting data from a subset (i.e. a sample) of the population.

To be able to measure the effectiveness of the interventions on all five dimensions of behaviour change (reliability, speed of change, particularism, generality, and durability) for all three behavioural objectives (perception of biowaste, selective sorting, and acceptance of biobased products), the survey will include five sections:

1) Attitude regarding urban biowaste as a local resource
2) Self-reported biowaste sorting behaviour
3) Intention to buy and willingness to pay for biobased products
4) Level of circular behaviours adoption
5) Segmentation

Taken together, the data from sections 1, 2 and 3, collected through repeated measures, will allow to account for the reliability, speed of change and durability of the success of the intervention, while the data collected through section 4 will account for the generality and section 5 for the particularism of the intervention.

Before starting, the survey will provide a definition of biowaste:

Biowaste can be described as food waste (leftover foods, etc.), kitchen waste (vegetables and fruits scraps, etc.) and green waste (from garden, etc.).

The questions of the surveys are as follow, and described in more details in the following sections:

2.1.1 Attitude regarding urban biowaste as a local resource

This part of the survey will assess participant's perception of biowaste as a local resource. To do so, the specific **attitude** towards biowaste will be evaluated. An "attitude" is a psychological construct that is said to be developed from the beliefs people hold about the object of the attitude (Ajzen, 1991) and that should translate whether the individual evaluates the object as good or bad. Attitude can be observed through direct measures as well as through the evaluation of the beliefs associated with the object, here: the use of urban biowaste as a local resource. In this section, both type of measures will be implemented.

First, participants' specific **beliefs** regarding biowaste as a local resource will be assessed on a 7-point Likert scale:

Question 1: Beliefs associated with the use of biowaste as a local resource

Please indicate to what extent you agree with the following statement from "1-Completely disagree" to "7-Completely agree":

- Biowaste has no value
- Biowaste is just a useless substance
- Biowaste does not contain valuable nutrients anymore
- Biowaste can be turned into energy
- Biowaste can be recycled into valuable products
- Biowaste could replace fossil fuel

Second, a **direct measure** of the attitude towards the use of biowaste as a local resource will be done by asking participants to rank it on a continuum of bipolar adjectives that best describe their opinions (Icek Ajzen, 2006).

Question 2: Attitude regarding the use of biowaste as a local resource

What do you think about using biowaste produced in your city as a local resource to make new products (through a treatment and recycling process)? Please tick the circle that would best describe your opinion:

Using biowaste produced in my city as a resource to make new products is ...

- Useful   o o o o o o o   useless
- Harmful   o o o o o o o   beneficial
- Bad   o o o o o o o   good
- Dreadful   o o o o o o o   wonderful

2.1.2   Active participation in selective biowaste sorting

The active participation in selective biowaste sorting can be measured with several means. Some researchers have made use of participation rate, which consists of the number of participants compared to those who do not participate for a given location - municipality, community, city, etc. (e.g. Harder et al., 2006; Reams & Ray, 1992). However, this measure is confronted to practical issues in multiple family units and does not account for individual participation rate, as the unit of analysis is the location (Dai et al., 2016). Recycling tonnages (absolute amount in kg of waste selectively sorted), source separation ratio (the amount of biowaste selectively sorted compared to other waste) and the purity of waste (composition of the waste in terms of components that are correctly and faulty sorted) are other methods that have the advantage to be more objective but also have the disadvantage of not providing information on the individual participation rate. Further, they are highly time- and resource-intensive (Dai et al., 2016). The common denominator of these measures is that they require access to objective and comprehensive data for the sample studied. **After discussion with the pilot partner of Pilot 1, 5 and 6, it was concluded that this would not be feasible**. Therefore, the active participation in selective biowaste sorting will be assessed through self-reported participation rate.

Self-reported participation rate is the most widely used method to measure the active participation in sorting due to its relative facility to implement: it is less invasive, time consuming or expensive than the collection of objective data (Elimelech et al., 2018). However, the measure is criticized due to its lack of validity, following several studies documenting the inconsistency between self-reported behaviours and actual behaviour (Perrin and Barton, 2001; Williams and Kelly, 2003). Indeed, self-reported measures are based on the assumption that individuals can accurately estimate the extent to which they do sort their waste. Frequency-related questions, such as in Williams and Kelly's survey (2003), measured on a simple 4-point frequency scale from "not at all" to "all the time" might therefore not yield to valid data.

An attempt to render the self-reported participation rate more valid was made by Visschers and colleagues (2016) in their study on food waste. They asked participants to estimate the frequency and amount to which they dispose of certain items, classified in 11 food groups (fruits and berries; vegetables; potatoes and potato products; pasta, rice and corn products; meat; fish; dairy products; bread and rolls; sweet and savoury bakery products; fresh convenience meals; and processed vegetable and fruit products). The **frequency** was reported on a 6-point scale : "6-7 times per week"; "3-5 times per week"; "1-2 times per week"; "2-3 times per month"; "about once per month"; and "less often or never". The **amount** was reported on a 3-point scale: "more than 3 portions"; "2-3 portions"; "about 1 portion, ½ portion and less or nothing" – one portion was defined as one handful of food. However, the authors called for future research to validate their self-report measure with more objective data. This call has recently been answered by van der Werf and colleagues (2020) who demonstrated that this measure tends to underestimate food waste disposal.

We might argue that this type of measure, because it focuses on "general" or "average" behaviours, might represent a challenge for participants that have to estimate, on average how much and how frequently they discard of some products. Rather, we advise for a measure that reports daily waste discard. By targeting the measure on a short and recent time-period, participants might be better able to estimate with accuracy the frequency and/or amount of waste

they discarded. To be able to observe representative data of participants' life, this measure should be repeated over several days, and a mean score should be computed. Therefore, the **self-reported selective biowaste sorting behaviour** will be assessed 7 days in row through two questions (Question 3 and 4), adapted from Visschers and colleagues (2016). Question 3 assesses the quantity of the item discarded, approximated in handful. Question 4 assesses in which specific bin the item has been discarded - if the respondents has indicated "none" for one of the item, question 4 will not be displayed for the item. It has to be noted that these questions will therefore constitute one survey on their own, separated from the other questions which require only a one-time completion.

Question 3: Self-reported selective sorting – quantity per item (daily)

What type of waste have you discarded today? Please indicate the quantity discarded for each type of waste, approximated in handfuls.

If you **have not** discarded this item, you can let the default choice "none" selected and move on to the next item.

	Portions in handfuls					
	None	1 or less	2	3	4	5 or more
Fruits or vegetables (also scraps)	○	○	○	○	○	○
Pasta, rice or corn products	○	○	○	○	○	○
Meat or fish	○	○	○	○	○	○
Dairy products	○	○	○	○	○	○
Bread, rolls or bakery products	○	○	○	○	○	○
Processed or transformed foods	○	○	○	○	○	○
Diapers	○	○	○	○	○	○
Food plastic packaging	○	○	○	○	○	○
Food paper packaging	○	○	○	○	○	○
Tissues	○	○	○	○	○	○

Question 4: Self-reported selective sorting - specific bag/bin per item (daily)

Please indicate in which specific bag or bin (in your home) you discarded the aforementioned item.

	Specific bag or bin				
	Residual	Biowaste	Paper	Plastic	Glass
Fruits or vegetables (also scraps)	○	○	○	○	○
Pasta, rice or corn products	○	○	○	○	○
Meat or fish	○	○	○	○	○
Dairy products	○	○	○	○	○
Bread, rolls or bakery products	○	○	○	○	○

Processed or transformed foods	○	○	○	○	○
Diapers	○	○	○	○	○
Food plastic packaging	○	○	○	○	○
Food paper packaging	○	○	○	○	○
Tissues	○	○	○	○	○

To ensure that participants answer these questions every day for 7 days, a daily reminder will be sent to their email address. However, seen this method requires recurrent efforts and availability from the participants, we also consider other possibility of data collection, should the day-today basis inquiry leads to insufficient amount of data collected. To mitigate for a lack of sufficient data, and therefore, the impossibility to assess a change in selective biowaste sorting, we will integrate two questions in the survey as mitigation track.

First, the daily questions regarding selective biowaste sorting will be converted into weekly questions, adding a component of frequency to Question 3 and 4. This Question 5 will be displayed before Question 3 and 4, and if a participant indicates "never" discarding of that item, the item will be subsequently deleted from the next questions. Question 3 will also display two more choices ("6 and "7+") and will rephrase the question to assess the quantity discarded "in general".

Question 5: Self-reported selective sorting – frequency per item (weekly)

How often have you discarded each of these items in the last 7 days?								
				Frequency				
	Never	1/7	2/7	3/7	4/7	5/7	6/7	7/7
Fruits or vegetables (also scraps)	○	○	○	○	○	○	○	○
Pasta, rice or corn products	○	○	○	○	○	○	○	○
Meat or fish	○	○	○	○	○	○	○	○
Dairy products	○	○	○	○	○	○	○	○
Bread, rolls or bakery products	○	○	○	○	○	○	○	○
Processed or transformed foods	○	○	○	○	○	○	○	○
Diapers	○	○	○	○	○	○	○	○
Food plastic packaging	○	○	○	○	○	○	○	○
Food paper packaging	○	○	○	○	○	○	○	○
Tissues	○	○	○	○	○	○	○	○

Second, a general frequency question will be added, in the case respondents would not fulfil the previous questions.

Question 6: Self-reported selective sorting behaviour - general frequency

When you have to discard an item that can be identified as biowaste (food waste, kitchen waste or green waste) to what extent do you actually dispose of the item in the separate and dedicated bag/bin?

- o Never
- o Rarely
- o Sometimes
- o About half the time
- o Often
- o Most of the times
- o Always

2.1.3 Acceptance of urban biobased products

The acceptance of urban biobased products will be assessed through four elements: **beliefs** regarding biobased products; the general behavioural **attitude** regarding biobased products procurement; the **intention to buy;** and the **willingness to pay** for specific products.

Question 7: Beliefs regarding biobased products

Please indicate to which extent you agree with the following statement from "1-Completely disagree" to "7-Completely agree":

- - Products made out of recycled biowaste are unhygienic
- - Products made out of recycled biowaste are expensive
- - Products made out of recycled biowaste are of better quality than regular products
- - Products made out of recycled biowaste are safe to use

The general behavioural **attitude** of buying urban biobased products will be assessed through a direct measure.

Question 8: Attitude regarding the biobased products' procurement

What do you think about **buying** products that are made out of recycled biowaste? Please tick the circle that best describes your opinion:

I think buying products made out of recycled biowaste is ...

- - Useful   o o o o o o o   useless
- - Harmful   o o o o o o o   beneficial
- - Bad   o o o o o o o   good
- - Dreadful   o o o o o o o   wonderful

Further, the section will also assess the **intention to buy** biobased products. The intention is conceptualized as the most important antecedent and predictor of behaviour and indicates the extent to which individuals are willing to try and make an effort to perform a behaviour. In this sense, they translate the motivational factors that influence a specific behaviour. However, the link between intention and behaviour is only straightforward if the individual has a volitional control over the action, i.e. if the decision to act or not is under the individual's control (Ajzen, 1991). Elements such as personal capability (time, money, knowledge, etc.) and external factors

(availability, regulations, etc.) might hinder that process. The statements included in the measure of the intention to buy biobased products are thus formulated to take that aspect into consideration.

Question 9: Intention to buy biobased products

> Please indicate to which extent you agree with the following statement from "1-Completely disagree" to "7-Completely agree":
> - Given the opportunity, I would buy products made out of recycled biowaste
> - If my local shop or market starts to sell them, I would buy products made out of recycled biowaste
> - Would they be available to me, I would buy products made out of recycled biowaste

Finally, the **Willingness To Pay** (WTP) for biobased products will be assessed[3]. The WTP corresponds to the maximum amount of money a customer is willing to spend for a service or product. In this sense, the WTP represents the measure of the value that a person assigns to an experience in monetary units (Homburg et al., 2005). The WTP towards biobased products will be assessed through the use of "survey experiments", where respondents are randomly assigned to different conditions, while the researcher actively manipulates the treatment conditions (Gaines et al., 2007). More specifically, the WTP will be investigated through a "**vignette study**". A vignette is a short constructed description of an object, representing a combination of characteristics (Atzmüller & Steiner, 2010). Through their specific design, vignettes enable the presentation of both explanatory and contextual factors, leading to more realistic scenarios. Because the different characteristics of the vignette are systematically manipulated, vignette studies are a very powerful inference tool for causal link between factors and answers (Atzmüller & Steiner, 2010).

To assess the WTP for biobased products, scenarios staging different end-products foreseen to be the results of some of the WaysTUP! pilots are drafted – however, it is possible that they would change during the course of the project through discussion with the relevant partners. The scenarios will be presented to participants with two vignettes, one staging a normal, "mainstream" product, and another other staging the biobased product. The vignette presenting the normal product will always remain the same. The vignette describing the biobased product on the other hand could vary on several elements such as, for example[4] : (1) the **price** (equal, 25% lower, 50% higher) and (2) the **denomination** of the product ("biobased product" / "made out of recycled biowaste" / "made from local recycled resources"). The participants are then asked which product they would rather buy. By comparing the number of participants that chose the biobased product rather than the "mainstream" product, the willingness to pay will be assessed as a function of the variation on each parameter (here: price and denomination).

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[3] It is to be noted that this specific question (question 10) will only be included in the first post-test survey for two main reasons: (1) the introduction of this question in all of the surveys (pre-test, intermediate, post-test 1 and post-test 2) would lead, in this case, to the creation of 72 groups to compare, which would either be meaningless or require an astonishing amount of participants; (2) it would be more relevant to detail and specify the vignettes towards the end of the project, when the technical partners will have more information on the definite use of their products and the marketing strategy they would like to pursue.

[4] These elements are subject to change through the development of the project.

Question 10: Willingness to pay for biobased product (tentative example)

Today, you have to fuel your car. You arrive at the gas station and notice two pumps to choose from. The information panel shows you the following information:

Pump A	Pump B
Normal Fuel	This fuel is a biobased product / made out of recycled biowaste / made from local recycled resources
[local price] €/L	[to be defined] €/L
Compatible with all cars	Compatible with all cars
Quality Premium	Quality Premium

Which fuel do you buy?

You are going to your local craft store because you need to buy some paint for a DIY project you are making. Once at the store, you find two paints:

Paint A	Paint B
Paint	This paint is a biobased product / made out of recycled biowaste / made from local recycled resources
20 €/L	15 / 20 / 30 €/L
High coverage	High coverage
Odorless	Odorless
Easy application	Easy application

Which paint do you buy?

Some time ago you bought a new plant, which now needs to be re-potted. You do not have any plant soil available at home, so you decide to go to the store. There, you also decide to buy some soil fertilizer. After some search, you find two fertilizers:

Fertilizer A	Fertilizer B
Conventional /typical fertilizer	This fertilizer is a biobased product / made out of recycled biowaste / made from local recycled resources
7 €/L/Pack	5,25 / 7 / 10,5 €/pack
For strong roots	For strong roots
No chemical	No chemical
Pack of 5	Pack of 5
Good for all indoor plants	Good for all indoor plants
Good drainage	Good drainage
Active 100 days	Active 100 days

Which fertilizer do you buy?

You are at the grocery store and you are looking to buy some crackers. You are in the aisle and notice two interesting types of cracker:

Crackers A	Crackers B
Cracker	This insect-based cracker was made using biobased product / recycled biowaste / local recycled resources as feed for the insects
2 €/pack	
Pack of 30	1,5 / 2 / 3 €/pack
Flavourful and salty	Pack of 30
Fresh package™ for longer crisp	Salty and flavourful
	Fresh package™ for longer crisp

Which crackers do you buy?

2.1.4   Spillover

Pro-environmental behaviours have the tendency to "**spill over**" to other behavioural domains, as individuals have the urge to avoid inconsistencies in their beliefs, attitudes and behaviours (Thøgersen & Ölander, 2003). However, there has also been example of negative spill-over, also referred to as "moral licensing" when the costs of behaving primarily benefits others or the society to a large extent rather than the individual him/herself, leading the individual to perform in a less ecological manner for other behaviours (Tiefenbeck et al., 2013).

To investigate the potential "spillover" effect that the behavioural change intervention might have on other behaviour, this section of the survey will ask participants to rate the frequency to which they undertake various behaviours.

Question 11: Self-reported frequency on associated behaviours ("spillover")

Please indicate to which extent you have undertaken the following activities from "1-Never" to "7-All the time":

In the last month:

- I have sorted my paper waste in the paper bin
- I have sorted my plastic waste in the plastic bin
- I have sorted my glass waste in the glass bin
- I bought food in bulk (without packaging)
- I ate locally grown food
- I ate seasonally grown food

2.1.5   Segmentation

In this last section of the survey, questions enabling us to segment the sample will be asked. These questions will only be asked in the first pre-test survey and will be followed by an **identification question** (first two letters of the mother's first name - if none use xx; first two letters of the father's first name - if none use xx; numbers (2) of the month one was born; first two letters of the middle name - if none use xx) that will enable the research team to link each participant's contribution together.

First, the 'Six Americas Short SurveY' (SASSY), a 4-item survey derived from the longer 36-item Global Warming's Six Americas (GWSA), slightly modified to fit the pilot's situation (i.e. when "in America" was mentioned in items, it was systematically replaced by "in your country") will be used – as was the case in D4.2. As a reminder, the 36-item GWSA is a widely used segmentation tool developed by Maibach et al. (2009) that accounts for the variation of responses in the population regarding climate change, translating the need for a tailored approach for each segment. Recently, the scale was shortened to a 4-item version which was tested and validated by the same team of researchers – its segmentation performance being comparable to the longer version of the survey (Chryst et al., 2018) – which we selected for our segmentation. The GWSA identifies six distinct groups regarding their beliefs about global warming, their engagement with the issue, their actions and how they believe their government should handle the issue. Ranking from the segment that holds the highest belief in global warming and is the most concerned and motivated, to the one that hold the lowest belief in global warming and is the least concerned and motivated, the segmentation goes as follows: (1) alarmed, (2) concerned, (3) cautious, (4) disengaged, (5) doubtful, (6) dismissive. Through this segmentation, the effectiveness of the intervention will be assessed, investigating if the effect is comparable or different from one segment to the other.

Question 12: Six Americas Short SurveY (SASSY) 4-item segmentation

How important is the issue of global warming to you personally?

- Extremely important
- Very important
- Somewhat important
- Not too important
- Not at all important

How worried are you about global warming?

- Very worried
- Somewhat worried
- Not very worried
- Not at all worried

How much do you think global warming will harm you personally?

- A great deal
- A moderate amount
- Only a little
- Not at all
- I don't know

How much do you think global warming will harm future generations of people?

- A great deal
- A moderate amount

- Only a little
- Not at all
- I don't know

Further **demographic** questions will be asked to the respondents such as the age, gender, income, level of education and household composition of the respondents.

2.2 Qualitative inquiry

To complete the quantitative data collected through the web survey, a qualitative inquiry will take place after the completion of the analysis of the first post-test. The subjects investigated during the qualitative inquiry will be determined based on the results of the quantitative data. E.g. the subject of inquiry could be to understand a possible lack of self-reported change in regard to selective biowaste sorting, a negative spill-over detected on the other investigated behaviours, a lack of intention to purchase biobased products, etc.

The qualitative inquiry can take the form of a qualitative survey (e.g. open questions), focus groups or interviews. Based on the needs identified through the quantitative results, the best approach will be selected after the analysis of the first post-test.

3. Timing

The evaluation of the randomized controlled trials will be done through a **modified pre-test post-test plan** including a pre-test, an intermediate test and two post-tests.

(1) The **'pre-testing'** is foreseen to be implemented before the start of the first intervention, as such to provide us with a baseline measurement for the target populations (citizens and businesses) regarding our three 'change areas' (perception of biowaste; active participation in selective biowaste sorting; acceptance of biobased products). Taking into consideration the time needed to prepare the intervention (material, setting up events, contacting different stakeholders) and taking into consideration the summer holidays, the first evaluation point will start in September 2021 and is foreseen to last for a month, allowing a maximum of participants to take part.

(2) The **'intervention phase 1'** is foreseen to last 3 months and will take place between in the months of October, November and December 2021.

(3) The **'intermediate testing'** will be implemented at the start of January 2022, directly after the end of the 'intervention phase 1' and will provide **a monitoring** of the change for the target population. As for the pre-test, the testing period will last one month.

(4) An '**analysis and corrections**' period will then take place, analysing the results of the intermediate testing and comparing them with the baseline measures from the pre-testing. If the change measured is not satisfactory, corrections to the behaviour change intervention will be undertaken, and a new toolkit will be provided.

(5) The '**intervention phase 2**' will be launched for 3 additional months, in May, June and July 2022.

(6) A first '**post-test**' will be conducted directly after the end of 'intervention phase 2' in August 2022 and will collect the impact of the behaviour change intervention on the target population, comparing the results to the predefined behavioural targets (pre-test / post-test analysis).

(7) A second '**post-test**' will provide an evaluation of the long-lasting effect of the behaviour change intervention (durability analysis). This evaluation will take place 3 months after the end of the final intervention phase, in November 2022, and will assess whether the changes observed on the three behavioural objectives are sustained in time.
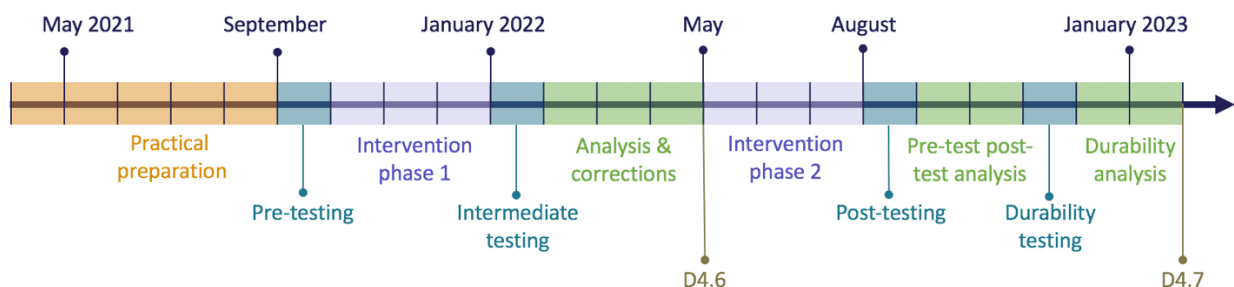
4. Incentives

Maximizing the response rate of self-administered survey is key to reach a certain level of internal and external validity in a study. Different methods exist to motivate individuals to take part in surveys such as repeated contacts, appeals, short survey forms and monetary incentives (Yammarino et al., 1991).

Within WaysTUP! the survey consists of two parts:

(1) a general survey that participants take once for each testing periods (pre-test, intermediate test, post-test 1 and post-test 2);
(2) a daily survey composed of two questions (question 3 and 4) that participants take every day for 7 days for each testing period.

Both surveys are kept as short as possible but drop-outs from testing period to testing period are always a possibility. To mitigate that risk, participants will receive reminders to complete the questionnaires for both surveys: for the general survey, participants will firstly receive an invitation, when the questionnaire is available, and then a reminder every week for a month until the completion; for the daily survey, participants receive an invitation each day in the evening to complete the survey.

Further, a monetary incentive will be used to increase respondent's motivation to fill in the questionnaires. Although this technique can increase significantly the costs of a survey, the use of monetary incentives has been proven to have a significant impact on the responses' rates (Jobber et al., 2004; Yammarino et al., 1991). Moreover, although some studies indicate that the use of incentives has no effect on the socio-economics characteristics of the sample, a few studies seem to indicate that it may increase the percentage of less educated, less interested or lower income individuals (Nederhof, 1983; James & Bolstein, 1990; Arzheimer & Klein, 1999 in Teisl et al., 2006) – which we do not consider as problematic but rather as beneficial, as it may balance out the usual profile of individuals engaged and interested in pro-environmental behaviour. Therefore, a "lottery incentive" will be implemented where participants will have the chance to win a 50€ voucher, with three possible winners per pilot cities, per testing period (total cost = 50 x 3 x 3 x 4 = 1800€).

Finally, participants will receive three free bags to start their biowaste sorting journey. The costs associated with these three bags per person depends on the number of the participants that will sign up for the study. It is estimated that a maximum of 900 participants will be included, resulting in a total cost of approx. 300€ total (approx. 11 eurocents per bag x 3 x 900).

In total, it is foreseen that the costs of the incentive should amount around 2100€ for the whole study.

5. Conclusions

This deliverable has laid down the evaluation methodology linked to the behaviour change interventions that is to be implemented in the three pilot cities of the WaysTUP! Project: pilot 1 – Valencia, 5 - Athens and 6 – Barcelona. The evaluation methodology aims to **assess the success of the behaviour change interventions in reaching the three behavioural target goals**: (1) improved biowaste perception >80%; (2) improved participation in selective biowaste sorting >60%; (3) improved acceptance of biobased products >75%.

To do so, the collection of data is performed through two means: quantitative and qualitative data. More specifically, the online self-administered survey will assess the attitude regarding the use of biowaste as a local resource, the active participation in selective biowaste sorting, the acceptance of urban biobased products, the spill-over to other types of behaviours and the profiles of the participants. The qualitative inquiry will be developed to answer more in-depth questions based on the analysis of the online survey.

The behaviour change intervention will be launched in two phases: phase 1 from October to December 2021 - followed by an intermediate testing and possible adjustment of the behaviour change toolkit - followed by phase 2 from May to July 2022, i.e. each phase will last for 3 months. To be able to assess the effectiveness of both intervention phases in reaching behaviour change on 5 components (reliability, speed of change, particularism, generality, durability), the online survey is foreseen to be implemented four times through: (1) a pre-testing in September 2021, (2) an intermediate testing in January 2022, (3) a first post-test in August 2022 and (4) a second post-test in November 2022. Reminders through emails and monetary incentives are foreseen to increase the participation rates.

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