

D1.4: Report on barriers for urban biowaste valorisation for biobased products (state of play)

WP1 – Identification of opportunities and barriers to utilisation of urban biowaste sources

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Executive summary

The first version of Deliverable 1.4 includes two basic parts focusing on primary and secondary research in order to catalogue the technological, the logistical, the regulatory and the cultural barriers related to urban biowaste valorisation for biobased products. More particularly, the deliverable introduces the methodological aspects of the primary research including the *extended questionnaire for barriers' evaluation*, the *stakeholders' identification* and the *final questionnaire's circulation plan*. The initial extended questionnaire included thirty-one questions for the three main barriers' categories i.e., cultural; technological and logistical; and regulatory barriers. The extended version of the questionnaire was circulated for internal evaluation by project partners who scored the *Cultural barriers* as the most important type of barriers, followed by the *Regulatory barriers* and finally by the *Technological and Logistical barriers*. Moreover, it was concluded that the final questionnaire will include a set of twelve questions/statements to be circulated to at least five hundred registered respondents from the following target groups: *Consumers, Business, Public authorities* and *Others*. Until now, one hundred and seventy respondents have been registered to the *stakeholder identification template* with the following distribution: 26 % from the public administration; 33 % from the business category; 19 % others and 12 % consumers. The survey circulation will take place for eighteen months through on-line and web-based means i.e., on-line survey, e-mail exchange and remote interviews.

In addition, the secondary research has identified policy, market, finance, cultural, technological and regulatory barriers. It was in the aim of the secondary research to gather information on the *overarching formal barriers and barrier categories* that impede the establishment both of circular economy and bioeconomy based on *selected reports and EU funded projects*. Based on the analysis conducted, differences are mainly uncovered during the break down of such broad categories into more specific ones. Another influential factor is the sample of respondents, as different perceptions can reinforce pluralism while at the same time increasing the risk of misunderstand on the same matter arising. It is also evident that many interconnections exist between the formal barriers towards the development of circular economy and the full exploitation of the bio-based sector. Reported barriers can be coherently organised under the three overarching categories of cultural, technological/logistical and regulatory; however, attention must be paid when integrating sector-specific barriers in broader categories such as the once identified in the case of circular economy. On the one hand, special attention needs to be paid not to oversimplify factors hindering biowaste valorisation while on the other hand, starting with broader categories of barriers can assist in encapsulating the respondents' perspective on specific issues.

This is a revised version of D1.4 derived from the comments of the Project Officer at the WaysTUP! 2nd Review Meeting held on 01/12/2022. Due to the proposed changes, this revised version has been created in order to include the methodology for interviewing selected stakeholders, and provide information on how they will be conducted, in order to compile the final version of this deliverable.

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List of Acronyms

| | |
|-------|--|
| BBE | Bio-based Economy |
| BBI | Bio-Based Industries |
| CBM | Circular Business Model |
| CE | Circular Economy |
| CEBM | Circular Economy Business Model |
| EC | European Commission |
| EU | European Union |
| FP7 | Seventh Framework Programme |
| H2020 | Horizon 2020 |
| GDPR | General Data Protection |
| IB | Industrial Biotechnology |
| ICT | Information and Communications Technology |
| R&D | Research and Development |
| REACH | Registration, Evaluation, Authorisation and Restriction of Chemicals |
| RED | Renewable Energy Directive |
| SME | Small and Medium Enterprise |
| WP | Work Package |

1. Introduction

1.1. Background

The concept underpinning **WaysTUP!** is to demonstrate the establishment of new value chains for urban biowaste valorisation for the production of higher value purpose products (i.e., bio-based products, including food and feed ingredients), through a multi-stakeholder approach in line with circular economy. The project will showcase a portfolio of new 'urban biowaste to bio-based products' processes starting from different feedstocks i.e., fish and meat waste, spent coffee grounds, household source separated biowaste, used cooking oils, cellulosic waste derived from municipal wastewater and waste treatment plants and sewage sludge.

In the context of WP 1 titled *Identification of opportunities and barriers to utilisation of urban biowaste sources*, the project will target to identify opportunities and barriers which are promoting or hindering urban biowaste exploitation. The main categories will include cultural, technological and logistical, as well as regulatory barriers. This work will take place in the context of Task 1.3 titled *Catalogue of technological, logistical, regulatory and cultural barriers related to urban biowaste valorisation for biobased products*. In particular, the main barriers categories will include:

- Cultural: lacking awareness and/or willingness to engage with the circular economy;
- Technological and logistical: lacking (proven) technologies to implement biowaste utilisation; and
- Regulatory: lacking policies that support a circular economy.

In order to achieve the objectives of Task 1.3 primary and secondary research will be performed. During primary research survey activities will take place involving relevant stakeholders from several group categories. Outcomes from the primary research will be evaluated in comparison to the results derived from the literature review (secondary research) and thus establish a set of recommendations so as to overcome these barriers.

Two versions of the report on barriers for urban biowaste valorisation for biobased products (D1.4) will be delivered. The present deliverable constitutes the first version. The second version will be provided at the end of the project (M47). In order to facilitate the work and be in line with the project's progress, the present version includes the methodological approach of Task 1.3 and the preparatory activities. Then the second version will present the results of the primary and secondary research and the final recommendations on barriers for urban biowaste valorisation for biobased products.

1.2. Structure of Deliverable 1.4

The first version of Deliverable 1.4 is organised as follows:

In *Chapter 1* titled *Introduction* (the present chapter), the *background* and the *structure of the report* is presented.

In *Chapter 2* titled *Methodological approach*, the overall methodology for cataloguing technological, logistical, regulatory and cultural barriers for biowaste valorisation are given.

In *Chapter 3* titled *Primary research on barriers for biowaste valorisation*, the methodological aspects of the primary research that will take place in the context of Task 1.3 is provided. More particular, *Chapter 3* includes the *developed survey (questionnaires and interviews)* for barriers evaluation, the *Stakeholders' identification* and the *survey's circulation plan*.

In *Chapter 4* titled *Secondary research on barriers for biowaste valorisation*, the results from the preliminary review of literature regarding challenges that have to be considered during urban biowaste valorisation for biobased products is illustrated.

The conclusions are drawn in *Chapter 5* titled *Conclusions*.

Finally, two (2) annexes are included. More particularly, in *Annex I* titled *1st version of the questionnaire* the internal evaluation process of questionnaire is presented while in *Annex II*: titled *Ranking analysis of the 1st version of the questionnaire* the results of the internal evaluation of the extended questionnaire are given.

References are provided at the end of this deliverable.

2. Methodological approach

The focus of Task 1.3 is twofold. Firstly, it aims at reviewing existing literature on barriers hindering the implementation of circular economy and bioeconomy through desk research. Secondly, the goal is to perform a primary research on the same issue, and then compare the results and establish a set of recommendations to overcome the barriers related to urban biowaste valorisation for biobased products. In order to implement the task, Task 1.3 is divided into nine (9) sub-tasks, those are:

1. Sub-Task 1.3.1: Implementation of a thorough review of literature and projects funded under FP7, H2020 and BBI Programmes regarding challenges that have to be considered during urban biowaste valorisation for biobased products.
2. Sub-Task 1.3.2: Development of a comprehensive questionnaire targeting to identify and reveal the cultural, technological and regulatory barriers related to urban biowaste valorisation for biobased products.
3. Sub-Task 1.3.3: Development of the methodology for conducting interviews with stakeholders in order to identify cultural, technological and regulatory barriers related to biowaste and biobased products.
4. Sub-Task 1.3.4: Stakeholders' identification including waste management authorities, waste converters, consumers, legislators and project's partners. These stakeholders will be targeted for the questionnaire survey, and the dedicated interviews.
5. Sub-Task 1.3.5: Preparation of a circulation plan to guide the questionnaire and interview implementation.
6. Sub-Task 1.3.6: Survey implementation activities, following the circulation plan (sub-task 1.3.5), targeting the identified stakeholders (sub-task 1.3.4) through the dissemination of the questionnaire (sub-task 1.3.2).
7. Sub-Task 1.3.7: Survey implementation activities, following the circulation plan (sub-task 1.3.5), targeting the identified stakeholders (sub-task 1.3.4) through the scheduling of interviews. (sub-task 1.3.3).
8. Sub-Task 1.3.8: Processing of results from primary and secondary research and prepare the recommendations.
9. Sub-Task 1.3.9: Task execution activities and Deliverable(s) preparation.

Based on the above-mentioned segmentation, a methodology has been set up for the overall Task implementation. Table 1 presents in detail the sub-task activities, the relevant deliverable version, the timeline, a brief description and the type of research performed.

Table 1. Methodology for Task 1.3 implementation

| Activities | Sub-task's activities | Timeline | Description | Research |
|---------------------------------------|-----------------------|---------------------------------|---|--------------------|
| Deliverable 1.4 | | | | |
| Detailed secondary research | 1.3.1 | M1 - M16 (Sub-Task end: M36) | <p>Conduct desk research and literature review on reports, studies and EU funded projects.</p> <p>Identify the most commonly cited key circular economy related barriers.</p> <p>Present key barriers on bioeconomy and bio-based products of various relevant EU funded projects.</p> <p><u>Ongoing sub-Task – continuous update</u></p> | Secondary Research |
| Questionnaire for barriers evaluation | 1.3.2 | M1 – M18 | <p>Methodology for questionnaire creation: from extended to final version of the questionnaire</p> <p>Questionnaire structure in segments for each category: cultural - technological and logistical – regulatory.</p> <p>Questionnaire preparation and validation.</p> <p>Creation of a comprehensive and well-designed questionnaire.</p> | Primary Research |
| Stakeholders' identification | 1.3.4 | M1 – M16 (Sub-Task end: M36) | <p>Stakeholders' identification methodological approach</p> <p>Creation of target group categories</p> | Primary Research |

| Activities | Sub-task's activities | Timeline | Description | Research |
|--|-----------------------|-----------|---|---|
| | | | Stakeholders' identification template Create the stakeholders' identification list Identification targets and metrics <u>Ongoing sub-Task with iterative methodological approach</u> | |
| Survey circulation plan | 1.3.5 | M16 | Develop circulation strategy Define the circulation means Define the circulation time plan Recognise the survey's implementation risks | Primary Research |
| Task execution activities – preparation of the first Deliverable | 1.3.9 | M1-M16 | Implementation of the specific sub-task activities: methodology deployment, assign sub-tasks to the Task working team, review, contacts, etc. Select input and combine feedback for elaborating the deliverable Draft Deliverable concluded for internal review D1.4: Report on barriers for urban biowaste valorisation for biobased products (first version) | Task implementation & Deliverable elaboration |
| Deliverable 1.6 (final) | | | | |
| Detailed secondary research | 1.3.1 | M16 – M40 | Update the desk research and literature review of reports, studies and EU funded projects. Update the most commonly cited key circular economy related barriers. | Secondary Research |

| Activities | Sub-task's activities | Timeline | Description | Research |
|--|-------------------------|-----------|--|------------------|
| | | | Update the key barriers on bioeconomy and bio-based products of various relevant EU funded projects. <u>Ongoing sub-Task – continuous update</u> | |
| Methodology of conducting interviews for barriers evaluation | 1.3.3 | M1 – M38 | Methodology that will be followed for conducting dedicated interviews Selecting the right framework/formats for conducting the interviews Description of different steps that will be followed. | Primary Research |
| Stakeholders' identification | 1.3.4 | M16 – M40 | Implementation of stakeholders' identification methodology Constant review of targets and metrics Expand stakeholders' identification list <u>Ongoing sub-Task with iterative methodological approach</u> | Primary Research |
| Survey and interviews execution | 1.3.5 1.3.6 1.3.7 | M18 – M42 | Survey implementation activities Circulation plan execution Conducting the interviews | Primary Research |
| Survey and interviews results' evaluation | 1.3.8 | M41 – M45 | Assess primary research outcomes Assess secondary research outcomes Analyse the survey's results Compare barriers emerged from primary and secondary research | Primary Research |

| Activities | Sub-task's activities | Timeline | Description | Research |
|---|-----------------------|----------|---|---|
| | | | Prepare recommendations | |
| Task execution activities – preparation of the second Deliverable | 1.3.9 | M16-M47 | Implementation of the specific sub-task activities Select input and combine feedback for elaborating the deliverable Draft deliverable concluded for internal review D1.4: Report on barriers for urban biowaste valorisation for biobased products (second version) | Task implementation & Deliverable elaboration |

The aforementioned activities will be in line with other Work Packages and will be supported by the project partners' communication channels and project pilots' initiatives. **DRAXIS** is leading this task in collaboration with **CIRCE**, **VAL** and **TiX**. Moreover, strong interconnection with **ETAM**, WP8 (Communication and Dissemination) leader, and with pilot partners will also take place as the task execution includes several interdependencies between WPs and project partners in terms of activities that has been or being implemented, as well as the dissemination initiatives which can provide useful data and possible communication routes. These interdependencies are summarised in Table 2 below, providing the contact information of project partners that will facilitate the task implementation.

Table 2. Task 1.3 interdependencies

| Sub-task activities | Interconnection with other WPs | Task interconnection | Contact person/ project manager |
|-----------------------------|---|--|---|
| 1.3.6 Survey implementation | WP3. Demonstration of urban biowaste utilisation through PILOTS operation | Pilots exploitation for questionnaire circulation purposes | Pilot leaders: P1: Jeronimo Franco jfranco@sav.es P2: Benjamin Mills-Lamptey ben@bio-bean.com |

| Sub-task activities | Interconnection with other WPs | Task interconnection | Contact person/ project manager |
|--|--|---|---|
| | | | P3: Santos Rojo santos.rojo@ua.es P4: Vladka Matušková vladka.matuskova@nafigate.com P5: Dimitris Malamis malamis.dimitris@gmail.com P6: Caterina Coll caterina@imecal.com P7: Nikolaos Nikolaidis nikolaos.nikolaidis@enveng.tuc.gr |
| 1.3.1 Detailed secondary research 1.3.8 Survey results evaluation | WP4. A behavioural change approach for the collection of urban bio-waste and usage of bio-waste derived products with citizens & communities | Task 4.1 Behavioural mapping exercise: Understanding current behaviours and perceptions of citizens and local communities and setting the scope | Task leader: IMEC Carina Veeckman carina.veeckman@imec.be |
| 1.3.1 Detailed secondary research 1.3.8 Survey results evaluation | WP5. Evaluation of PILOTS, end-products and new value chains from urban biowaste | Task 5.1 Technical evaluation of PILOTS and assessment of practical barriers | Task leader: BIOPOLIS Antonia Rojas antonia.rojas@adm.com |
| 1.3.1 Detailed secondary research 1.3.8 Survey results evaluation | WP5. Evaluation of PILOTS, end-products and new value chains from urban biowaste | Task 5.5 Assessment of regulatory aspects related to new value chains from urban biowaste | Task leader: BIOPOLIS Antonia Rojas antonia.rojas@adm.com |
| 1.3.1 Detailed secondary research 1.3.8 Survey results evaluation | WP7. Policy implications and recommendations | Task 7.1 Assessment of policy framework | Task leader: DRAXIS Katerina Valta katvalta@draxis.gr |
| 1.3.5 Survey circulation plan 1.3.6 Survey implementation | WP8. Communication and Dissemination | Task 8.2 Development of Communication and Dissemination tools and material | Task leader: ETAM Manolis Tsantakis mdt@etam.com |
| 1.3.4 Stakeholders' identification 1.3.6 Survey implementation | WP8. Communication and Dissemination | Task 8.3 Network of Interest | Task leader: ETAM Manolis Tsantakis mdt@etam.com |

| Sub-task activities | Interconnection with other WPs | Task interconnection | Contact person/ project manager |
|---|--------------------------------------|----------------------------|--|
| 1.3.4 Stakeholders' identification 1.3.6 Survey implementation | WP8. Communication and Dissemination | Task 8.4 Project workshops | Task leader: ETAM Manolis Tsantakis mdt@etam.com |

3. Primary research on barriers for biowaste valorisation

Primary research is a reliable method for finding the information of any kind of research, while getting conclusive primary data that are collected for a specific research theme, using procedures that best fit the research needs¹. Several types for primary research exist each of which serves a special purpose depending on the goal of the research. An established primary data collection strategy is the *survey*, which can be carried out in multiple ways so as to collect respondents' beliefs, attitudes, feelings, experiences or opinions.

Given that the goal of this research is to catalogue the technological, logistical, regulatory, and cultural barriers related to urban biowaste valorisation for biobased products, the survey method is considered a suitable method for implementing primary research using a representative sample of a defined target group. This will be achieved by circulating a comprehensive questionnaire to stakeholders i.e., waste management authorities, waste converters, consumers, and legislators. This systematic and science-based approach to stakeholder and policy interaction can provide researchers and research groups with opportunities to:

- Improve the relevance of their research through identification of societal problems and new perspectives;
- Enhance the quality of research through improved access to data; and
- Effectively communicate with stakeholders to enhance the possibilities that research results come into use and influence decision-making².

There are established frameworks for good communication between the researcher and the stakeholders which shall be embraced during the primary research. The ability to summarise the essence of the research and to use comprehensible language are essential elements during questionnaire's design. The ability to understand the target audience, their context and their perspectives is defined through stakeholders' identification activities. Such skills can improve the research process, the quality of the findings² and the uptake of an effective survey circulation strategy.

¹ Hox, J. J., & Boeije, H. R. (2005). Data collection, primary versus secondary.

² Slunge, D., Drakenberg, O., Ekblom, A., Göthberg, M., Knaggård, Å., & Sahlin, U. (2017). Stakeholder Interaction in Research Processes-A Guide for Researchers and Research Groups.

According to Burgess (2001)³, "*there is no other method of collecting survey data that offers so much potential for so little cost as web surveys*". Unlike traditional surveys, **online surveys** have become a mainstream data collection method that provide new-found opportunities such as increased response rates because of the convenience for the respondents, as well as ease of data gathering, automation in data handling and flexibility on the design⁴.

The initial plan was to enrich primary research with paper-based survey and in-person interviews. However, due to the Coronavirus disease 2019 (COVID-19) and the methodology selected from the working team, web-based survey is preferred as the basic form of primary data collection. The paper-based survey and in-person interviews can be also used as supplementary activities following, nevertheless, the same methodological approach, which is described in the following chapters.

Considering the above, as part of the primary research of Task 1.3 a questionnaire has been developed (sub-task 1.3.2) to facilitate primary data collection for Deliverable 1.4. This questionnaire will be circulated among targeted stakeholders (sub-task 1.3.4) following a circulation plan (sub-task 1.3.5) in order to select on-line feedback and compare the results to literature review outcomes (on-going sub-task 1.3.1) for establishing a set of recommendations to overcome the identified cultural; technological and logistical; and regulatory barriers related to urban biowaste valorisation for biobased products.

3.1 Questionnaire for barriers evaluation

Questionnaires constitute a traditional mean to conduct primary research, especially if the purpose is to address questions to a large and diverse group of people. The main goal of this research is to acquire a sufficient primary data, from waste management authorities, waste converters, consumers, and legislators, so as to evaluate the barriers related to biowaste valorisation.

Every questionnaire includes a written set of questions which is the essence of this primary research; therefore, it is crucial for the implementation of sub-task 1.3.2 to prepare a comprehensive and well-designed questionnaire by the time the survey implementation will initiate (Month 18). The working team with the active guidance of CIRCE⁵ (David Zambrana, dazambrana@fcirce.es) has developed the following methodology for the questionnaire design.

³ Burgess, T. F. (2001). A general introduction to the design of questionnaires for survey research. Leeds: University of Leeds.

⁴ Chang, T. Z. D., & Vowles, N. (2013). Strategies for improving data reliability for online surveys: A case study. *International Journal of Electronic Commerce Studies*, 4(1), 121-130.

⁵ <https://www.fcirce.es/en/>

3.1.1 Questionnaire design

Early stakeholder involvement can highly benefit the research process as they can facilitate understanding of the practical context of the research and the issues that the working team might face. In addition, cooperation with stakeholders at the early stages can provide with guidance on how to avoid misinterpretations⁶.

Hence, the initial stage of this methodology involves the WaysTUP! project partners as the foremost stakeholders on contributing to the questionnaire design. Firstly, an extended version of the questionnaire has been drafted (1st version), based on overview of existing barriers in line with the secondary research that is being conducted in parallel. Then, the extended version of the questionnaire was circulated for an internal evaluation from project partners to prioritise questions and conclude to a final version. The final version is the structure of final questionnaire as it will be used for the next steps of the task.

The methodological approach for creating this questionnaire included two (2) main activities:

- Preparation of the 1st version of questionnaire (drafting, structure, features, and limitations); and
- Internal survey execution with WaysTUP! project partners, questionnaire validation and prioritisation for the creation of the final version.

In the following figure the methodological workflow for the questionnaire design is illustrated.

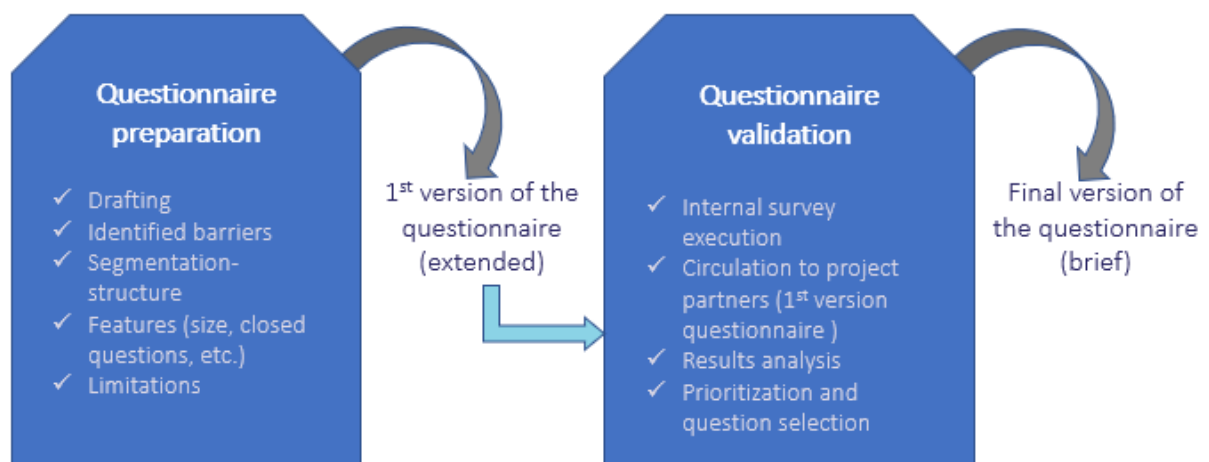


Figure 1. Methodological workflow for the questionnaire design

⁶ Slunge, D., Drakenberg, O., Ekblom, A., Göthberg, M., Knaggård, Å., & Sahlin, U. (2017). Stakeholder Interaction in Research Processes-A Guide for Researchers and Research Groups.

3.1.2 Questionnaire preparation

In order to prepare the questionnaire, a combined literature review of similar surveys has been executed by the working team. The secondary research which was implemented in parallel (see Chapter 4) provided useful information regarding the surveys implemented on biowaste valorisation and circular economy while it also provided recommendations on how to design the questionnaire. In addition, the questionnaire segmentation was based both on barriers categories and the profile of the participants, as the working team concluded to the main stakeholder categories. Therefore, the structured questionnaire contains the following three basic segments of barriers:

- **Cultural:** lacking awareness and/or willingness to engage with the circular economy;
- **Technological and logistical:** lacking (proven) technologies to implement biowaste utilization; and
- **Regulatory:** lacking policies that support a circular economy.

Having these three basic barriers sections in mind, the questionnaire integrates questions that are suitable for the main stakeholders' categories, as recognised in the Stakeholders' identification analysis (see Chapter 3.2). Stakeholders' categories are:

- **Consumers:** e.g., chemical, energy, food companies, consumers' communities and organisations;
- **Business:** e.g., waste management and biobased industries, commerce, and services;
- **Public authorities:** national/regional/local administration, waste management regulators and policy makers;
- **Others:** the scientific community (academic and research organisations) in the field of environment and waste management, waste and biomass valorisation, technology transfer and innovation.

The ultimate goal is to produce a comprehensive, concise and easy to complete questionnaire. The questionnaire will be the tool to conduct the primary data on the barriers for urban biowaste valorisation as the data can be collected relatively quickly and in a reliable way from a significant number of stakeholders. In this framework, the closed questionnaire has been selected due to the fact that it can provide responses which fit into the predefined categories and are focused on what the research examines.

In addition, these questions are practically barriers' descriptions in which the respondents will rate the importance of the statement using a scale. Rating scale questions display a scale of any range—from 0 to 10, 1 to 5, 0 to 100, etc.—and ask respondents to select the numerical point on the scale that represents their response best.

Closed and rating scale questionnaires have the advantage of providing answers which can be ranked and measured easily. The questions/statements are also standardised as all respondents are asked to respond to a given context. In this way, the participants provide information which can be easily converted into quantitative data, as the working team will be able to exploit answers using various analysis techniques. However, there are also limitations e.g., the lack of details as the responses are fixed, and the participants cannot express their opinion analytically. Such limitations will be assessed in the following period, while executing the survey.

Taking into account the above-mentioned parameters an extended 1st version of the questionnaire was developed by the working team in English to identify the level of relevance for specific barriers related to urban biowaste valorisation from cultural, technological, logistical and regulatory perspectives. The first version of the questionnaire is given in **Annex I**. The extended questionnaire contains thirty-one (31) questions provided through an online form of Microsoft Forms. Each question has five (5) options (from 1 to 5) depicting the opinion of the respondents regarding the importance of the question/statement. The ranking starts from 1 which corresponds to 'not important' and finishes with 5 which corresponds to 'very important'.

The 1st version of the questionnaire (extended) was distributed to the partners via an online survey tool that offers advantages such as the speed and effectiveness of data collection as well as data quality⁷. There is a number of survey platforms that allow the researcher to customise a survey. The working team has reviewed the most popular⁸ and compared their features and ratings to select the right one. Eventually, a well-established digital tool such as the selected Microsoft Forms selected for the internal survey circulation. Microsoft office forms are friendly to handle both by the user and the organiser. They also provide several features, with the most important to be the ability to structure the questions and establish discrete segments for the categories needed (cultural - technological and logistical – regulatory)⁹.

3.1.3 Questionnaire evaluation

From the 1st of September till the 30th of September 2020, the WaysTUP! project partners participated in the evaluation of the extended [online questionnaire](#), as their answers contributed into the assessment of the questionnaire.

⁷ Heiervang, E., & Goodman, R. (2011). Advantages and limitations of web-based surveys: evidence from a child mental health survey. *Social psychiatry and psychiatric epidemiology*, 46(1), 69-76.

⁸ Captera: free service that helps organizations find the best software for their needs (<https://bit.ly/331E7EU>)

⁹ Microsoft Forms: <https://support.microsoft.com/en-us/office/create-a-form-with-microsoft-forms-4ffb64cc-7d5d-402f-b82e-b1d49418fd9d>

The total number of participants in this survey including individual contributors and separate partners were twenty-one (21). The ranking analysis is provided in **Annex II**. The goal, as already mentioned, is to end up with a comprehensive online questionnaire, which will be further improved in order to be circulated to the Stakeholders.

Table 3 shows the general results for the three (3) main barriers categories i.e., i) cultural, ii) technological and logistical and iii) regulatory barriers. Statistically, the most important type of barriers according to the project partners are 'Cultural barriers' with ranking of 4.18. The second most important category is the 'Regulatory barriers' (3.97 out of 5) and finally the least important category is 'Technological and Logistical barriers' according to partners' scaling.

Table 3. Main barriers scores

| Type of Barrier | Average score <i>Ranking score from 1 to 5¹⁰</i> |
|---------------------------------------|--|
| Cultural barriers | 4.18 |
| Technological and logistical barriers | 3.59 |
| Regulatory barriers | 3.97 |

In the following table the five most popular (highest score) answers for each barrier category are recorded. These questions will compose the core content of the final questionnaire, as they are further specified in the final version and modified accordingly for a larger and diverse group of participants.

Table 4. Most important cultural, technological & logistical and regulatory barriers

| Most important cultural barriers | Average score <i>Ranking score from 1 to 5¹⁰</i> |
|--|--|
| Environmental issues | 4,67 |
| Health / safety issues | 4,62 |
| Awareness, public communication, and information campaign | 4.38 |
| Need of active participation of end-user | 4.33 |
| Knowledge about related issues, e.g., general knowledge about circular economy strategies and their environmental benefits | 4.33 |
| Most important technological and logistical barriers | Average score <i>Ranking score from 1 to 5¹⁰</i> |
| Supply risk or volatile price of raw materials | 4.00 |

¹⁰ The ranking is escalated from 1 - not important to 5 - very important.

| | |
|---|--|
| Not competitive price of end-product | 3.90 |
| Lack of collaboration platforms (R&D programmes, B2B collaboration, Public-private partnership) | 3.76 |
| Decision-making conflicts between local/regional/national entities | 3.76 |
| Possible new technology failure or malfunctioning | 3.48 |
| Most important regulatory barriers | Average score <i>Ranking score from 1 to 5⁰</i> |
| Environmental regulations and legislative regime in national level | 4,52 |
| Market regulation: Clear, transparent and consumer-protecting regulations that ensures customer rights and market rules | 4.24 |
| Use of land and Preserved areas regulations | 4.05 |
| Lack of legislative incentives: Subsidies, technical support, etc. | 3.95 |
| Lack of transparency in market rules and remuneration settlements | 3.86 |

3.1.4 Questionnaire Results

Having in mind the overall aim of the online questionnaire, the group of the participants and the questionnaire evaluation, the structure and the content of the questionnaire is slightly modified. Considering that the respondents constitute a diverse group of stakeholders, the working team elaborated the final questionnaire in order to draft the barriers' description in a more specific and comprehensive way. Moreover, some barriers have been merged.

The final questionnaire includes twelve (12) barrier-related questions/statements as the core content of the primary research. Table 5 presents an overview of the final questionnaire on cultural, technological & logistical and regulatory barriers. These questions will be incorporated in the web-based tool. The survey will be conducted based on the circulation plan (sub-task 1.3.5). The working team designs the online survey having the flexibility to add clarifying sub-questions, descriptions and use any additional survey feature that will facilitate stakeholders' participation.

Table 5. Final questionnaire on cultural, technological & logistical and regulatory barriers

| No | Most important cultural barriers derived from internal assessment | Further barriers' specification and inclusiveness |
|----|---|---|
| C1 | Environmental issues | Lack of environmental culture and misconceptions towards biowaste valorisation and biobased products in consumers, companies, and organizations |
| C2 | Health / safety issues | Possible issues on health and safety due to introduction of new biowaste valorisation practices |

| | | |
|----|---|--|
| C3 | Awareness, public communication, and information campaign | Limited awareness on urban biowaste valorisation for biobased products due to the lack of organized and effective awareness strategies |
| C4 | Need of active participation of end-user | Limited willingness for collaboration in the valorisation procedures due to consumers attitude and businesses rigidity |
| C5 | Knowledge about circular economy related issues, e.g., general knowledge about circular economy strategies and their environmental benefits | <i>This barrier has been merged with the C3 barrier description</i> |
| No | Most important technological and logistical barriers derived from internal assessment | Further barriers' specification and inclusiveness |
| T1 | Supply risk or volatile price of raw materials | Barriers associated with uncertainty of supply or volatility of feedstock in terms of cost, logistics and quality |
| T2 | Not competitive price of end-product | Lack of competitive biobased products in terms of cost, quality, and accessibility |
| T3 | Lack of collaboration platforms (R&D programmes, B2B collaboration, Public-private partnership) | Lack of cooperation and interaction between technological and business stakeholders in the value chains of for urban biowaste valorisation |
| T4 | Decision-making conflicts between local/regional/national entities | <i>This barrier has been merged into the T3 barrier description</i> |
| T5 | Possible new technology failure or malfunctioning | Lack of technical and technological background regarding circular models and biobased product design |
| No | Most important regulatory barriers derived from internal assessment | Further barriers' specification and inclusiveness |
| R1 | Environmental regulations and legislative regime in national level | Lack of policy harmonization and aligned regulatory regime between National and European legislations |
| R2 | Market regulation: Clear, transparent and consumer-protecting regulations that ensures customer rights and market rules | Lack of supporting market mechanisms for biobased products (e.g., bureaucratic public procurements, poor market legislation, lack of harmonized Intellectual Property regulations and certified labelling) |
| R3 | Use of land and Preserved areas regulations | <i>This barrier has been merged into the R1 barrier description</i> |

| | | |
|-----------|--|---|
| R4 | Lack of legislative incentives: Subsidies, technical support, etc. | Limited financial support for new investments and lack of incentives for scale-up biowaste valorisation projects |
| R5 | Lack of transparency in market rules and remuneration settlements | Lack of transparency in market rules, commercial framework and taxation |

3.2 Interviews for barriers evaluation

Interviewing is characterized as the strategy of research questions to collect both subjective and quantitative information¹¹. Researchers use this method in order to obtain information, gain insights into the research subject, or understand the related thoughts of the participants. In quantitative questions, participants answer providing measurable information, while subjective questions aim to get the respondents' perceptions of a particular theme. There are various strategies for collecting subjective information, such as documents reviews and diaries, nevertheless interviews are the most commonly used procedures for a meaningful collection of subjective information, as they provide a comfortable environment for participants to obtain the desired knowledge^{12,14}.

3.2.1 Interviews' approach and design

As indicated in Figure 2, the interview planning process involves two important elements. From one hand there is the process to conduct the interview, and on the other hand, there is the format that will be used^{11,12}.

¹¹ (Adams, Anne and Cox, Anna L. (2008). Questionnaires, in-depth interviews and focus groups)

¹² (Turner III, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. The qualitative report, 15(3), 754.)

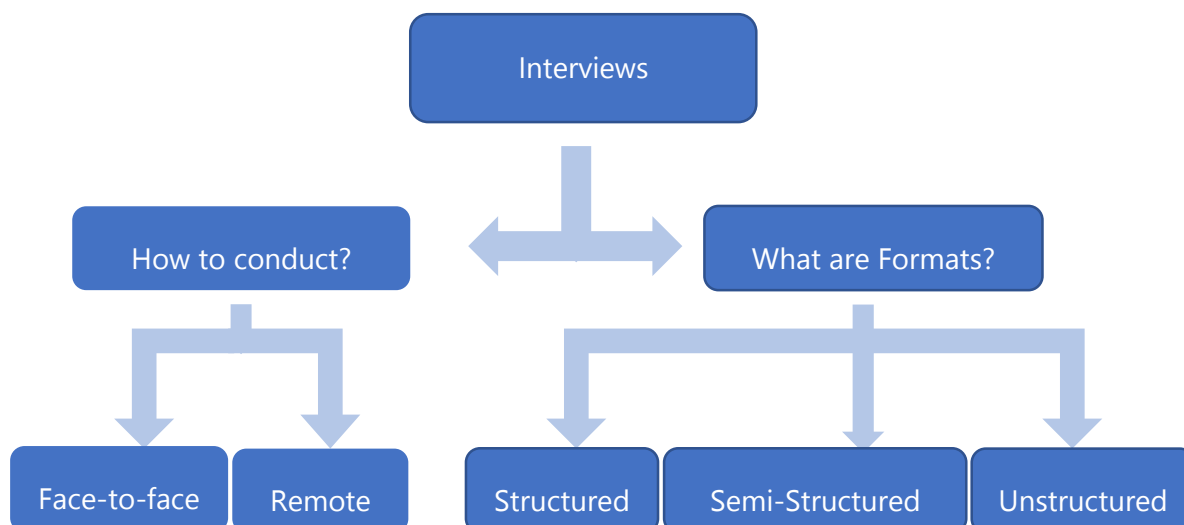


Figure 2. Interview design

As seen in the figure above, there are three (3) types of interviews format. An interview can be conducted in structured, semi-structured, and unstructured formats. Semi-structured and unstructured formats are used for qualitative research^{13,14}, and questions do not have to follow a specific format. In structured interviews, the questions are the same for all participants.

Structured method can be useful, as it helps to collect specific answers and reduce the time required. In addition, it facilitates the analysis of the results. Hence, this method is not suitable for qualitative research.

When using semi-structured techniques, interviews are based on the use of a questionnaire; however, interviewers are also free to ask further questions when needed¹³. In particular, interviewers can adapt the format, and the structure of the questions, and consider new ways of achieving the research objective. This method has the potential to collect both specific data and new insights. Yet, it requires experienced interviewers who can determine when, and how, to ask the relevant questions, and collect responses without losing data¹⁴.

Finally, interviews cannot be considered completely unstructured, and this is because a guide is required to lead to the research topic. The difference, however, is that the questions are more flexible and more indirect. Therefore, the interviewer starts with some general questions, based on the research question, and moves on to more specific ones. With this method, interviewers are not limited to a set of questions; instead, they can obtain data from unknown facts and various other information that are not included in a fixed questioner. When the

¹³ (Slade, S., & Sergent, S. R. (2018). Interview techniques. StatPearls Publishing LLC.)

¹⁴ Doody, O., & Noonan, M. (2013). Preparing and conducting interviews to collect data. Nurse researcher, 20(5)

interviewers have no experience, it is difficult to apply the unstructured interview format. It is also mandatory to interact with the participants, actively listen, take important notes, and ask specific questions.^{13, 14}

Lastly, as seen in Figure 2, communication with the respondents for the interviews can be done using various techniques. On the one hand, there are in-person interviews, which can be divided into individual or group interviews, and on the other hand, there is the remote method, which can be carried out by telephone or computer.¹³

3.2.2 WaysTUP! interviews' preparation

The goal of the interviews that will place in the WaysTUP! project is to help the research team to gather primary data on existing bio-waste and bio-based product barriers. The research team will develop a clear plan for how the interviews will be conducted, including the arrangements of scheduling and conducting the interviews, as well as the process for recording and transcribing the data.

Figure 3 illustrates the methodological workflow for the interview preparation.

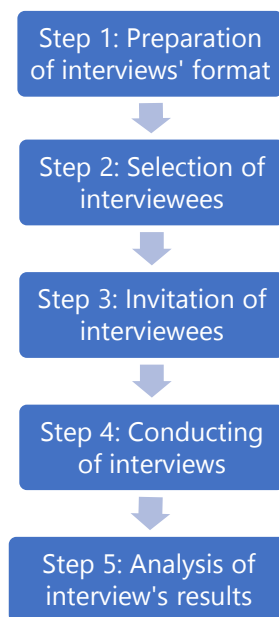


Figure 3. WaysTUP! Interviews' preparation

As presented above, the interview process is divided by the research team into the five (5) following steps:

Step 1: Preparation of interviews' format and content

The interviews will be semi-structured, including closed and open questions.

For the preparation of the format and content the research team will gather examples of existing questionnaires, which have similar objectives and aim to gather comparable information. For the preparation of the content, the on-line questioners will serve as a first base. In particular, the interview format will be developed based on the different barriers' categories that we have identified, of as well as the estimated profiles of the participants, based on the identified main stakeholder categories¹⁵.

Step 2: Selection of interviewees

The interviewees will include a number of stakeholders from various professional backgrounds, from a selection of project participating countries', and the rest of the European Union, as well as the project partners of WaysTUP! In particular, the list will include a number of players from industry, government, academia, civil society, and associations.

Interviewers will be selected appropriately, in order to have the envisaged experience and background and to be able to provide the necessary insights and information required for the study.

Step 3: Invitation of interviewees

The research team will first contact the selected interviewees to determine their willingness to participate in the interview.

Specifically, before conducting the interview, a comprehensive pre-questionnaire will be send to the interviewees in order for them to understand the purpose and the interview goal. The interviewees will also receive details regarding the interview's length and schedule.

Step 4: Conducting of interviews

Interviews with selected interviewees will be conducted both mostly remotely, depending on the availability of the interviewers, as well as their location.

The duration of each interview will be approximately one hour.

Step 5: Analysis of interview's results

Once the interviews are completed, the research team will gather and analyse all the obtained results in order to provide further input for the targeted report on bio-waste and bio-based product barriers.

¹⁵ (Turner III, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. The qualitative report, 15(3), 754.)

3.3 Stakeholders' identification

The main goal of the stakeholders' identification sub-task (1.3.4) is to elaborate a targeted group of stakeholders, as the recipients of the online final questionnaire. The identification activities are continuous until Month 34 of the project. The proposed methodology is an ongoing framework which will be followed for the constant update of the stakeholders list, supporting survey implementation sub-task (1.3.6).

The stakeholders' identification is also related to WP8 *Communication and Dissemination*, specifically to Task 8.3 *Network of Interest* and the *Deliverable 8.1 Dissemination and exploitation plan*, as will contribute to exploit the channels of communication (social media, newsletters, Press Releases, etc.), the dissemination activities (workshops, seminars, events, etc.), and the Network of Interest (targeted audiences). The members of the Task 1.3 working team are in collaboration with the WP8 Leader Manolis Tsantakis from ETAM¹⁶ (mdt@etam.com). In addition, the working team will cooperate with project partners especially with those partners that are involved in the project pilots. The pilots will take place within the WaysTUP! project aiming at demonstrating the WaysTUP! solutions, along with the logistics, allowing local partners to better involve the pilot actors as well as get the interest from other national stakeholders.

There are many ways to identify stakeholders. The most efficient way is to perform a gradually deployed methodology to ensure that all relevant stakeholders have been considered¹⁷. The proposed methodology identifies stakeholders organisationally, geographically, and professionally, depending on their involvement with the urban biowaste valorisation for biobased products.

The expected outcome of stakeholders' identification is a complete stakeholder registration form as the main mechanism to recognise the potential participants to the primary research on barriers for biowaste valorisation. The working team by the end of this sub-task will have the pertinent information on stakeholders.

3.3.1 Methodology

The proposed methodology for the identification of stakeholders and the establishment of a targeted group of stakeholders is divided into three main activities as follows:

¹⁶ <https://www.etam.gr/en/home/>

¹⁷ Bryson, J. M. (2004). What to do when stakeholders matter: stakeholder identification and analysis techniques. *Public management review*, 6(1), 21-53.

- **Stakeholders' identity data collection:** It is the identification of all possible individuals and organisations that can have interest in urban biowaste valorisation for biobased products. The stakeholders' contact details data collection is performed via:
 - Established contact lists from WaysTUP! project activities and Network of Interest – WP8;
 - Pilot areas of WaysTUP! project, refer to the cities of Valencia (Spain), London (United Kingdom) (UK), Alicante (Spain), Prague (Czech Republic), Athens (Greece), L'Alcúdia (Spain), Terni (Italy) and Chania (Greece);
 - WaysTUP! Project's partners and their stakeholders' contacts; and
 - Stakeholders that have already identified and participated in the survey.

It goes without saying, that a priority of the working team in this activity is to contact the identified stakeholders in order to ask for their permission to be included as potential respondents of the questionnaire so as to be in line with the Regulation (EU) 2016/679 (General Data Protection Regulation).
- **Stakeholders' data classification:** It is the process in which the identified stakeholders are categorized in terms of their role (target groups), geographical scope, conditions of participation, and their expertise description. This activity is very important due to the need of a diverse group of stakeholders for statistical purpose, which will increase the credibility of the primary research. Therefore, it has been created a predefined template for stakeholders' registration, as well as a target group categorisation.
- **Stakeholders' connection establishment:** In this activity the working team aims at establishing a preferred communication channel with every stakeholder for obtaining their feedback from online questionnaire. The preferred communication channel for each or groups of stakeholders will be chosen in relation to the stakeholders' profile and the circulation plan (sub-chapter 3.4). An important part of this connection establishment is the level of the interaction that the working team will choose to develop with the stakeholders.

The above-mentioned activities are strongly related to the *Stakeholders' categories* (see chapter 3.3.2) and the *Stakeholders' identification list* (see chapter 3.3.3) which is the main outcome of the identification sub-task. The overall methodological process is an iterative procedure which will be repeated several times in order to acquire a representative stakeholders' list and a balanced sample for the survey. For this reason, the working team has set *identification targets and metrics* (see chapter 3.3.4) that drives the effort of the sub-task into the proper track. Figure 4 depicts the iterative methodological approach for the identification of stakeholders. This method incorporates the basic scheme of registration template and group categorisation and metrics feedback.

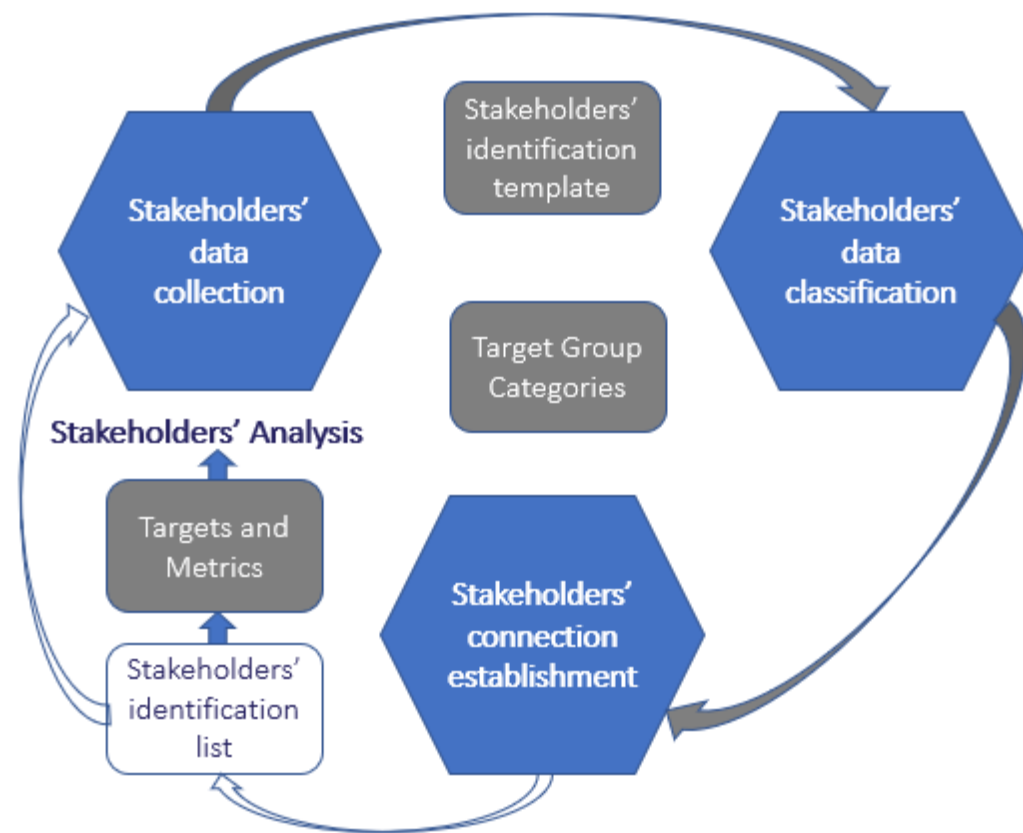


Figure 4. Methodological approach on Stakeholders' Identification

3.3.2 Target group categories

Stakeholders' identification process incorporates target group categorisation that includes waste management authorities, converters, consumers and legislators. The target group categorisation offers the appropriate structure in the identification process which will facilitate the survey circulation process as well. In addition, the identification list that will be created through the identification methodology will contain clustered data for the following stakeholders' categories:

- **'Consumers category'** is the category of stakeholders that are potentially the main consumers of the biobased products from urban biowaste valorisation. Primarily there are various chemical, energy and food companies, as well as consumers communities and organisations.
- **'Business category'** is the group of stakeholders that are involved into the collection of waste and the conversion into final product. There are various waste management and biobased industries, commerce, and services.

- **'Public authorities target group'** incorporates national and/or regional and/or local administration including but not limited to Ministries, Regions, Municipalities, Unions, Associations, etc.) that manage or supervise waste and/or wastewater utilities, as well as waste management regulators and policy makers.
- **'Others category'** is a relatively broader category which includes Academic and Research community (Universities, Institutes, Research Centres, Laboratories and Scientific societies) in the field of environmental and waste management, waste and biomass valorisation, technology transfer and innovation.

3.3.3 Stakeholders' identification template

The goal of the stakeholders' identification template is to receive, organise and standardise the information collected on potential survey participants. This standardised form of registration provides multiple advantages such as credibility and data accuracy. Keeping an registry of contacts in a template form offers the ability to the working team to analyse and evaluate metrics even if there are some deficiencies in quality and quantity of information. The fields of the template are chosen carefully for the best description of the registered Stakeholder as they include information as follows:

- Contact details of the provider of the information (project partner or stakeholder);
- Name of the identified stakeholder (Organisation, Entity, Company);
- Short description of stakeholder's activity related to project or urban biowaste valorisation;
- Country (Nationality of the stakeholder);
- Geographical area of stakeholder operation;
- Likelihood to establish communication: *In your opinion, the collaboration with the stakeholder can be easily achieved/ could be possible/ would be hard to get.* Select from drop-down menu;
- Collaborated in the past: *Yes/No* (declare previous collaboration with the proposed stakeholder);
- Other comments.

The contact details of the proposed stakeholder such as: name of representative, email, phone, skype id, etc. are part of the Stakeholders' identification template. However, due to the GDPR¹⁸ requirements, the contact data are in possession of the project working team and the project partners that provided the information. All Stakeholders that are or will be included in the


¹⁸ General Data Protection Regulation: <https://gdpr.eu/>

identification template are aware that sharing of their contact details in compliance to General Data Protection Regulation rules.


In the following figure the stakeholder's identification template is depicted. Using this template, the working team collected the contact information for the survey distribution according to the circulation plan. This template will be the final stakeholders' registration list as well. The template is divided into four segments for each of the target group category: 'Consumers', 'Business', 'Public administration', and 'Others', as it is asked from the provider of information to cluster the stakeholders into these categories and fill in all template's requirements. The providers of information are:

- established contact lists from WaysTUP! project activities and Network of Interest – WP8;
- pilot areas of WaysTUP! project, refer to the cities of Valencia (Spain), London (United Kingdom) (UK), Alicante (Spain), Prague (Czech Republic), Athens (Greece), L'Alcúdia (Spain), Terni (Italy) and Chania (Greece);
- WaysTUP! project partners and their stakeholders' contacts;
- stakeholders that have already identified and participated in the survey.

Stakeholder's identification template



| | | | | |
|--------------------------------|---|---|--------------|---------------------|
| | Providers info: Select your organization <small>For WaysTUP! partners selection from dropdown menu</small> | <small>For independent Stakeholders</small> | | |
| Provider's Contact info | Name | Last Name | Email | Phone number |


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The project team is committed to ensuring the security and protection of the personal information that we process, and to provide a compliant and consistent approach to data protection. If you have any questions related to our GDPR compliance, please contact the Work Package leader or the Project Coordinator.

Figure 5. Stakeholder's identification template: Provider's contact information

| CONSUMERS: Final product consumer (companies, consumers communities and organisations) | | | | | | | |
|--|---|---|---|---|---|--------------------------|----------------|
| Identified stakeholder | Contact details (Name of representative, email, phone, skype id, etc.) | Short description of stakeholder's activity related to project or urban biowaste valorisation | Country (Nationality of the stakeholder) | Geographical area of stakeholder operation | Likelihood to establish communication: In your opinion, the collaboration with the stakeholder can be easily achieved/ could be possible/ would be hard to get. Select from drop-down menu | Collaborated in the past | Other comments |
| | | | | | | | |
| BUSINESS: Waste management and biobased industries, commerce, and services | | | | | | | |
| Identified stakeholder | Contact details (Name of representative, email, phone, skype id, etc.) | Short description of stakeholder's activity related to project or urban biowaste valorisation | Country (Nationality of the stakeholder) | Geographical area of stakeholder operation | Likelihood to establish communication: In your opinion, the collaboration with the stakeholder can be easily achieved/ could be possible/ would be hard to get. Select from drop-down menu | Collaborated in the past | Other comments |
| | | | | | | | |
| PUBLIC AUTHORITIES: national/regional/local authorities, waste management regulators and policy makers | | | | | | | |
| Identified stakeholder | Contact details (Name of representative, email, phone, skype id, etc.) | Short description of stakeholder's activity related to project or urban biowaste valorisation | Country (Nationality of the stakeholder) | Geographical scope of stakeholder operation | Likelihood to establish communication: In your opinion, the collaboration with the stakeholder can be easily achieved/ could be possible/ would be hard to get. Select from drop-down menu | Collaborated in the past | Other comments |
| | | | | | | | |
| OTHERS: NGOs, Universities, Institutes, Research Centres | | | | | | | |
| Identified stakeholder | Contact details (Name of representative, email, phone, skype id, etc.) | Short description of stakeholder's activity related to project or urban biowaste valorisation | Country (Nationality of the stakeholder) | Geographical scope of stakeholder operation | Likelihood to establish communication: In your opinion, the collaboration with the stakeholder can be easily achieved/ could be possible/ would be hard to get. Select from drop-down menu | Collaborated in the past | Other comments |
| | | | | | | | |

Figure 6. Stakeholder's identification template: Registration information

3.3.4 Identification Targets and Metrics

Table 6 depicts the target set for primary research on barriers for urban biowaste valorisation for biobased products. This target is indicative and can be updated based on how the primary research progresses.

Table 6. Target for primary research on barriers for urban biowaste valorisation for biobased products

| Identification Target | No |
|---|-----|
| Identified Stakeholders (registered in identification template) | 500 |
| <i>Target for survey participants (Stakeholders respond to survey): 100</i> | |

The target has been set following the primary research context and the basic principles of statistics. The sample size can vary in relation to the credibility of the research. The sample size

for organizational research is proposed to involve at least 100 participants¹⁹. Accordingly, and taking into account literature, the response rate of an internet-based survey, which is the main circulation mean in this primary research, is estimated around 20%²⁰. Thus, the minimum target for the registered stakeholders in the final identification template is 500.

The identification process will be implemented in parallel with the circulation of the survey. Metrics will reflect the qualitative evaluation of the research progress and the targets the quantitative progress. This approach provides the flexibility to the working team to guide the research to the preferred direction.

Table 7. Targets for primary research on barriers for urban biowaste valorisation for biobased products

| Identification Metrics | Goal |
|---|---|
| Type of Stakeholder (Target group categories) | Consumers 25%, Business 25%, Public authorities 25%, Others 25% |
| Stakeholders' nationality (country) | Stakeholders from 27 EU countries |
| Stakeholders' area of operation (geographical area) | EU/Non-EU ²¹ |
| Stakeholders' likelihood to establish communication (according to the provider of information assessment) | |

The metrics will help the working team to monitor the research direction and take corrective actions if needed. Hence, the metrics proposed above will be monitored every three months in order to validate the progress of the research, as the evaluation of the target will be performed every six (6) months starting from M17, when the circulation of the on-line questionnaire will occur. An indicative plan for targets and metrics evaluation is given below.

Table 8. Identification metrics and targets evaluation time plan

| Identification metrics evaluation | Due Month | Project Month |
|--|---------------|---------------|
| Selection of web-based survey tool | April, 2021 | M20 |
| 2 nd metrics evaluation | July, 2021 | M23 |
| 3 rd metrics evaluation and target update | October, 2021 | M26 |
| 4 th metrics evaluation | January, 2022 | M29 |
| 5 th metrics evaluation and target update | April, 2022 | M32 |

¹⁹ Kotrlik, J. W. K. J. W., & Higgins, C. C. H. C. C. (2001). Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information technology, learning, and performance journal*, 19(1), 43.

²⁰ Deutskens, E., De Ruyter, K., Wetzels, M., & Oosterveld, P. (2004). Response rate and response quality of internet-based surveys: An experimental study. *Marketing letters*, 15(1), 21-36.

²¹ EU/Non EU" indicates whether the organisation of registered individuals is based in a country that is a member of the European Union or not.

3.3.5 Results

The working team is in the process of collecting feedback for stakeholders' identification sub-Task. All contacts will be included in the list only after having their permission in line with the GDPR. The 1st metrics evaluation and targets' update are planned to be launched on 30 March 2021 while the 2nd metrics evaluation will be launched on June of 2021. A preliminary research conducted until the end of November 2020 resulted in 170 stakeholders as potential entries to the identification list. The overall evaluation until December 2020 is presented to the following table.

Table 9. Evaluation metrics and targets – December 2020

| | |
|---|--|
| Target evaluation – December 2020 | No |
| Identified Stakeholders (registered in identification template) | 170 |
| Identification Metrics evaluation – December 2020 | Goal |
| Type of Stakeholder (Target group categories) | Consumers: 21- 12 % Business: 56 – 33 % Public authorities: 60 36 % Others: 33 – 19 % |
| Stakeholders' nationality (country) | <u>Stakeholders from 10 EU countries</u> France, Belgium, Greece, Czech Republic, Slovak Republic, Spain, Austria, Italy, Portugal <u>Stakeholders from 5 Non-EU countries</u> <i>UK, Switzerland, Serbia, Turkey, Thailand</i> |
| Stakeholders' area of operation (geographical area) | EU/Non-EU 10/5 |
| Stakeholders' likelihood to establish communication (according to the provider of information assessment) | Would be hard to get: 55 Could be possible: 79 Can be easily achieved: 13 No info: 23 |

3.4 Survey's circulation plan

Based on the specifications of the research and the initial mapping and analysis of stakeholders, it is crucial to establish an interaction formula with the stakeholders, and also allocate the adequate resources and time for the circulation purposes. The Task working team incorporates a circulation plan in the implementation methodology that fits the research process and builds on the strengths of the project activities.

This circulation plan (sub-task 1.3.5) is drafted to maximise opportunities for the dissemination of the survey as part of the primary research, as will ensure that stakeholders can contribute to, and act in the direction of participating in the survey on barriers for urban biowaste valorisation for biobased products.

3.4.1 Dissemination of the survey

The circulation strategy mainly foresees the direct contact with the stakeholders who are recorded on stakeholders' identification list. On-line and web-based means of communication will be applied in order to promote the dissemination of the survey. The preferable means of communication include:

- **On-line survey tool:** communication with minimum interaction via a shared online survey link;
- **e-mail exchange:** communication with medium interaction via e-mail;
- **Remote interviews:** communication with maximum interaction via on-line means.

In more detail, a web-based survey offers advantages such as the speed and cost-effectiveness of data collection as well as data quality acquisition²². There are number of survey platforms that allow the researcher to customise a survey and conduct the primary research, using automation both in survey dissemination and results processing.

The working team based on previous experience favours the EUSurvey platform²³. An online survey management system for creating and publishing forms available to the public such as user satisfaction surveys and public consultations. EUSurvey provides a wide variety of elements used in forms, ranging from the simple multiple-choice questions to the advanced editable spreadsheets and multimedia elements. EUSurvey platform incorporates a number of features namely: Customisable forms, Dependent questions, Direct invitations from the

²² Heiervang, E., & Goodman, R. (2011). Advantages and limitations of web-based surveys: evidence from a child mental health survey. *Social psychiatry and psychiatric epidemiology*, 46(1), 69-76.

²³ EUSurvey Platform: <https://ec.europa.eu/eusurvey/home/welcome>

application, 23 of the official EU languages, Advanced privacy, Offline answering, etc. In addition, it provides several management tools that will help the researchers to analyse, visualize, publish and elaborate questionnaire results.

An important element of the EUSurvey is that the platform supports 23 official EU languages. As the original version of the questionnaire was developed in English, the circulation plan proposes that the questionnaire should be also translated into the project pilot languages: Spanish, Czech and Greek. This is expected to increase participation and facilitate participants to easily answer the survey, taking into account that a great number of Stakeholders will be identified by the WaysTUP! pilots.

The final selection of the web-based survey tool will be determined at the beginning of sub-task 1.3.6 *Survey implementation*, when the questionnaire will be adapted into the survey platform.

Finally, as presented above, the dissemination of the questionnaire can be also promoted through e-mails and the scheduled interviews on-line. These means of communication may be used by the working team for particularly focused audiences that will strengthen the primary research by ensuring better sample distribution. The dissemination via email will be accompanied with a direct and personal message that will encourage the recipient to participate. In rare occasions, in which a stakeholder's contribution assessed as necessary, the working team can arrange an interview via teleconference.

3.4.2 Survey circulation time-plan

The survey circulation will take place from M18 to M42. This is a sufficient timeframe in which the circulation strategy can be deployed. The survey execution plan will be implemented based on the circulation time-plan presented in Table 10.

Table 10. Survey circulation time-plan

| Metrics evaluation | Due Month | Project Month |
|--|--|------------------------|
| Selection of web-based survey tool | February, 2021 | M18 |
| Circulation of the online survey | From February 2021 to February, 2023 | M18 - M42 |
| Stakeholders identification activities | From <i>September 2019</i> to February, 2023 | M1 ²⁴ - M42 |

²⁴ Stakeholders' identification activities are part of the ongoing sub-task 1.3.4 that overlaps Survey implementation activities. It is mentioned in the survey circulation time-line due to the importance of the activity and the interaction between those sub-tasks.

3.4.3 Circulation risk management

This circulation plan adopts risk management in order to ensure that the mitigation actions can be taken on time in order to resolve issues before they impact the survey circulation realisation, and where this is possible to reduce the risk.

The working team will oversee the risks and monitor the required risk mitigation activities. During the survey circulation, the potential risks which may endanger the successful outcome of the sub-task will be recognized in terms of:

- Realisation schedule;
- Quality of the work delivered; and
- Technical and scientific content of the work performed

Alongside, the risk analysis will monitor:

- The probability of the risk and
- The potential impact

After the analysis of the potential strategy for mitigation, the risk avoidance and/or other reactions to risk handling is defined. The risk is allocated to the Task Leader. The Task Leader in cooperation with the Work Package Leader are the most adequate persons to monitor the risk and implement mitigation actions when needed. At this moment, the following risks are identified and discussed below.

Table 11. Survey implementation risks

| Risk number | Description of risk | Likelihood | Impact | Proposed risk-mitigation measures |
|-------------|---|------------|--------|--|
| 1 | Limited number of stakeholders identified | Medium | High | Intensive stakeholders' identification activities through project partners, project pilots and alternative identification channels such as stakeholders that have already identified and participated in the survey. |
| 2 | Insufficient feedback collected from stakeholders | Medium | High | Implementation of a more interactive circulation strategy, using medium and maximum interaction processes: personal e-mail exchange and teleconference interviews. Update of the questionnaire structure. Use of an alternative web-based survey tool. |
| 3 | Limited number of respondents | Medium | High | Intensive stakeholders' identification activities. Implementation of a more interactive circulation strategy, using medium and maximum interaction processes: personal email exchange and mainly on-line interviews. Translate questionnaire into more European languages. |

4. Secondary research on barriers for biowaste valorisation

It is true that several concepts and policies developed by the European Union (EU), such as resource efficiency and circular economy, are closely interconnected with bioeconomy. The European Commission (EC), in its recently updated Bioeconomy Strategy, has acknowledged bioeconomy as the “renewable segment of the circular economy”²⁵, underpinning this way the strong linkage between circular economy and bioeconomy and bio-based products. In addition to this, the EC states that bio-based sector does have potential for innovative chemicals, materials and processes, which is identified as an “integral part of circular economy”²⁶. However, simply realizing the bio-based sector’s potential cannot pose any change by itself. Thus, it is essential to identify the barriers hindering the transition from potential to actual opportunities and the full exploitation of new business models focusing on circular economy and bioeconomy.

The interrelation and the acknowledged linkages between circular economy and bioeconomy as well as bio-based products serve as a point of departure for the analysis to follow. Therefore, it is in the aim of this secondary research to gather information on the overarching formal barriers and barrier categories that impede the establishment both of circular economy and bioeconomy without moving on an exhaustive list of repeating categorisation approaches. Additionally, at this stage of research it is out of the scope of this first version Deliverable to provide a detailed and in-depth analysis of existing barriers with regard to technology type, supply sector and bio-based products. For this reason, the information included in this report have been collected from selected reports and EU funded projects. In particular, this chapter is organized in two sections both based on desk research and literature review of reports, studies and EU funded projects. In the first section the most commonly cited key circular economy related barriers are analysed based on desk research of various studies. In the second section key barriers with regard to bioeconomy and bio-based products are presented based on desk research of various relevant EU funded projects.

²⁵ European Commission (2018) A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment-Updated Bioeconomy Strategy. https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf

²⁶ European Commission (2015) Closing the loop - An EU action plan for the Circular Economy, COM/2015/0614 final <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614>

4.1 Barriers towards Circular Economy

This is the first section of the current chapter covering the barriers that hamper the development and establishment of Circular Economy. The aim of this section is to highlight the most common barriers attributed to the adoption of the circular economy concept. Additionally, interest is focused on how various barriers are organized and categorized into broader thematic areas. For this, in the paragraphs to follow key barrier categories and category-specific barriers are analysed. The outcomes of five (5) concise and recent studies were selected to be included in this first version of this Deliverable.

According to Rizos et al. (2016)²⁷ there are seven broad barrier categories that prevent small and medium-sized enterprises (SMEs) from adopting circular economy business models (CEBMs). The first barrier category identified was “company environmental culture” which refers to the philosophy and attitudes within the company both in managerial and employee level. In both cases, it seems that moving towards circular economy is affected by habitual and perception conflicts that keep companies in their conventional business practices. “Lack of capital” is another decisive factor that acts as a barrier for most SMEs. Adopting circular economy business models requires a great amount of both time and money. High upfront costs as well as uncertainty in the payback period prevents SMEs from investing in such business models as they are more sensitive in additional costs than large enterprises.²⁷ In addition, the emerging need for continuous improvement of the product’s lifecycle requires significant number of resources to ensure commitment both by the employees and the customers. These issues are reinforced by the limited access to finance for the SMEs. It is difficult for SMEs to access both external (e.g., EU) and commercial bank financing taking also into consideration lack in financing methods for innovative business models. The need for monitoring brings up another barrier category, this of “administrative burden”. This refers to monitoring and reporting procedures that are complex and usually not affordable for SMEs. In addition to this, circular business models may call for more complex and high-cost management and planning processes.²⁷

Moving on, another common barrier category is “lack of government support/effective legislation”. One major issue is the lack of coherent and concrete legislative framework as well as limited funding opportunities and ineffective taxation system. Furthermore, absence of appropriate “market signals”, such as raw material prices and externalities, further impedes SMEs from adopting circular economy approach in their operations. Finally, circular business

²⁷ Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyke, T., ... & Topi, C. (2016). Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, 8(11), 1212.

models opportunities are rarely integrated in innovation policies.²⁸ “Lack of information” is another important issue arising when it comes to implementation of circular economy. Collaboration and information exchange between the different stakeholders are prerequisites for the successful transition to circular economy. Competition and confidentiality issues hampers the distribution of knowledge and information among companies. Moreover, lack of practical knowledge arises as a result of lack of records on successful circular practices due to the limited application of circular business models.²⁸

“Lack of technical and technological know-how” can impede SMEs from moving into circular practices. Transforming the well-established linear business models requires skilled professionals to integrate new production and consumption technologies. Factors such as increased complexity of materials mixes in new products, lack of advanced resource efficiency technologies and lack of investments with regard to circular operations and product design do have a role to play in SMEs being stuck in business models they are familiar with. Lastly, as it has already been mentioned collaboration between the different factors of the value chain is a determinant factor for the successful development of circular economy. “Lack of support from the supply and the demand network” is identified to hamper such a development. On the one hand there is the demand network, where lack of consumers’ awareness with regard to benefits of green products inhibits the shift of habits and consumption choices. Consumers are greatly affected by norms and external conditions making it difficult to predict their response towards such products. On the other hand, there is the supply network, where reluctance of suppliers and service partners to be a part of new circular business models is recorded. This is a result both of stakeholders’ mindset and managerial issues arising, such as complex and costly procedures.²⁸

A survey within a sample of SMEs, that have already integrated circularity, was distributed by Rizos et al. (2016) including the seven barrier categories previously identified. In the following table the results of the survey are included in order of decreasing citation frequency of barriers by the respondents along with some key points.

²⁸ Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., ... & Topi, C. (2016). Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, 8(11), 1212.

Table 12. Overview of barrier categories in order of decreasing citation frequency by the respondents of the survey²⁸

| Category | Description |
|--|---|
| Lack of support from the supply and the demand network | <ul style="list-style-type: none"> • Absence of “green” suppliers • Sectors with correlated high environmental impact • Provision of accurate evidence related to the benefits of green products • Consumers mindset and misconceptions towards circular economy and green products |
| Lack of capital | <ul style="list-style-type: none"> • Difficulties in attracting the necessary funding from traditional banks • Lack of financial opportunities or alternatives to private funds • Bankers reluctance and difficulty understanding the commercial potential of the circular economy |
| Lack of government support/effective legislation | <ul style="list-style-type: none"> • Lack of effective legislation • Lack of support from local authorities |
| Administrative burden | <ul style="list-style-type: none"> • Complex systems and long procedures for certifications, labels and standards |
| Lack of technical and technological know-how | <ul style="list-style-type: none"> • Gap in employee skills and lack of knowledgeable people |
| Lack of information | - |
| Company environmental culture | - |

According to Ritzén and Sandström (2017)²⁹ barriers hindering the transition towards Circular Economy can be organized in five broad categories and nine sub-categories. Their study focused on **organizational barriers** that product-oriented manufacturing firms face moving from a linear to a circular economy and which are directly linked to the integration of new perspectives and different domains. **Little understanding of and knowledge on CE** seems to be an important barrier within an organization. Additionally, both lack of information distribution across the different departments of organisations and unclear attribution of responsibilities towards adopting circular business models act as dominant structural barriers. It appears that organizations did **not** seem **willing to take large risks** and **disruptive changes** which results in limited adoption of circular business models. This hesitation in adopting circular business models, also, arises from several financial barriers. Respondents seem to question the occurring **revenue flows** especially since moving towards CE will require **changes within the**

²⁹ Ritzén, S., & Sandström, G. Ö. (2017). Barriers to the Circular Economy—integration of perspectives and domains. *Procedia Cirp*, 64, 7-12, <https://doi.org/10.1016/j.procir.2017.03.005>.

organization and its departments, investments and time. The technological barriers identified were related to **quality issues** and **changes in the product design**. Respondents were hesitant about the integration approach of the required changes into the production process as well as the quality of the recycled materials. These barriers are significantly enforced by **the role** each organization has **in the value chain** and their **market outreach**.²⁹ The barriers identified by Ritzén and Sandström (2017) are presented in the following table.

Table 13. Categorisation of barriers towards CE by Ritzén and Sandström (2017)

| Category | Sub-category |
|---------------|--|
| Attitudinal | Perception of sustainability |
| | Risk aversion |
| Financial | Measuring financial benefits of circular economy |
| | Financial profitability |
| Operational | Infrastructure/ Supply chain management |
| Structural | Missing exchange of information |
| | Unclear responsibility distribution |
| Technological | Product design |
| | Integration into production processes |

Focusing more on the eco-innovation pathway towards a circular economy, de Jesus and Mendonça (2018)³⁰ have concluded in four main factors that constraint the development of circular economy, namely “Technical”, “Economic”, “Institutional” and “Social”. Moving a step further, “Technical” and “Economic” barriers have been identified as **hard barriers**, while “Institutional” and “Social” as **soft barriers**. Having as a point of departure hard and soft innovation, hard barriers are linked with the ability to force change while soft barriers refer to achieving change through values and practices that eventually will shape their attitudes³⁰. Technical factors include barriers related to the available technologies, the technological gaps and the required skills for the transition to a more circular organizational model. de Jesus and Mendonça (2018) underlie that though there are available technical solutions from the production phase to recycling and waste management and information and communications technologies (ICTs), yet establishing circular economy depends on the **combination of these technologies**. The existence of appropriate technologies does not however ensure their entry in the market due to economic and market limitations. Investments are limited due to high costs and market uncertainty. **Lack of supportive financial tools** is decisive factor when it comes to investments within circular economy, especially for SMEs. Moreover, it is crucial to only to

³⁰ de Jesus, A., Mendonça, S., (2018). Lost in transition? Drivers and barriers in the ecoinnovation road to the circular economy. Ecol. Econ. 145, 75–89. Available at: <http://www.sciencedirect.com/science/article/pii/S0921800916316597>

bridge the gap between innovation and production as well as processes and product development but also to ensure the involvement of **specialized personnel**.³⁰ Moving on to *soft* barriers, policy and regulation along with consumers' awareness and education are considered important factors acting both as drivers and as barriers for the development of circular economy. **Conflicting policies, limited institutional and regulatory framework** and **misaligned incentives** are the main policy related barriers hampering the establishment of circular economy. Furthermore, consumers seem to lack information and education on the concept of circular economy as well as the alternative choices, in terms of habits and businesses, they have in this context, which is directly linked to policy gaps concerning consumers' awareness.³⁰

Table 14. Overview of the barriers towards CE typology by de Jesus and Mendonça (2018)

| Category | Sub-category |
|---------------------------|--|
| Economic/Financial/Market | Large capital requirements, significant transaction costs, high initial costs, asymmetric information, uncertain return and profit |
| Technical | Inappropriate technology, lag between design and diffusion, lack of technical support and training |
| Institutional/Regulatory | Misaligned incentives, lacking of a conducive legal system, deficient institutional framework |
| Social/Cultural | Rigidity of consumer behaviour and businesses routines |

Adopting de Jesus's and Mendonça's conceptual categorisation of barriers, but not their distinction in hard and soft ones, Kirchherr et al. (2018)³¹ identified circular economy barriers focusing on the EU region through literature review and survey on a large sample of businesses and policy-makers. They have resulted in a framework consisting of four barrier categories and fifteen barriers. Moreover, they do note that the included barrier categories have various possible interaction effects and can be considered to be nested. Based on their survey, it was found that cultural rather than technological barriers are the most pressing ones impeding the transition towards circular economy. Cultural barriers that refer to consumers' and **company's culture** relate to them being stuck in linear business models. Companies are a lot of times hesitant in abandoning their linear approach and **consumers' habits**, stemming from their interest and level of awareness, is a crucial factor for businesses to adopt circular business models. Moreover, one should not overlook the fact that in order to reach full circularity it is not enough for a company to adopt a circular economy approach, if its **entire supply chain** does not do so. Market barriers appeared to be the second most prominent ones. **Low prices of virgin raw materials** and **high investment costs** of embracing circular economy hinder circular

³¹ Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the circular economy: evidence from the European Union (EU). *Ecological Economics*, 150, 264-272, <https://doi.org/10.1016/j.ecolecon.2018.04.028>.

products from competing their linear counterparts. These later barriers are somehow induced by regulatory barriers. Current **laws and regulations** as well as **lack of financial support** obstruct the diffusion of circular products in the market thus hindering the adoption of a more circular approach by businesses. Finally, technological barriers did not appear to be perceived as core barriers. This is evaluated by the authors as a “promising finding” since the existence of appropriate technologies can assist in intervention strategies delivering results in the short- and medium-term.³¹

Table 15. The “coding framework” for barriers towards CE in EU by Kirchherr et al. (2018)

| Category | Sub-category |
|--|---|
| Cultural: <i>Lacking awareness and/or willingness to engage with CE</i> | Hesitant company culture |
| | Limited willingness to collaborate in the value chain |
| | Lacking consumer awareness and interest |
| | Operating in a linear system |
| Market: <i>Lacking economic viability of circular business models</i> | Low virgin material prices |
| | Lacking standardization |
| | High upfront investment costs |
| | Limited funding for circular business models |
| Regulatory: <i>Lacking policies in support of a CE transition</i> | Limited circular procurement |
| | Obstructing laws and regulations |
| | Lacking global consensus |
| Technological: <i>Lacking (proven) technologies to implement CE</i> | Lacking ability to deliver high quality remanufactured products |
| | Limited circular designs |
| | Too few large-scale demonstration projects |
| | Lack of data, e.g., on impacts |

Bianchini et al. (2019)³² have identified several barriers that hamper the practical implementation of Circular Business Models (CBMs), both internal and external, and have organized these under five broad categories. Although it is not in the scope of their article to further analyse circular economy barriers, yet they provide a useful coherent overview of existing barriers which is very much in line with everything mentioned above. Nevertheless, they do underlie the importance of participation, collaboration, coordination and communication of different stakeholders in the context of circular economy. In addition to this, it is highlighted that in order to implement circular economy a network of data and information

³² Bianchini, A., Rossi, J., & Pellegrini, M. (2019). Overcoming the Main Barriers of Circular Economy Implementation through a New Visualization Tool for Circular Business Models. *Sustainability*, 11(23), 6614.

is crucial as it allows businesses to better capture the opportunities occurring and create a circular economy strategy.³²

Table 16. Categorisation of barriers limiting the implementation of Circular Business Models by Bianchini et al. (2019)

| Category | Challenges |
|--------------------------------------|--|
| Internal Process | Organizational capabilities necessary for implementing circular business across different organizational functions |
| | Efforts in terms of business strategy definition and company structure |
| | Need for new organizational competences (e.g., team motivation, organizational culture, participation) |
| Technical | Need for technical and technological know-how and expertise |
| | Adoption of specific technologies (e.g., recycling technologies) for the redesign of circular products and production systems maintaining the same quality level |
| | Development of methodologies and procedures for dissemination of innovation without excessive delay between design and diffusion phases |
| Market | Stakeholder relationship: compatibility with partner business models; lack of supply network support; geographical dispersion, poor services and infrastructures, conflict of interest within companies and misaligned profit-share along supply chain |
| | Customer acceptance: specific restrictions, rigidity in customer behaviours and business routines |
| Institutional, regulatory and social | Misaligned incentives |
| | Complexity of regulations, lacking conducive legal system and poor institutional framework |
| Economic and financial | Need for high long-term investments |
| | Costly management and planning processes due to more complex practices |

4.2 Barriers under relevant EU funded projects

It is within the project's aim to establish and achieve a system change with parallel actions along the value chain rather than a purely sector and/or product focused approach. For this, gaining a better understanding and further knowledge of relevant initiatives on research and innovation as well as demonstration actions, that have been completed or are currently being developed in the EU by receiving public funding, is needed. Therefore, the second section of the secondary research is dedicated to the review of EU funded projects that support and promote the deployment of bio-based products, in order to identify the barriers that have been reported. The aim of this step is to collect information on the barriers that have been identified in different context and by various groups of stakeholders within the value chain to be further utilized in designing the questionnaire.

Seven EU funded projects have been selected to further present and analyse their outcomes in this first version of the Deliverable. These projects and their respective reviewed Deliverables, as presented in the following table, were selected as the most suitable samples to highlight the main barriers with regard to bioeconomy and bio-based products. Nevertheless, this does not imply that other EU funded projects will not be studied or taken into consideration as this Task progresses. For now though, it should be noted that it is out of the scope of this first version to go more in detail concerning technology and product-specific barriers. The aim is to gain an overview of high-level barriers and explore the linkages with the ones identified in the previous section before moving on to a more detailed study and analysis.

Table 17. Overview of the selected Deliverables of relevant EU funded projects analysed in this report

| Project acronym | Reviewed Deliverable | Year |
|------------------|---|------|
| BIO-TIC | The bioeconomy enabled: Summary of Hurdles and Solutions | 2015 |
| | The bioeconomy enabled: A roadmap to a thriving industrial biotechnology sector in Europe | |
| KBBPPS | Deliverable 5.3: Market entry barriers | 2015 |
| BIOWAYS | Deliverable 2.1 Bio-based products and applications potential | 2017 |
| | Deliverable 2.4 Public perception of bio-based products – societal needs and concerns (updated version) | 2018 |
| BioBase4SME | Needs and challenges of companies in the bioeconomy in NW Europe | 2019 |
| R ² π | Deliverable 6.2: Summary of Key Factors of CEBM | 2019 |
| RoadToBio | Strategy document | 2019 |
| POWER4BIO | An overview of suitable regional policies to support bio-based business models (Deliverable 4.2) | 2020 |

4.2.1 BIO-TIC

The **BIO-TIC**³³ project focuses on the hurdles hindering the **Industrial Biotechnology's (IB) potential** based on the analysis of five business cases. In the framework of the project, three roadmaps have been produced, namely the "Market roadmap", the "Technology roadmap" and the "Non-technological roadmap", providing a thorough identification and analysis of the innovation hurdles in Industrial Biotechnology. The "Market roadmap" serves as an umbrella research for the two roadmaps to follow providing an overview of areas of hurdles to focus further on. Thus, the "Technology roadmap" focuses on hurdles related to the Research and Development (R&D) areas in order to expand the potential of IB in Europe. Additionally, the "Non-technological roadmap" focuses on market entry barriers, through an analysis of various regulatory and non-technological bottlenecks. The project findings resulted in four broad thematic areas, namely "*Feedstock*", "*Technology*", "*Markets*", and "*Innovation System*", under which the various hurdles examined in the aforementioned roadmaps were organized.³³

Starting with the "Feedstock" thematic area, the identified hurdles are related to the **feedstock availability**, mainly focusing on high costs. On the one hand, **high feedstock costs** are observed in the European Union mainly due to seasonality, complex regulations and high operating and labour costs. On the other hand, the various uses of feedstock in conjunction with high demand in the market and subsidies can also lead to increased feedstock prices. This cost rise is strengthened by the needs for imported feedstock which are accompanied by trade barriers and high import costs depending on the feedstock. Apart from the feedstock costs, it is also mentioned that the collection, transportation and storage **infrastructure is not sufficiently developed** thus limiting the available feedstock. With regard to the "Technology" thematic area, the identified hurdles are focused on Bioconversion and Downstream Processing. It is argued that the bioconversion processes per se are of limited "*yield, productivity and robustness*" having a direct impact on the economic competitiveness of the products. It is noted that due to variability in the feedstock quality both products and waste streams do not have a consistent quality, thus making it difficult to up-scale.³³

Moving on to the "Markets" thematic area, the hurdles identified are related to four categories, i.e. "Low cost-competitiveness versus fossil products", "Investment barriers and financial hurdles/capital requirements", "Definition of bio-product is unclear which makes it difficult to communicate the benefits", and "Poor public perception and awareness of bio-based products". The increased costs of feedstock and production processes have a great impact on the **competitiveness** of bio-based products compared to their fossil fuel counterparts. As a result, bio-based products have limited potential in entering the market without support. Moreover, market entry for bio-based products is challenged by the **regulatory constraints**,

³³ BIO-TIC Project (2015), The bioeconomy enabled: A roadmap to a thriving industrial biotechnology sector in Europe

such as REACH procedures, as well as the **lack of awareness in consumers**. The lack of a coherent strategy on bio-based products and a common understanding on key issues and terms prevents from communicating the benefits of such products.³³

Last but not least, comes the thematic area of “Innovation systems”, in which the identified hurdles fall under six categories, i.e. “Investment barriers and financial hurdles/capital requirements”, “Investment barriers and financial hurdles/ confidence requirements”, “Human resources”, “Inefficient collaboration”, “Intellectual Property (IP)”, and “Sustainability barriers”. The main barriers in this case appear to be the lack of **access to finance**, **collaboration** between various stakeholders and **regulatory obstacles**. Moving further to a commercial stage of production is a challenge for most companies as there is lack of public funding to support them. Given the nature of this field, companies have to face high costs of patenting as well as the lack of harmonized regulation concerning Intellectual Property. In addition to this, it is noted that collaboration between companies and the academia is not yet well established leading to a limited competitiveness of the sector.³³

Table 18. Summary of hurdles identified in the BIO-TIC project

| Hurdles | | |
|---|---|---|
| Feedstock | Feedstock availability | Costs of feedstock produced in Europe are too high compared to other regions |
| | | Pellets are heavily subsidised (bio-energy subsidies) which may contribute to price fluctuations |
| | | Seasonability of biomass cropping versus need of continuous feedstock supply is a major problem |
| | | Logistics: inefficient transport and distribution of biomass |
| | | (High) import costs for certain types of feedstock |
| | | Fluctuating feedstock quality and price which has the potential to affect the whole value chain |
| Technology | Bioconversion and Downstream Processing | The yield, productivity and robustness of many (bio) conversions is still too low to make processing economically competitive |
| | | Genetic engineering has proven to be a costly and time-consuming process |
| | | Water removal in (bio)conversion process is still very costly and not fully optimized |
| | | Advanced bioreactor equipment is often lacking hindering process integration and CAPEX |
| | | Lack of integration of (bio)conversion, product recovery and downstream processing together |
| | | Lack of continuous fermentation systems hamper the economics of the bioconversion processes |
| Lack of predictive models to aid scaling up | | |

| Hurdles | | |
|---|--|---|
| | | Difficult to produce product, by-product and waste streams with consistent and uniform quality when utilising second generation feedstocks with wide ranging specifications |
| Markets | Lower cost - competitiveness versus fossil products | Limited availability of low-cost feedstocks |
| | Investment barriers and financial hurdles/capital requirements | Lack of mechanisms/incentives compensating for poor cost competitiveness |
| | | Untapped potential of IB in developing new functionalities |
| | | Long time to market because of regulatory constraints |
| | | Different understanding of definition "bioproduct" across regions and stakeholders |
| | Definition of bio-product is unclear which makes it difficult to communicate the benefits | Lack of common agenda for bioproducts development - incoherent policies and regulations |
| | Poor public perception and awareness of bio-based products | Negative messages in the media on GMO and biofuels may influence the perception of IB |
| Advantages of biobased products are not visible enough/ unclear definitions | | |
| Investment barriers and financial hurdles/capital requirements | Limited availability of public R&D funding for demonstration and commercial plants | |
| | Limited access to finance for spin offs and start-ups | |
| | Limited access to finance for SME | |
| | Limited financial support for new production facilities | |
| | Limited financial support for new production facilities and too long return on investment time | |

| Hurdles | | |
|--|--|--|
| Innovation systems | Investment barriers and financial hurdles/ confidence requirements | Lack of visible tangible products and blockbusters |
| | | Lack of investor confidence |
| | Human resources | Lack of HR with right skills and curricula |
| | Inefficient collaboration | Insufficient cooperation and knowledge exchange between the parties in the value chain |
| | | Difficulties to establish operational alliances between industry and academia |
| | | Regional funding conditions hinder establishment of international networks |
| | Intellectual property (IP) | High patent costs hinder start-ups and SME |
| | | Lack of harmonised IP regulation |
| | Sustainability barriers | Difficulties in implementing the sustainability agenda and life cycle thinking in policies, and lack of coherent policy framework for sustainability |
| | | No general consensus on important definitions of the bioeconomy |
| No commonly accepted "sustainability" certification system | | |

4.2.2 KBBPPS

The KBBPPS³⁴ project ("Knowledge Based Bio-based Products' Pre-Standardization") focuses on the barriers hindering the **market entry** of bio-based products. Two broad market entry barrier categories are identified, **technical** and **non-technical**. In particular, the project takes into consideration 26 product categories and the barriers they face in terms of regulations, norms and standards due to their technical properties, referred to as technical barriers. In addition to this, some non-technical barriers in the process chain stemmed out. Concerning the technical barriers resulting from standards and norms, based on the survey conducted, these were identified as follows:³⁴

- "Commonly used product specifications are not addressing favourable bio-based properties"

³⁴ KBBPPS – Knowledge Based Bio-based Products' Pre-Standardization Project (2015), Deliverable 5.3 Market entry barriers, <https://www.biobasedeconomy.eu/app/uploads/sites/2/2017/03/Market-entry-barriers.pdf>

- “Commonly used product specifications cover properties that are not really necessary for or related to product functionality, but these are not fulfilled by bio-based products”
- “Bio-applicability is missing due to “old thinking” in terms of conventional products”

The results indicated that not all bio-based products face the same technical barriers. Furthermore, the results showed that some do not face these specific barriers at all. These are bio-based products, such as bio-PET, that have identical chemical and technical properties as their fossil fuel counterparts, as well as bio-based products that have already been successful in the market, such as starch based filling chips. No matter the case, it has been noted that **uniform standards and regulations** can promote the market access of bio-based products by reducing consumers’ doubts on safety and functionality issues and by facilitating the integration of bio-based products in public authorities’ procurement.³⁴

With regard to the non-technical barriers identified in the KBBPPS Projects, these fall under four areas: Political framework, Marketing/Image/Information, Finance and Standards/Labelling. In more detail, based on the answers of the participants, five barriers were identified under the Political framework area, eight under the Marketing/Image/Information area and six under the Finance area, while more general statements were made about the Standards/Labeling area. With regard to the Political framework area, the main barrier appears to be the “conflict” between **material and energy use of biomass**, with the later been supported by the Renewable Energy Directive (RED) of the European Commission. Respondents noted that feedstock demand for energy use (bio-energy & biofuels) leads to **increased prices**, which cannot be met by the material use since there is lack of incentives, resulting in market distortions. **Lobbying, fragmented policies** and **difficult admission procedures for new chemicals through REACH** were also mentioned as barriers under the Policy framework area. For the Marketing/Image/Information area, the main barrier was found to be **unclear communication and understanding** that leads to various misconceptions about bio-based materials and products, such as green-washing. Moving on to the Finance area, the **lack in access to capital and public support for the production phase** appear as the frontrunner barriers, since support is needed for up-scaling to large-scale. Along with the barrier of **lack of industrial investment**, these three underline the gaps in the political framework. **High prices of raw and bio-based materials** as well as **increased manufacturing costs** are also identified, barriers that are mainly linked to investors’ will to provide capital for bio-based materials and processes. Finally, the barriers falling under the Standards/Labelling area refer mainly to **complex and expensive procedures** of verification/certification and labelling. These complex labelling and certification status is confusing for the consumers and deterrent for the companies.³⁵

³⁵ KBBPPS – Knowledge Based Bio-based Products' Pre-Standardization Project (2015), Deliverable 5.3 Market entry barriers, <https://www.biobasedeconomy.eu/app/uploads/sites/2/2017/03/Market-entry-barriers.pdf>

4.2.3 BIOWAYS

The **BIOWAYS**³⁶ project focuses on the one hand on barriers related to the sustainable production and market exploitation of bio-based products and on the other hand on the public's perception on barriers preventing the wider use of bio-based products³⁷. Starting with the public's perception on barriers that hinder the wider use of bio-based products, the results showed that the public is not familiar with both the bio-based applications and the production processes used by industries and companies. The public seems to lack information concerning the origin and environmental performance of bio-based products, underlying the consumers' confusion towards this matter. However, it should be noted that the respondents have indicated high prices and limited market availability of bio-based products as important issues hampering a wider use.³⁶ Moving on to the barriers hampering the sustainable production and market exploitation of bio-based products, these were organized under three major categories, namely "**Feedstock related barriers**", "**Industry related barriers**" and "**Market related barriers**".³⁷ The majority of the key barriers presented under these categories focuses on the same areas as the ones mentioned before in the BIO-TIC project. For this reason, no further analysis is made here, but instead just an overview of the stated barriers is presented in the table to follow. Moreover, in the context of the BIOWAYS project, barriers related to six specific bio-based product categories were identified. Several barriers were also recorded for each bio-based product category; however, it is out of the scope of this report to analyse product-specific barriers.³⁶

Table 19. Summary of barriers for the sustainable production and market exploitation of bio-based products as reported by the BIOWAYS project

| Category | Barrier |
|-------------------|--|
| Feedstock related | High costs of biomass feedstock produced in EU |
| | Inadequate availability of biomass feedstock at the required quality, quantity and price throughout the year |
| | Seasonality in biomass feedstock production |
| | Inefficient transport and distribution systems of several biomass feedstock types |
| | Inefficient recovery systems for (bio)waste that could possibly be used as feedstock for bio-based products |

³⁶ BIOWAYS Project (2017), Deliverable 2.1 Bio-based products and applications potential, <http://www.bioways.eu/download.php?f=150&l=en&key=441a4e6a27f83a8e828b802c37adc6e1>

³⁷ BIOWAYS Project (2018), Deliverable 2.4 Public perception of bio-based products – societal needs and concerns (updated version), <http://www.bioways.eu/download.php?f=150&l=en&key=441a4e6a27f83a8e828b802c37adc6e1>

| Category | Barrier |
|------------------|---|
| Industry related | Low technology readiness level and commercialization status for many bio-based products |
| | Lack of cooperation between the stakeholders in the relevant value chains |
| | Hurdles in establishing partnerships between academia and industry |
| | Limited financial support for new production facilities |
| | Lack of a trained workforce |
| Market related | Low price of crude oil and natural gas that make the use of biomass feedstock and bio-based production processes economically unattractive |
| | High cost of bio-based products compared to their fossil-fuel derived equivalents |
| | Lower performance of many bio-based products compared to their fossil-fuel derived equivalents |
| | No dedicated and detailed EU legislation framework, conflicts between sustainability goals and market needs, lack of uniform standardization and certified labelling for bio-based products |
| | Gaps in the policy and subsidy framework |
| | Intellectual property related barriers |
| | Low public awareness of the benefits of using bio-based products |
| | Lack of reliable and sufficient information about bio-based products |

4.2.4 BioBase4SME

The **BioBase4SME**³⁸ project aims at supporting Start-ups and SMEs to bring their innovation to market, by helping them overcome both technological and non-technological barriers. In the framework of the project, various SMEs were asked to rate 43 barriers falling under nine broad categories and 15 sub-categories as presented in the following table. Based on the answers provided by the SMEs the proposed barriers were further evaluated as high, medium and low.³⁹

Table 20. Overview of barrier categories and sub-categories in the BioBase4SME project

| Category | Sub-category |
|---------------------------------|---------------------------|
| Demand-side policy barriers | Demand-side policies |
| | Public procurement policy |
| Stakeholder perception barriers | Poor public perception |
| Investment barriers | Capital requirements |

³⁸ BioBase4SME (2019), Needs and challenges of companies in the bioeconomy in NW Europe, https://www.nweurope.eu/media/8950/needs-and-challenges_final_2019.pdf

³⁹ BioBase4SME (2019), Needs and challenges of companies in the bioeconomy in NW Europe, https://www.nweurope.eu/media/8950/needs-and-challenges_final_2019.pdf

| Category | Sub-category |
|---------------------------------------|--|
| | Industrial biotechnology and bio-based sectors perceived as sector with high investment risk |
| Regulatory barriers | Full assessment guidance |
| | Robust standards and methods |
| Intellectual property related hurdles | Patent filing, cost and regulation |
| Human resource barriers | Skilled workforce |
| Policy barriers | National and European policies and regulations |
| Hurdles for efficient collaboration | Suitable network and cooperation strategy |
| | Knowledge exchange |
| Feedstock related barriers | Logistics: securing large quantities of biomass |
| | Feedstock at affordable prices |
| | Sustainability of feed stock supplies |

The lack of “Demand-side policy” was found to be the top barrier category based on the respondents’ answers. In more detail, the **lack of commercial frameworks** (market supports, incentives, taxations, product standards and specifications, etc.) appeared to be the most important barrier. Another top barrier category was “Stakeholder perception”, as **lack of both knowledge** (low visibility of bio-based products) and **efficient communication of the benefits of bio-based products** were identified as high barriers for the involved SMEs. However, other barriers in the same category such as the **labelling** of bio-based products. “Investment barriers” category was also perceived as a top barrier category by the respondents, as the bio-based sector is considered of **high risk** by the investors requiring also a **long time for return on investment**. Additionally, **lack of public support for up-scaling** and of **financial support** in terms of new production facilities were identified as important barriers. “Regulatory barriers” category was found in the top as well, however with a lower score than the previously mentioned categories, mainly focusing on lack of international agreed sustainability standards and certification procedures.³⁹

The rest of the barrier categories were characterized as “medium”, but not of less importance, based on the respondents’ answers. The barriers that were identified to be more important among these categories were **patenting costs** and **lack of harmonization in international Intellectual Property regulation** as well as **challenges in collaboration** between different stakeholders of the value chain and especially knowledge and technology transfer between academia and industry. Finally, it is noted that although barriers such as high feedstock costs and lack of harmonized regulatory framework were considered as “low”, this has to do with the production processes of the different SMEs that took part in the survey.³⁹

4.2.5 R²π-The route to circular economy

The R²π-The route to circular economy⁴⁰ project focuses on barriers that hamper the transition towards circular economy and the adoption of different Circular Economy Business Models (CEBM). In the framework of R²π project barriers arose from the examined case studies were organized under three broad categories. The category of **“Internal Economic barriers”** includes barriers that hamper the implementation of CEBMs, mainly through an economic point of view. On the one hand there are increased materials, operational and infrastructure **costs** for the companies. On the other hand **consumers’ lack of knowledge, understanding and information** on circular economy makes them unwilling to pay for products deriving from CEBMs. This in turn can make various stakeholders hesitant towards adopting such an approach. Barriers related to elements of the environment that can affect adopting or expanding CEBMs are referred to as **“Contextual barriers”**. Under this category barriers related to **high degree of competition in the market, unavailability of supporting infrastructure and logistics issues and lack of access to funding and financial support**. Last but not least come the **“Policy barriers”**. **Bureaucracy, taxes, inefficient internalization of environmental costs** with regard to linear economy models, **lack of public funding and subsidies** are some of the barriers that seem to hinder the development of CEBMs. Additionally, **lack of consistent standards and protocols** as well as the **heterogeneity in application of the EU’s legislation** serve as barriers.⁴⁰

Table 21. Overview of the identified barriers for CEBM by the R²π Project

| Category | Sub-category |
|-------------------|----------------------------------|
| Internal Economic | Cost issues |
| | Consumer Issues |
| Contextual | Sectoral issues |
| | Infrastructure |
| | Technology and dynamic aspects |
| | Finance |
| Policy | Obstructive Policy & bureaucracy |
| | Externalities |
| | Missing Regulation |
| | EU Policy |

⁴⁰ R²π-The route to circular economy Project (2019), *Deliverable 6.2: Summary of Key Factors of CEBM (Circular Economy Business Models)*

4.2.6 RoadToBio – Roadmap for the Chemical Industry in Europe towards a Bioeconomy

The RoadToBio – Roadmap for the Chemical Industry in Europe towards a Bioeconomy⁴¹ project focuses on barriers hampering the utilisation of bio-based resources by the chemical and material industry, which is directly related to the EU chemical industry's role to the bioeconomy. A thorough analysis was conducted to identify barriers for nine different product groups, namely "Cosmetics", "Paints and coatings", "Agrochemicals", "Surfactants", "Lubricants", "Man-made fibres", "Solvents", "Adhesives", and "Plastics/polymers". As it is out of the scope of this report to analyse barriers per product category, a reference is thus made in the six broader barrier groups identified in the context of the RoadToBio project that seem to prevent an increase of the bio-based share in the chemical industry. **Limited access to feedstock** mainly due to **high costs for commercial scale production** and **lack of supportive policies for bio-based materials**, compared to the established policies for the use of biomass for the production of bioenergy and biofuels – such as RED – is a crucial barrier. The high feedstock costs among others seem to decrease **the cost-competitiveness** of bio-based products against the well-established fossil ones. Furthermore, the immaturity of bio-based economy, when compared with the fossil-based one, can act as a barrier as it leads to a **lower performance** of bio-based products. In addition to this, the growth of bio-based processes is hampered as a result of **high investment costs** combined with **limited incentives for scale-up** and **little access to finance**, as well as **current financing structure**, especially for the SMEs. **Regulatory uncertainty** and **lack of policy harmonization** strongly affect the transition towards the establishment of bioeconomy. The market up-take of bio-based chemicals and materials is hindered by **non-harmonised standards, complex and costly processes** (e.g., REACH) and **lack of specific policy instruments** in the long-term. Moreover, **little visibility** of bio-based products due to distorted or **limited consumers' knowledge – understanding – awareness** and **lack of multi-stakeholder cooperation**, is identified as a significant barrier.⁴¹

Table 22. Overview of the identified barriers for CEBM by the R²π Project

| Group | General barrier |
|--|---|
| Access to feedstock | Low availability of biomass |
| | Non-level playing field |
| Competition with established fossil industry | Bio-based alternatives not cost-competitive |
| | Lower performance of bio-based alternatives |
| Policy and Regulatory framework | Lack of policy harmonisation |
| | Limited long-term reliability |

⁴¹ RoadToBio Project – Roadmap for the Chemical Industry in Europe towards a Bioeconomy (2019), *Strategy document*, https://www.roadtobio.eu/uploads/publications/roadmap/RoadToBio_strategy_document.pdf

| Group | General barrier |
|---|--|
| | Registration, Evaluation, Authorisation and Restriction of Chemicals – REACH |
| Public perception and societal challenges | Lack of information, understanding and expertise |
| | Low awareness of bio-based products |
| | Unrealistically high expectations |
| Markets, Finance and Investment | Limited availability of funding in the early stages |
| | Limited support for scale-up |
| | Limited access to finance for start-ups and SMEs |
| Research and Development | Ongoing need for funding |
| | Limited guidance and direction in Research and Development |
| | Limited understanding of ecological boundaries and innovation adaption and diffusion |

4.2.7 POWER4BIO

The **POWER4BIO**⁴² project (emPOWERing regional stakeholders for realising the full potential of European BIOeconomy) aims at supporting the transition towards bioeconomy. The POWER4BIO project focuses on barriers related to the application of regional policies which aim to support a bio-based. To begin with, five key/typical barriers were identified, out of which three were assigned as **barriers for the bio-based economy (BBE) development** and two as **barriers for the development of effective policies** for the bio-based economy.⁴²

Table 23. Summary of the key barriers for the development of bio-based economy and policy development

| | Category | Description |
|------------------------|---|--|
| BBE development | Biomass availability | The sustainable mobilisation of sufficient and good quality biomass is essential to build the bio-based economy. Obstacles are a.o. low cooperation of farmers and foresters, seasonal availability, provenance (and logistics), quality and sustainability. |
| | Lack of public acceptance and awareness | Acceptance by the public is crucial to make sure bio-based products are taken up by the market. Problems are public's resistance to change, lack of consumer knowledge and confidence, and product quality. |

⁴² POWER4BIO Project – emPOWERing regional stakeholders for realising the full po-tential of European BIOeconomy (2020), *Deliverable 4.2 An overview of suitable regional policies to support bio-based business models*, https://power4bio.eu/wp-content/uploads/2020/07/POWER4BIO_D4.2_Policies_support_bio-based_business_models_FINAL_doi.pdf

| | Category | Description |
|------------|---------------------------------------|---|
| | Lack of supporting market mechanisms | Developing a bio-based economy requires a shift in the whole value chain, from producers to consumers. This shift is not easy to make, given the current market mechanisms, for instance the price competition from the petrochemistry. |
| BBE policy | Vague goals and no operationalisation | Policies often miss clear goals and ways to measure and evaluate progress in meeting policy targets. The policy documents are described in a strategic but qualitative way and rarely include indicators to monitor the progress of the bioeconomy development. |
| | Timeframe of policy is uncertain | Long term vision and policy continuity are needed to build up investor confidence and to catalyse investments. |

Furthermore, in the context of the POWER4BIO project, **barriers related to policies' integration** through the different phases of bio-based economy development maturity (high, medium, initial) have been identified. Different development maturity phases can be hampered by different barriers. However, six barriers were argued to hinder bio-based economy in all three phases of development maturity, as follows⁴²:

- Absence of clear and well elaborated bioeconomy strategy
- Lack of transparency and policy coherence
- Fragmentation of policy instruments
- Biomass availability
- Need for research and innovation that are required to design a bioeconomy that fits to the regional potentials
- Public awareness and stakeholder acceptance, and lack of demand-side policy.

Finally, investment and regulatory barriers were also identified of high importance for the development of bio-based economy. On the one hand, investors perceive bio-based economy as a sector of high risk leading to **investment barriers**. On the other hand, **regulatory barriers** arising mainly by the lack of common understanding in sustainability criteria, transparent standards, and agreed certification systems in an international level, are even hampering regions of high bio-based development maturity.⁴²

5. Conclusions

The current version of Deliverable 1.4 (first version) focuses on the development and presentation of the methodological approach for conducting primary and secondary research in order to catalogue the technological, the logistical, the regulatory and the cultural barriers related to urban biowaste valorisation for biobased products. Two versions of Deliverable 1.4 will be delivered i.e., the first version (current version) on M16 and the second version on M42. Both primary and secondary research are continuous activities that will be concluded at the end of the project, and the overall catalogued barriers hindering biowaste valorisation will be delivered on the second version of Deliverable 1.4.

The first version of Deliverable 1.4 includes two basic parts focusing on primary and secondary research respectively. More particularly, the deliverable introduces the methodological aspects of the primary research on barriers for biowaste valorisation that will take place including the *extended questionnaire for barriers' evaluation*, the *stakeholders' identification* and the *final questionnaire's circulation plan*. An extended survey for barriers' evaluation was prepared including thirty-one (31) questions. The extended version of the questionnaire was circulated for internal evaluation by twenty-one (21) project partners aiming to prioritise questions for the three (3) main barriers categories i.e., i) cultural; ii) technological and logistical; and iii) regulatory barriers. Based on the analysis of results, the most important type of barriers are the *Cultural barriers*, then the *Regulatory barriers* and finally the *Technological and Logistical barriers*. Moreover, it was concluded that the final questionnaire will include a set of twelve (12) questions/statements as the core content of the primary research. The final questionnaire will be circulated to the target groups identified by the working team i.e., *Consumers*, *Business*, *Public authorities* and *Others*. Among those categories, the respondents of the survey will be identified. A target of five hundred (500) registered respondents has been set aiming to at least one hundred (100) completed surveys for further analysis. Until now, one hundred and seventy (170) respondents have been registered to the *stakeholder identification template* with the following distribution between the target group categories: 26 % public administration; 33 % business; 19 % others and 12 % consumers. The survey circulation will take place for an 18-months period (from M18 to M36). The circulation strategy mainly foresees the contact with the stakeholders who are recorded on stakeholders' identification list through on-line and web-based means i.e., on-line survey, e-mail exchange and remote interviews.

Then, the deliverable presents the approach regarding the secondary research on barriers for biowaste valorisation. It was in the aim of the secondary research to gather information on the *overarching formal barriers and barrier categories* that impede the establishment both of

circular economy and bioeconomy based on *selected reports and EU funded projects* (FP7, H2020 and BBI). Secondary research has identified policy, market, finance, cultural, technological and regulatory barriers. Differences are mainly uncovered during the break down of such broad categories into more specific ones. Another influential factor is the sample of respondents, as different perceptions can reinforce pluralism while at the same time increasing the risk of misunderstanding on the same matter arising. One should make sure that clear statements are put forward and have a full understanding of the respondents' sample.

Based on the analysis conducted it is evident that many interconnections exist between the formal barriers towards the development of circular economy and the full exploitation of the bio-based sector. Reported barriers can be coherently organised under the three overarching categories of cultural, technological/logistical and regulatory; however, attention must be paid when integrating sector-specific barriers in broader categories such as the once identified in the case of circular economy. On the one hand, special attention needs to be paid not to oversimplify and/or overlook important factors that can decisively affect the bio-based sector. On the other hand, starting with broader categories of barriers can assist in encapsulating the respondents' perspective on specific issues, since several studies mentioned above show that the importance of the barriers identified by literature is not always in line with stakeholders' perspectives.

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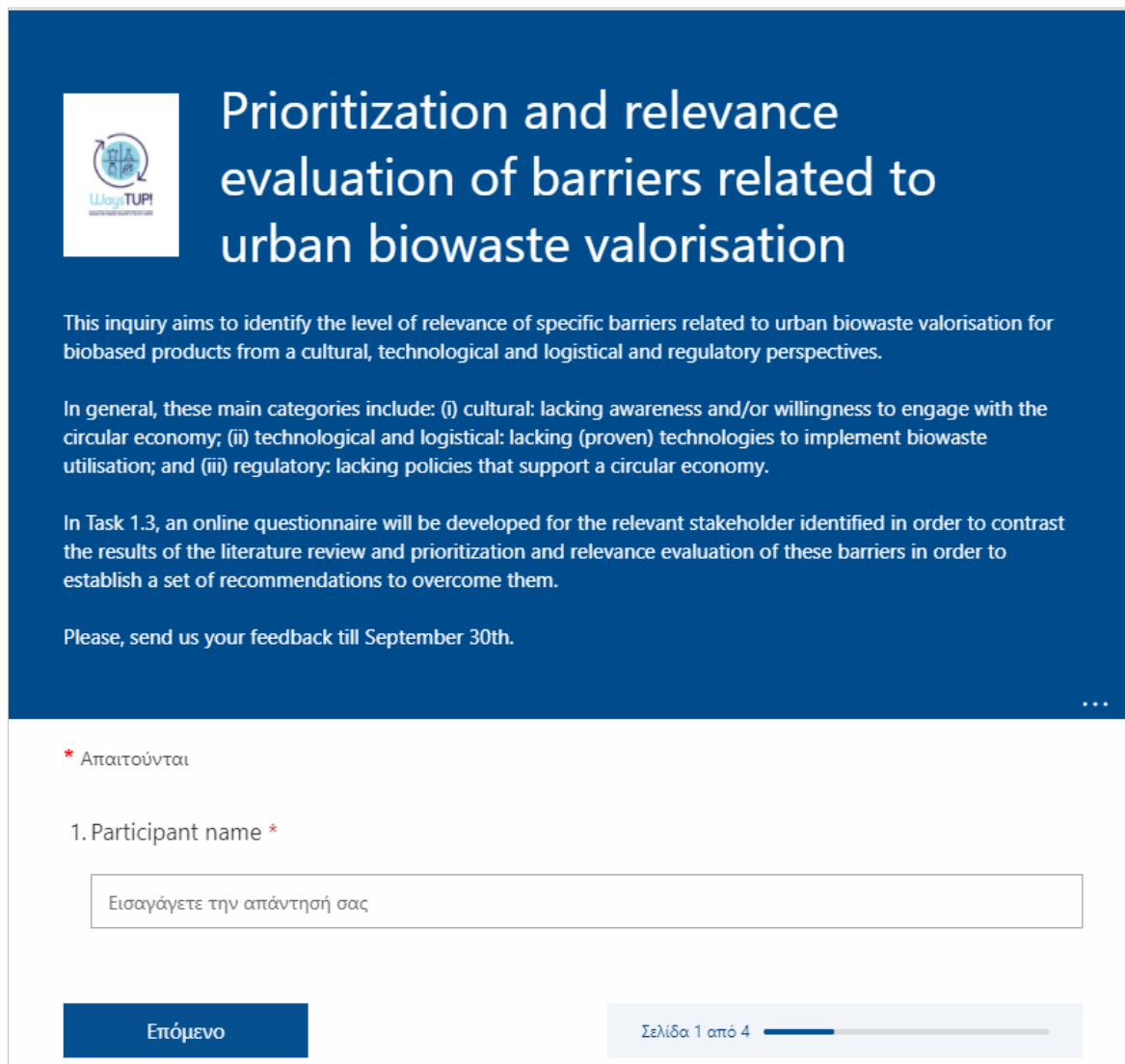
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Annexes

Annex I: 1st version of the questionnaire



 **Prioritization and relevance evaluation of barriers related to urban biowaste valorisation**

This inquiry aims to identify the level of relevance of specific barriers related to urban biowaste valorisation for biobased products from a cultural, technological and logistical and regulatory perspectives.

In general, these main categories include: (i) cultural: lacking awareness and/or willingness to engage with the circular economy; (ii) technological and logistical: lacking (proven) technologies to implement biowaste utilisation; and (iii) regulatory: lacking policies that support a circular economy.

In Task 1.3, an online questionnaire will be developed for the relevant stakeholder identified in order to contrast the results of the literature review and prioritization and relevance evaluation of these barriers in order to establish a set of recommendations to overcome them.

Please, send us your feedback till September 30th.

* Απαιτούνται

1. Participant name *

[Επόμενο](#) Σελίδα 1 από 4



Prioritization and relevance evaluation of barriers related to urban biowaste valorisation

...

* Απαιτούνται

Cultural barriers

How important are the following statements for you? (5 very important, 1 not important).

2. Privacy and data security: Possible misuse of personal information by third parties *

1 2 3 4 5

3. Knowledge about related issues, e.g., general knowledge about circular economy strategies and their environmental benefits *

1 2 3 4 5

4. Willingness to change behaviour, e.g., on barriers to urban biowaste valorisation for biobased products *

1 2 3 4 5

5. Community / Personal empowerment *

1 2 3 4 5

6. Awareness, public communication and information campaign *

1 2 3 4 5



7. Conflict representation and resolution about roles, emotions, misinformation and misinterpretation and values related to urban biowaste valorisation for biobased products *

1 2 3 4 5

8. Environmental issues *

1 2 3 4 5

9. Health / safety issues *

1 2 3 4 5

10. Need of active participation of end-user *

1 2 3 4 5

11. Employment generation *

1 2 3 4 5

12. Be among the first to participate in a new technologically advanced initiative *

1 2 3 4 5



13. Energy poverty (as a primary target group). [The "Grenelle II" Act defines energy poverty as a situation in which a person has difficulty obtaining the necessary energy in their home to meet their basic needs because of inadequate resources or living conditions] *

1 2 3 4 5

14. Public perception: *

| | Opción 1 | Opción 2 | Opción 3 | Opción 4 | Opción 5 |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Possible esthetical (landscape) or environmental impacts (flora, fauna, land use) caused by the project | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Reluctance to change current lifestyle | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Possible increment of prices | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Full respect to comfort standards as stated by the consumer. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Πίσω

Επόμενο

Σελίδα 2 από 4

Ποτέ μην αποκαλύπτετε τον κωδικό πρόσβασής σας. Αναφορά κακής χρήσης





* Απαιτούνται

Technological and logistical barriers

How important are the following statements for you? (5 very important, 1 not important).

15. Lack of collaboration platforms (R&D programmes, B2B collaboration, Public-private partnership)

*

1 2 3 4 5

16. Lack of previous experience *

1 2 3 4 5

17. Lack of Fair remuneration based on transparent, clearly communicated methodologies *

1 2 3 4 5

18. Not competitive price *

1 2 3 4 5

19. Supply risk or volatile price of raw materials *

1 2 3 4 5



20. Possible new technology failure or malfunctioning *

1 2 3 4 5

21. Seasonability of biomass cropping or/versus the need of continuous feedstock supply as a major problem. *

1 2 3 4 5

22. Lack of technological data, related databases, e.g., on impacts. *

1 2 3 4 5

23. Decision-making conflicts between local/regional/national entities *

1 2 3 4 5

24. Funding *

| | Opción 1 | Opción 2 | Opción 3 | Opción 4 | Opción 5 |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Initial investments (especially if technology is needed) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Possible economic penalties or losses if project fails | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Financial remuneration lower than initially expected | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Πίσω

Επόμενο

Σελίδα 3 από 4



Prioritization and relevance evaluation of barriers related to urban biowaste valorisation



* Απαιτούνται

Regulatory barriers

How important are the following statements for you? (5 very important, 1 not important).

25. Market regulation: Clear, transparent and consumer-protecting regulations that ensures customer rights and market rules. *

1 2 3 4 5

26. Environmental regulations and legislative regime in national level *

1 2 3 4 5

27. Use of land and Preserved areas *

1 2 3 4 5

28. Lack of transparency in market rules and remuneration settlements *

1 2 3 4 5

29. Lack of incentives: Subsidies, technical support, etc. *

1 2 3 4 5



30. Topics not included in school / university curriculum *

1 2 3 4 5

31. Public procurement (PP) practices (green PP, Precommercial PP) *

1 2 3 4 5

32. Regulatory frameworks: *

| | Opción 1 | Opción 2 | Opción 3 | Opción 4 | Opción 5 |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Government strategies and objectives related to urban biowaste valorisation | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Waste regulation (collection, treatment, definition of waste, extended producer responsibility and take-back systems) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Lack of common agenda for bioproducts development-incoherent policies and regulations | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

[Πίσω](#)

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Σελίδα 4 από 4

Ποτέ μην αποκαλύπτετε τον κωδικό πρόσβασής σας. Αναφορά κακής χρήσης



Annex II: Ranking analysis of the 1st version of the questionnaire

Prioritization and relevance evaluation of barriers related to urban biowaste valorisation

| | 21 Respuestas | 17:54 Tiempo medio para finalizar | Activo Estado |
|---|------------------|--------------------------------------|--|
| 1. Participant name | 20 Respuestas | | Respuestas más recientes "Akin Kardi" "SELCUK BULUT YAZAN" "Novamont" |
| 2. Privacy and data security: Possible misuse of personal information by third parties | 21 Respuestas | | 3.62 Promedio |
| 3. Knowledge about related issues, e.g., general knowledge about circular economy strategies and their environmental benefits | 21 Respuestas | | 4.33 Promedio |
| 4. Willingness to change behaviour, e.g., on barriers to urban biowaste valorisation for biobased products | 21 Respuestas | | 4.29 Promedio |