TECH4 BIOWASTE

Feasibility Study
Proofing market interest, describing a realistic business model and future perspective for a technology database

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Type

☒ **R** Document report

☐ **DEM** Demonstrator, pilot, prototype

☐ **DEC** Websites, patent fillings, videos, etc.

☐ **Other**

Dissemination Level

☒ **PU** Public

☐ **CO** Confidential, only for members of the consortium (including the Commission Services)

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BBI JU

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List of abbreviations

Abbreviation	Description
AB	Advisory Board
BBEPP	Bio Base Europe Pilot Plant
BP	Business Plan
CO2	Carbon dioxide
D	Deliverable
DOI	Digital Object Identifiers
FFF	Field Flow Fractionation
IT	Information Technology
ISBN	International Standard Book Number
NOVA	Nova-Institute
RCC	Renewable Carbon Community
SG	Stakeholder Group
SME	Small and Medium Enterprise
TRL	Technology Readyness Level
TTO	Technology Transfer Office
WP	Work Package
Q	Quarter

Publishable executive summary

Tech4Biowaste needs to involve the targeted database users and contributors. It shall develop an understanding of the needs and interest of the intended users, and of the willingness of intended contributors to voluntarily provide information.

The first step will be to initiate a process of engaging with these different categories of stakeholders from across Europe. Examples of information users include bio-waste management companies and other prospective users of new and innovative bio-based technologies that could improve their processes or enable new processes. Examples of information contributors include technology providers, technology searchers, technology transfer offices (TTOs) and other relevant members of the research and technology-transfer communities.

The first stage of a promotional campaign will be implemented as co-organiser of a pitching, matchmaking and networking event. A representative sample of different stakeholders from different categories will be surveyed, both individually (interviews) and group wise (during the second AB meeting), to determine their needs and requirements.

Expressed needs will be quantified. Based on the assessed needs and requirements of the surveyed stakeholders, as well as on technical requirements and limitations, a functional design will be made of the technology database and the associated (technology matching and comparison) decision support tool. As part of a feasibility study (a) proofing market interest and (b) describing a realistic business model, the functional design will be discussed with the stakeholders, and –if needed- refined.

Methods will be worked out to build, populate and update the database. The first phase with the internal contributions will be initiated. Finally, a future business plan with the possible integration of the Tech4Biowaste platform in the Renewable Carbon Community is being considered.

1 Introduction

A Feasibility Study will be conducted, (a) proofing market interest and (b) describing a realistic business model and future perspective for a technology database. Activities include:

- Document the confirmed interest of the targeted 'users' and the 'suppliers' of the technology database.

- Refine, validate and finalise what (technology and support) information shall be included in the database.

As part of the feasibility study the definitive database scope, set-up, structure, content, visualisation and functionality will be determined in close consultation with the intended users, when assessing their specific needs, interests and priorities.

The result is a feasibility study endorsing the direction of the database development, describing a realistic business model and defining the database content.

2 Proofing market interest

2.1 Engaging stakeholders from relevant sector

In order to involve relevant stakeholders in the implementation of the feasibility study, several options were elaborated and discussed in Q2 2021. The project partners of the consortium all have a broad network of relevant stakeholders. Thus, the considerations made were rather related to the choice of the most appropriate stakeholders on the one hand and the choice of the most efficient way of conducting the survey on the other hand.

During the discussions, the annual event[1] of Pilots4U, scheduled for 28 September 2021, came into the picture. An event where relevant stakeholders from all over Europe come together in Brussels. The Pilot4U community of open access pilot & demo facilities for the bioeconomy has a strong link with technology developers and feedstock owners on the one hand and industrial manufacturers and users of bio-based products on the other. Soon an evaluation was made of the advantages of using such a pitching & matchmaking event versus approaching stakeholders individually to conduct a survey.

There were several important arguments that led to the consortium's conscious decision to apply as co-organiser of the event:

- The ideal opportunity to make Tech4Biowaste known to a wide audience of relevant European stakeholders for the first time.
- The opportunity to screen many technology pitches on one day for their compatibility with the scope of the Tech4Biowaste data platform.
- The opportunity to carry out a representative number of surveys live (physically) with relevant stakeholders from one location on one day. The matchmaking tool of the event facilitates targeted invitations from the wide range of stakeholders present.
- The opportunity to show the first test version of the Tech4Biowaste database structure to some potential users or contributors of the technology platform.
- The time, energy and resources required to co-organise such a European event are limited. The organization is already largely in the hands of the Bio Base Connect team that already successfully organized a similar large-scale event in 2018.

In Q3 2021, the consortium therefore worked step-by-step and intensively towards this important momentum on 28 September 2021 in Brussels. A Tech4Biowaste call to action video was made with a premiere screening that day. Surveys were elaborated to be used during the matchmaking with the intention of investigating market interest in Tech4Biowaste. Dozens of technology owners were scouted for their value to complement the Tech4Biowaste technology platform.

[1] https://biopilots4u.eu/events/pitch-perfect-and-boost-european-bioeconomy-2021

2.1.1 Identification and engagement of stakeholders

The pitching, matchmaking and networking event brings together the networks of six[2] important bioeconomy platforms, including Tech4Biowaste. As such, this guarantees a diverse attendance reaching from investors, SMEs, start-ups, about-to-be start-ups, scale-ups, large companies, research organisations, technology providers to organisations offering relevant innovation services such as access to finance, scale-up trials, application testing, business plan writing, feedstock analysis, life cycle assessment, social acceptance, etc.

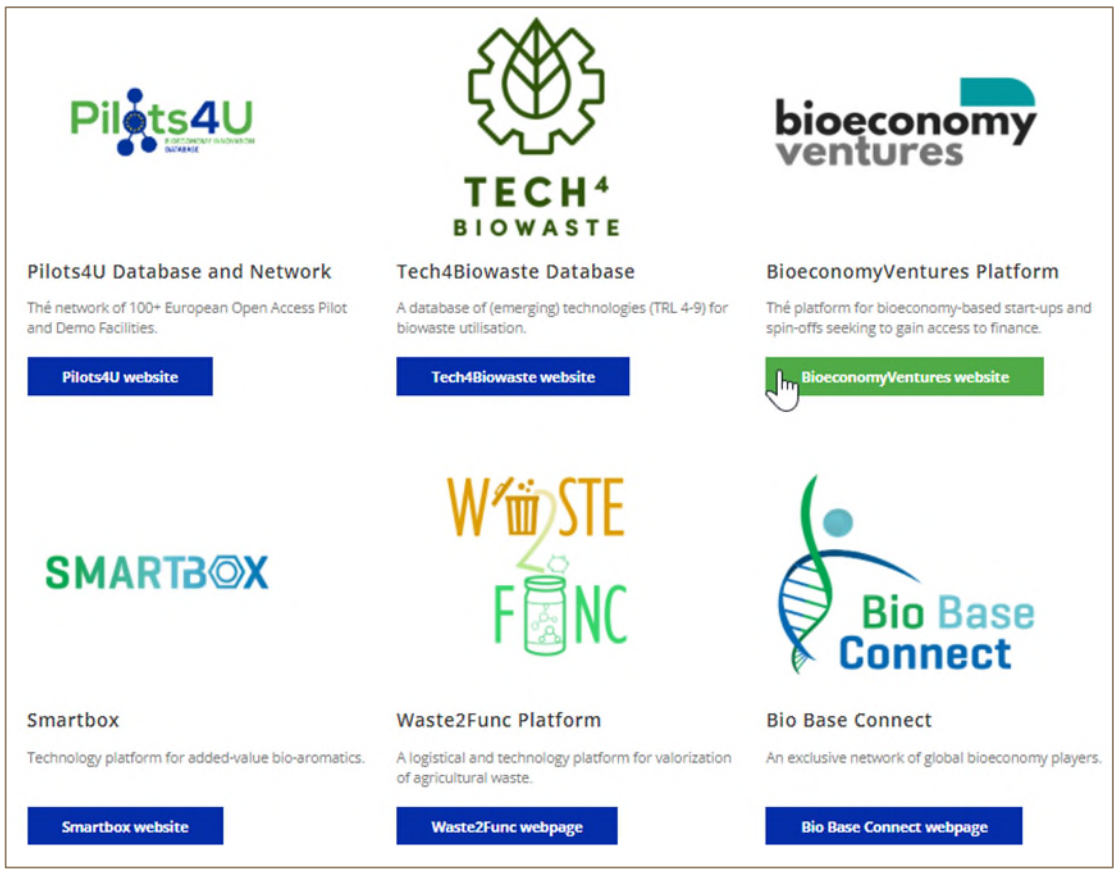

Figure 1: Co-organisation of 6 bioeconomy platforms with common target groups

The target groups of the five other bioeconomy platforms overlap with that of Tech4Biowaste. SMARTBOX develops innovative ways of transforming biomass into added-value bio-aromatics. BioeconomyVentures builds the reference platform for bioeconomy-based start-ups and spin-offs, so innovative technology developers, seeking to gain access to finance. WASTE2FUNC integrates new value chains based on the cost- and eco-efficient conversion of waste biomass, included industrial food waste, into market ready functional molecules for home- and personal care applications. Bio Base Connect is the broad network and global community of project partner BBEPP.

The overlap of target groups and the versatility of the programme also ensured that people had more than one reason to register for the event. Despite the uncertain covid period regarding the organisation of physical events, 165 people from 126 unique companies and

[2] Pilots4U, Tech4Biowaste, BioeconomyVentures, Smartbox, Waste2Func and Bio Base Connect.

organisations registered for participation, coming from 18 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, United Kingdom) and Switzerland.

Participants were invited to submit a pitch application for a 6-minute pitch with a subject relevant for further development of the bioeconomy. A total of 66 pitch slots were available and this supply eventually exceeded the demand. In the end, 68 pitches were programmed, divided into 3 major categories:

- 35 innovative technologies for the bioeconomy
- 20 innovation services
- 13 innovation scouting activities

The detailed programme of the event is included in **Annex 1**. By co-organising the event, the Tech4Biowaste partners could easily select from the 35 technology owners who came to pitch, focusing on the contacts that were relevant for integration on the Tech4Biowaste technology platform.

The matchmaking part of the event are one-on-one meetings of 15 minutes aimed at finding new partners. The scheduling of these meetings was supported by an online matchmaking system, easy to use on a smartphone or laptop. Hundreds of matchmaking sessions took place on 28 September.

This part of the event allowed the Tech4Biowaste consortium to make a highly targeted link with the different stakeholder types as defined in deliverable D1.1 List of contacts of stakeholders.

SH category	Stakeholder type	Number involved
SG1	bio-waste producer	2
SG2	bio-waste collector/processor	2
SG3	knowledge institute/university	5
SG4	technology developer	10
SG5	technology transfer organisation	0
SG6	open access scale-up facility	4
SG7	manufacturer of bio-waste derived products	0
SG8	user of bio-waste derived products	3
SG9	network organisation/industry cluster	2
SG10	public authority/government agency	3

Table 1: Number of stakeholders involved in the Tech4Biowaste survey

A total of 36 persons were invited to conduct a survey through a matchmaking session. What is remarkable is that only 3 persons declined the invitation (8,3%). In addition, 7 did

not respond to the invitation (19,5%). This ultimately resulted in the programming of 26 matchmaking sessions (72,2%). **This high success rate demonstrates the interest in the Tech4Biowaste platform.** The visits of several persons to the Tech4Biowaste booth in the Atrium during the various breaks also resulted in 5 additional surveys. In total, 31 people could be surveyed. With this, the target of 30 surveys was achieved.

The developers and owners of technologies falling under SG 3 and 4 were well represented when approaching various stakeholders. After all, they are valuable as potential contributors to the Tech4Biowaste database.

On the other hand, the link with potential users of the Tech4Biowaste platform, falling under SG 7 and 8 were rather limited. This is strongly due to the fact that among the 165 participants in the event, the share of industrial processing companies was rather limited. Therefore, this can certainly be considered a point for improvement when organising the next stakeholder approach and survey.

engagement category	Approach	Type	How
1	Individual	E-mail	E-mail message
2	Group	E-mail	Mailing
5	Individual	Survey	Questionnaire
11	Group	Exhibition	Booth
12	Group	Conference	Presentation
14	Group	Video	Internet
15	Group	Social media	Internet

Table 2: Suitable stakeholder engagement formats

In conclusion, the identification of the most appropriate stakeholders as well as the engagement of this group to carry out a short survey went well. A total of seven stakeholder engagement formats, as listed in deliverable D1.3 with the initial version of the Stakeholder Engagement Plan, were used within the framework of this whole exercise. They are listed in Table 2.

2.1.2 Interviewing representative stakeholders

In the run-up to the event of 28 September 2021, the consortium prepared the surveys with relevant questions to be asked to potential technology providers on the one hand and potential technology searchers on the other hand. Given the 15-minute time limit of each survey that will be conducted through the matchmaking sessions, the survey was limited to 7-8 short questions. The completed questionnaires are included in **annex 2**.

The survey aims to provide a concise overview of the current situation of various stakeholders and the extent to which they want to be involved in the Tech4Biowaste platform.

Technology providers are asked about how their technology is actually publicly findable today and what information they are willing to share. They are also asked how much time

and money they are willing to invest to get their technology on the Tech4Biowaste platform. Technology searchers get questions about how and where they search for the right technology today and what elements and details are decisive. They are also asked what a technology platform should be able to do.
Finally, everyone is asked if they want to be involved as a member of the first testing panel of Tech4Biowaste in the near future.

The 31 surveys were conducted by 8 members of the Tech4Biowaste consortium. A work breakdown was made beforehand with a concrete allocation of who fixed which of the 26 matchmaking sessions. In addition, 5 surveys were conducted via spontaneous visits to the Tech4Biowaste booth. After a brief introduction of both parties, the 15 minutes of each matchmaking session were used to try to get all questions answered. This was not always possible, given the limited time available, but the selection was large enough to receive sufficient responses to all questions.

The Tech4Biowaste members reported the results of the surveys centrally within a week. The answers were then compiled in a clear overview. The results will be discussed within the consortium during the bi-weekly meetings in November and December 2021.

2.2 User interests, needs & priorities

The market interest, needs & priorities were investigated in two different ways. The market interest, needs & priorities were investigated in two different ways. On one side via the execution of a survey on 28 September 2021 with a representative number of relevant stakeholders. On the other side, through the interrogation of the Advisory Board of Tech4Biowaste during the second AB meeting on 7 October 2021 after showing a draft structure and visualisation of the technology database.

The surveys were, as described in 2.1.2. *Interviewing representative stakeholders,* were conducted during the matchmaking sessions between members of the Tech4Biowaste consortium and relevant stakeholders. The results were positive overall and there was a high willingness to participate in the Tech4Biowaste technology platform. Remarkable is the answer given by the stakeholders to the last question: *Are you interested in becoming more closely involved as a member of the first testing panel next month?* Of the 31 surveys, 15 participants answered YES, and 5 participants answered YES BUT PLEASE LATER. Only 3 answered NO. The rest (8) remained neutral or did not answer the question due to lack of time. The results of the survey, including the description of the needs & priorities, are described more detailed in deliverable D2.1 *Description of stakeholders needs and requirements regarding the technology database*. With 64.5% positive responses to the last question, we can conclude that there is a high level of interest in the Tech4Biowaste platform. A dozen stakeholders were involved in a more extensive additional survey that zooms in on the draft structure and content of the Tech4Biowaste technology database. Their comments, advice, needs & priorities are also included in deliverable D2.1 *Description of stakeholders needs and requirements regarding the technology database.*

The feedback from the AB members on the first draft structure and content of the Tech4Biowaste technology database was also positive overall. Their comments, advice, needs & priorities are also included in deliverable D2.1 *Description of stakeholders needs and requirements regarding the technology database.*

3 First database refinement

During database preparation and set-up, several aspects were further refined which includes the overall structure including content and functionalities as well as various technical aspects. The following chapters will elaborate these refinements.

3.1 Database set-up and structure

The overarching database structure (FFigure 2: Visualisation of the overall database structure. Further subcategorisation will be applied as needed.) can be divided into 3 main branches which are feedstocks (types of biowaste), technologies (for biowaste valorisation), and products (bio-based products).

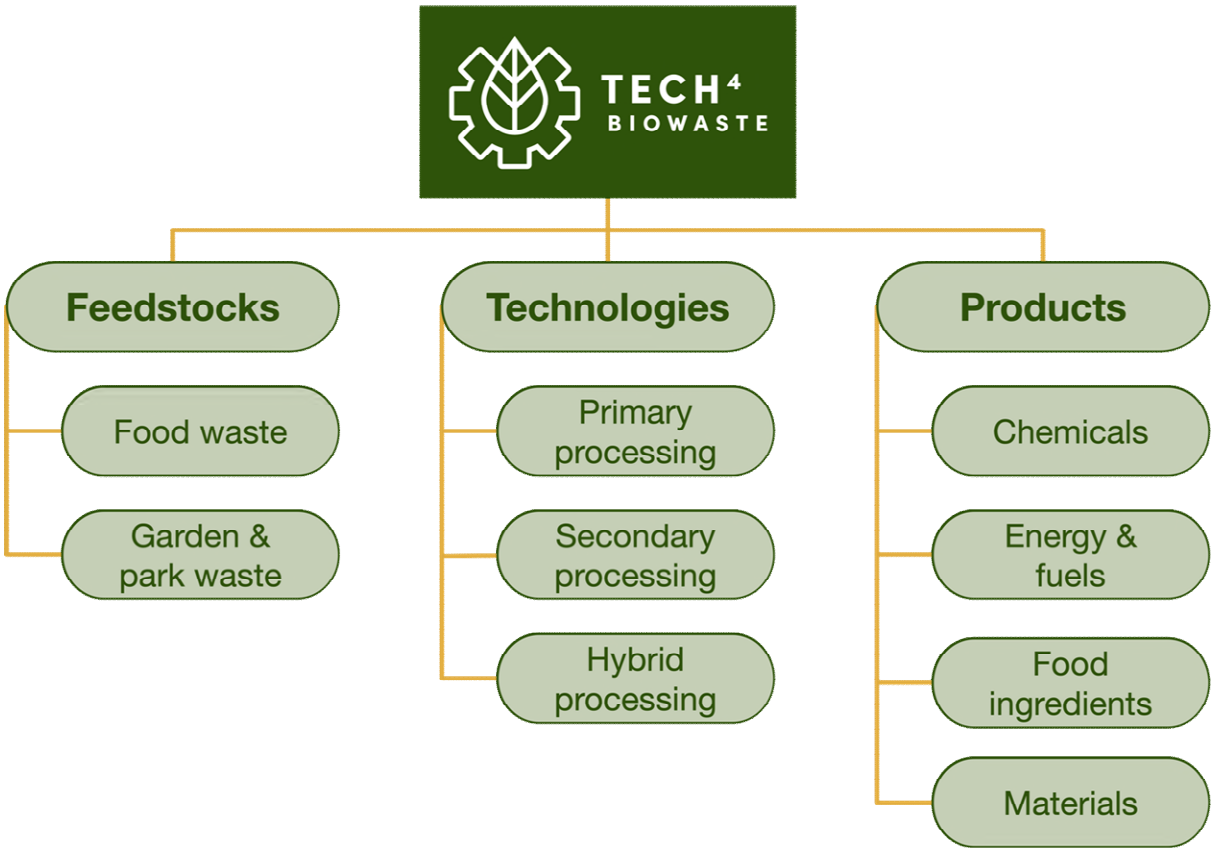

Figure 2: Visualisation of the overall database structure. Further subcategorisation will be applied as needed.

The feedstock branch is subdivided into food waste and garden & park waste and will contain descriptions and statistics on biowaste as well as detailed descriptions about specific and relevant waste fractions that have the potential to be valorised. As a starting point, the technology categorisation of the partner project Pilots4U[3] was used and further refined. The technology branch follows the higher-level categorisation of the Pilots4U database[4] including primary processing and secondary processing. Additionally, the hybrid

[3] https://biopilots4u.eu/

[4] The Pilots4U project set up a database and a network of open access pilot and multipurpose demo-infrastructures for the European bio-economy. The database maps existing open access pilot and demo-infrastructures across Europe, with the aim of creating one, very visible and easily accessible network for the

processing category was introduced for the Tech4Biowaste database to cover technologies that can be utilised in primary or secondary processing. Primary processing results in intermediate chemicals and/or materials which will then go into the secondary processing after which the final product is obtained. In contrast to that, the secondary processing covers either the direct or indirect (processing of intermediates from primary processing) valorisation of biowaste into a final product. Furthermore, hybrid processing covers processes that can be utilised in both, primary processing and secondary processing. Separation technologies for instance would be hybrid processing technologies since they can either directly or indirectly lead to the final product or they can be used to obtain intermediates that will then go into the secondary processing. While the Pilots4U database includes "separation technology" as a main category (in addition to primary and secondary processing), hybrid processing was introduced for the Tech4Biowaste database and separation technologies were subordinated to this category. This serves the purpose of now being able to subordinate other "hybrid" technologies to such a category that are not separation technologies, such as densification or sizing. Each technology will be further subdivided based on their basic principles (e.g.chemical, physical, thermochemical and so forth). The product branch is subdivided into chemicals, energy & fuels, food ingredients, and materials. The listed products will be supplied with descriptions and their application fields and may be further subcategorised as needed. In the following subchapters, a preliminary subcategorisation is proposed for the feedstocks, technologies, which will be finalised upon stakeholder feedback.

3.1.1 Feedstock content, and subcategorisation

The feedstock scope follows the definition of the European Commission (European Commission 2021) where bio-waste is defined as biodegradable garden and park waste and food waste from kitchens, households, restaurants, caterers and retail premises, as well as comparable waste from food processing plants. It does not include forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood. It also excludes those by-products of food production that never become waste. The Tech4Biowaste consortium decided to include waste from food processing plants in the project scope since the overall impact of the database would be much higher, a view that was confirmed by the feedback received from early engagement and interviewing of different stakeholders in the framework of the "Pitch perfect and boost the European Bioeconomy 2021" event[5] held in Brussels on 28 September 2021. Furthermore, garden and park waste are defined as any biogenic wastes that originate from gardens and parks such as green cuttings or bad harvests.

Within the database, the feedstock is divided into food waste and garden & park waste, these are then further categorised in dependence on the waste fraction/stream. As a first step, general data will be provided on food waste and garden & park waste (e.g. volumes, statistics). This data can be later further specified upon availability of more specified datasets (e.g. about composition, occurrence, supplier, volumes etc.) about different waste streams from the potential stakeholders. A preliminary subcategorisation is proposed as follows and will be finalised upon stakeholder feedback:

European bio-economy. The database includes 10 technological bioeconomy disciplines: algae cultivation and harvesting, anaerobic digestion, chemical processing, industrial biotechnology, material technologies, mechanical separations, physicochemical separations, pre-treatment, pulping, thermochemical conversion.

[5] https://biopilots4u.eu/events/pitch-perfect-and-boost-european-bioeconomy-2021

Food waste

- Kitchen waste
  - Cheese rinds without plastic
  - Coffee grounds, coffee filter, coffee pads
  - Egg shells
  - Flowers and (house) plants
  - Food waste (boiled, fried, raw)
  - Fruit and vegetable peelings
  - Gravy
  - Kitchen paper, soiled with food
  - Nuts and nuts shells
  - Plant pots made of organic material
  - Tea leaves and bags
  - Used cooking oil & grease

- Food industry waste
  - Beverages
  - Bread
  - Bulk organic waste
  - Dairy products
  - Decommissioning of the agri-food industry
  - Fruit and vegetable waste
  - Packaged food waste (various packaging except glass and ceramic) including raw and processed meat, poultry and fish waste
  - Packaged organic waste (e.g. tetra)
  - Raw materials from the food industry
  - Rejects from food industry
  - Prepared dishes, sauces
  - Meat, eggs, fish, ...
  - Sweets, food supplements

Garden & Park waste

- Bad harvests
- Grass, turf, roadside clippings
- Leaves, trunks and branches
- Pruning waste
- Soil, potting compost
- Tree roots, stumps

3.1.2 Technology content, and subcategorisation

The technology scope considers all emerging and established technologies along the value chain of bio-waste valorisation with Technology Readiness Level (TRL) ≥ 4. Therefore, also applicable pre- and post- treatment technologies are relevant for the database. In order to ensure that users with different background and knowledge are able to quickly find requested information, the database includes a harmonised description for each

technology. Each general technology will be represented as a separate page including the following subsections:

- Technology description/introduction
- Feedstock
- Process and technologies
- Product
- Technology providers
- Patents
- References

More details about each section can be found in the publicly available Deliverable 2.3 – *Functional design for technology database*. The following subcategorisation for technologies is proposed and will be further refined upon stakeholder feedback:

Primary processing

- Biochemical processes and technologies
    - Aeration
    - Anaerobic digestion
    - Composting
    - Insect farming
    - Enzymatic processes
    - Chemical processes and technologies (these might be hybrid processing)

- Chemical processes and technologies (these might be hybrid processing)
    - Hydrolysis
        - Acid
        - Alkali
        - Salt
            - Metal salts
            - Sulphite salt
        - Solvent
            - Organosolv
    - Ionic liquids
    - Oxidation

- Hybrid processes and technologies
    - Pulping
        - Chemical pulping
            - Organosolv
            - Soda
            - Sulphate
            - Sulphite
        - Hybrid pulping
            - Chemithermomechanical pulping
            - Neutral Sulfite Semi Chemical pulping
        - Mechanical pulping
            - Refiner

        - Refiner mechanical pulping
        - Thermomechanical pulping
    - Groundwood
        - Pressure groundwood
        - Stone groundwood
        - Thermal groundwood

- Physical processes and technologies (these might be hybrid processing)
    - Densification
    - Sizing
        - Chipping
        - Grinding
    - Microwave treatment
    - Steam explosion
    - Thermal expansion
    - Ultrasonication

- Thermochemical processes and technologies
    - Ammonia fibre expansion
    - Gasification
    - Hydrothermal processing
    - Pyrolysis
    - Torrefaction

Secondary processing

- Biochemical processes and technologies
    - Gas fermentation
    - Industrial fermentation
    - Solid state fermentation
    - Other biocatalytic conversions
        - In vitro processes
        - In vivo processes

- Chemical processes and technologies
    - Heterogeneous catalysis
    - Polymerisation

- Material processes and technologies
    - Biocomposite processing
    - Coating and lamination
    - Fibre web production
    - Nano/micro fibre production
    - Textile fibre spinning

- Thermochemical processes and technologies
    - Gasification
    - Pyrolysis

Hybrid processing

- Separation technologies
  - Mechanical separations
    - Centrifugation
    - Membrane filtration
    - Particle classification, sieving
    - Particle filtering
  - Physicochemical separations
    - Chromatography
    - Crystallisation and precipitation
    - Distillation
    - Drying
      - Air drying
      - Nitrogen drying
      - Freeze drying
      - Thermal drying
      - Vacuum drying
    - Extraction
    - Field-Flow fractionation
      - Asymmetric flow FFF
      - Centrifugal FFF
      - Electrical FFF
      - Split flow thin-cell fractionation
      - Thermal FFF
    - Flocculation
  - Other
    - Integrated hydroxyl radicals and hot water pre-treatment

3.1.3 Product content, and subcategorisation

Products will be linked to the suitable technologies and feedstocks. Furthermore, the application fields will be discussed for each product. The following categorisation for products is proposed and will be further refined upon stakeholder feedback, further subcategorisation remains to be developed in more detail:

- Chemicals
- Energy & fuels
- Food ingredients
- Materials

3.1.4 Database functionalities

Essential functionalities of the database will be the delivered via a technology comparison tool (Figure 3) and a matching tool in form of a technology provider infobox (Figure 4) as well as a coherent text about the technology/provider. The comparison tool is based on a sortable table which allows the user to sort the technology providers according to different criteria such as company name, country, capacity, category, maturity, feedstock, product,

or process details. Depending on the technology, different suitable criteria may be defined for each technology page. Once the user has found a suitable technology provider via the comparison tool, the user can be directed to the matching tool via a direct link. There, the user will find summarised information about the company and technology in form of a technology provider infobox as well as further and more detailed information in form of a coherent text. Depending on the technology different technology provider infoboxes are defined for each technology page in form of dedicated templates within the wiki system.

Technology comparison [Collapse]

Company name	Country	Technology category	Technology name	TRL	Capacity [kg/h]	Detailed information 1 [unit]	Detailed information 2 [unit]	Feedstock: Food waste	Feedstock: Garden & park waste	Product: Product 1	Product: Product 2	Product: Product 3
Company 1	[Country HQ location]	[Technology category (if different sub-categories are defined this has to be specified here, the available categories can be found on each technology page under the chapter Process and technologies)]	[Technology name (the "branded name" or the usual naming from company side)]	[4-9]	[numeric value]				•	•		
Company 2	[Country HQ location]	[(if different sub-categories are defined this has to be specified here, the available categories can be found on each technology page under the chapter Process and technologies)]	[Technology name (the "branded name" or the usual naming from company side)]	[4-9]	[numeric value]			•				•

Figure 3: General layout of the technology comparison tool realised via a sortable table. The comparison tool will be adapted for each technology.

[Technology name] provider

General information			
Company:	[Company name]	Webpage:	[URL]
Country:	[Country HQ location]	Contact:	[e-mail address]
Technology name:	["Brand name"]	Technology category:	[Secified technology sub-category from chapter process and technologies]
TRL:	[4-9]	Capacity:	[numeric value] $kg \cdot h^{-1}$
Technology and process details			
Obligatory detail 1:	[Detail 1] [unit]	Obligatory detail 2:	[Detail 2] [unit]
Obligatory detail 3:	[Detail 3] [unit]	Other:	[Other information, free to choose]
Feedstock and product details			
Feedstock:	[more specified feedstocks, (if possible: link to feedstocks from biowaste, garden and park waste, and food waste)]	Product:	[more specified products, (if possible: link to products)]

Figure 4: General layout of the technology provider infobox which can be inserted as template and will be adapted for each technology.

3.2 Technical aspects database

Several technical aspects had to be considered for the database. Beside the general requirements of the MediaWiki software (Table 3), further aspects had to be considered such as the adaptation and extension of MediaWiki with additional functions which are required to fulfil the project goals.

Requirements – MediaWiki 1.36.0		Compiled
Web server	Apache or…	✓
	…IIS	
Local command-line access		✓
PHP 7.3.19+ with…	…Perl Compatible Regular Expressions	✓
	…Standard PHP Library	✓
	…JSON support	✓
Database server	MySQL 5.5.8+ or…	✓
	…MariaDB or…	
	…PostgreSQL 9.2+ or…	
	…SQLite 3.8+	
Git access		✓

Table 3: Technical requirements of MediaWiki.

3.2.1 Technical implementation of the database

The technical implementation of the planned database needs to consider adopted software solutions for the connection to other services or platforms as well as other planned technical aspects as follows:

Connections to other services/platforms

- Citoid-Service: usage of Wikimedia-Citoid-server for the citation of literature via DOI, ISBN etc.
- Math-Service: Using the Wikimedia Math-Server to render mathematical and chemical formulas
- Enable "InstantCommons" to embed freely licensed pictures, videos, and audio-files directly from Wikimedia Commons.
- YouTube addon for embedding videos
- Links to all technology entries of the Pilots4U webpage including all search-strings/filters

Extensions

- FlaggedRevisions for quality management. New users can edit the database but the edits have to be approved by an experienced user

- UploadWizard for easy and fast uploading of new files. Configuration adapted for non-free licenses.
- Mobile Frontend: For the appropriate rendering of the database on mobile devices
- TimedMediaHandler: A playback software for directly uploaded videos.

Planned but not yet implemented

- Web-scraping services e.g. via python scripts (e.g. updating patent status from google patents, updating values from the Eurostat database etc., written with Spyder using the Beautiful Soup library)

3.2.2 Implementation of the technology comparison/matching tool

The technology comparison tool and the matching tool (including infobox and text, see chapter 3.1.4) were realised with MediaWikis own resources without the need of further adaptations. The technology comparison tool (Figure 3) is realised via a sortable table. Furthermore, the technology provider infobox (Figure 4) can be provided as template ensuring a uniform look and feel for users and contributors.

3.2.3 Tech4Biowaste bi-directional database link with Pilots4U database

The Tech4Biowaste database will allow embedding/linking existing databases and other information portals. The actual practicalities of automatic linking will be field-tested by connecting, as test case, the Pilots4U database. The Pilots4U network already set up an online database listing European pilot-, demonstration-, and tolling-equipment for various bio-economy processes. These open access infrastructures allow industry scaling-up bio-economy innovations, bringing them from the laboratory into industrial practice. Early-stage collaboration with such facilities substantially lowers the financial risk for the innovating company, by reducing the need for investment and providing access to relevant expertise. As a result, it speeds up the commercialisation of their product or process using new technologies. Therefore, a direct link between a technology database such as Tech4Biowaste and a bio-process facilities database such as Pilots4U is key. This will promote the collaboration among clusters/companies and service providers (shared research facilities and open innovation platforms) to facilitate the merge among the available technologies and the requirements, knowledge, and networks of local actors.

Smart linking should lead to a strengthening of the performance of all involved data platforms, to an increase in user convenience and to an increase in traffic on all linked platforms. To achieve this, the links must be bi-directional. In the test case Tech4Biowaste-Pilots4U, this means the ability to move from technologies to relevant scale-up facilities but also from these shared facilities to relevant technologies.

People and resources have been reserved to provide automated links from the Tech4Biowaste platform towards other data platforms such as Pilots4U. Both platforms have a similar technology scope, so that the links can unambiguously be made per technology of the Wiki-based Tech4Biowaste platform, and the user is immediately directed to the right part of the Pilots4U data platform.

As a first example, a link has been made from the Tech4Biowaste platform to the Pilots4U platform for the pyrolysis technology, see figure 5.

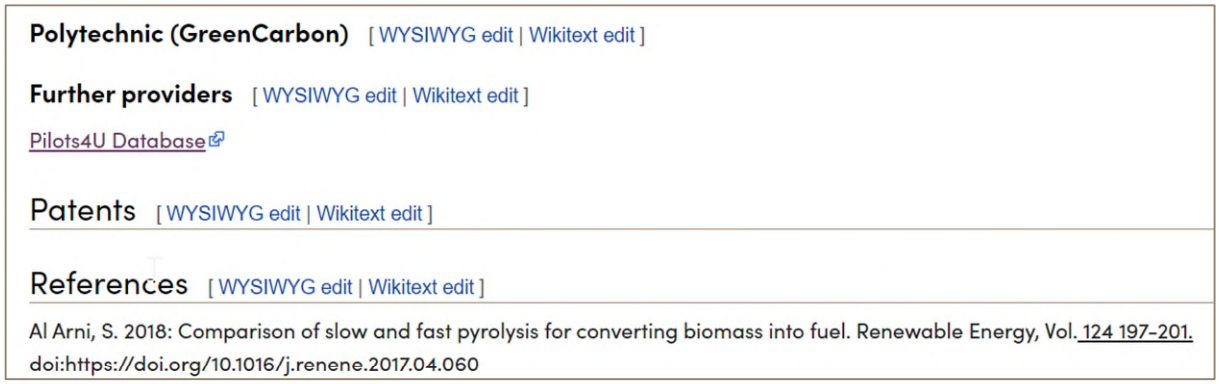

Figure 5: First example of technology link made from the Tech4Biowaste platform to the Pilots4U platform

This makes an automatic selection in the Pilots4U database as shown in figure 6, so that available pyrolysis facilities and equipment are immediately mapped on the Pilots4U platform.

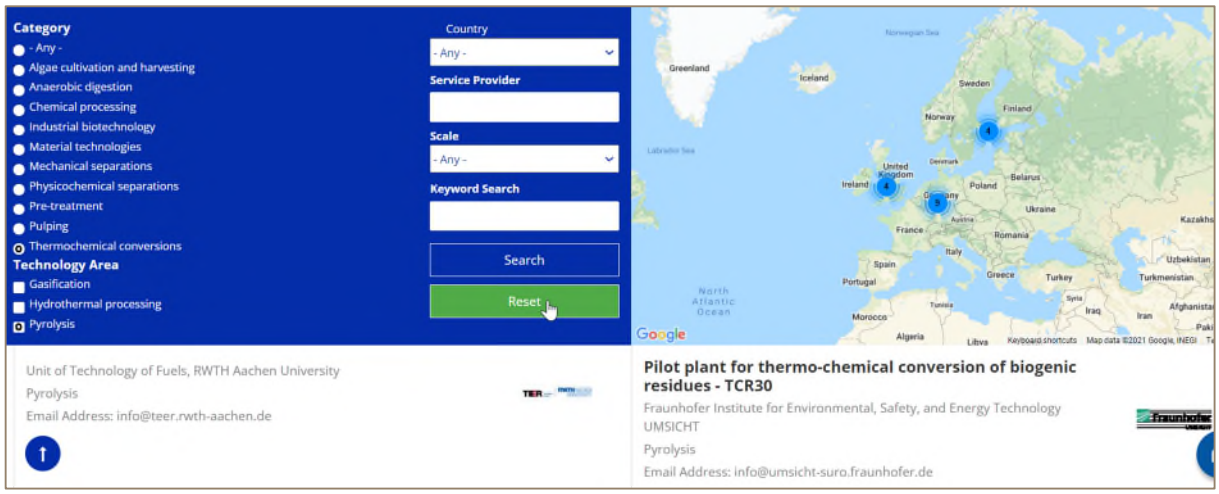

Figure 6: Automated selection of open access facilities in Europe with Pyrolysis infrastructure on Pilots4U platform

To provide the same functionality in the other direction, the software environment of Pilots4U needs to be adapted and automated links per technology need to be made towards the Tech4Biowaste platform.

To realise the link from the Pilots4U platform, an external service provider will be engaged in the coming period to carry out the following activities:

- An assessment of the technical structure of the Pilots4U platform

- Elaboration of a work plan with a technical elaboration of the technology links

- Discussion of the concrete link methodology on Tech4Biowaste with NOVA

- Implementing the technology links from Pilots4U to Tech4Biowaste.

4 Methods to build, populate and update the database

4.1 Database population strategy

Chapter 3 set out the set-up, structure, and technical requirements of the T4B database. Because a Wiki-based system is implemented, and a flexible and bottom-up approach is adopted, the process to **populate** the T4B database could start as soon as the database structure was sufficiently developed. This was already the case in early July 2021, just three months after project start. The (initial) database structure is described in Deliverable 2.3 *Functional design for technology database*.
Working procedures and a mechanism will now be put into place to smartly populate the database and the decision support tool.

4.1.1 Hybrid database population model

As per the T4B grant agreement, a **hybrid model** will be adopted to populate the database, smartly combining contributions from three different sources (see Figure 7):

1. **Internal contributors**, originating from the consortium's core publishers' team;
2. **External contributors**, originating from a community of volunteers from the stakeholder groups; and
3. **Automated contributors**, applying technical scripts and tools („bots") for automatic updating content and extracting new information.

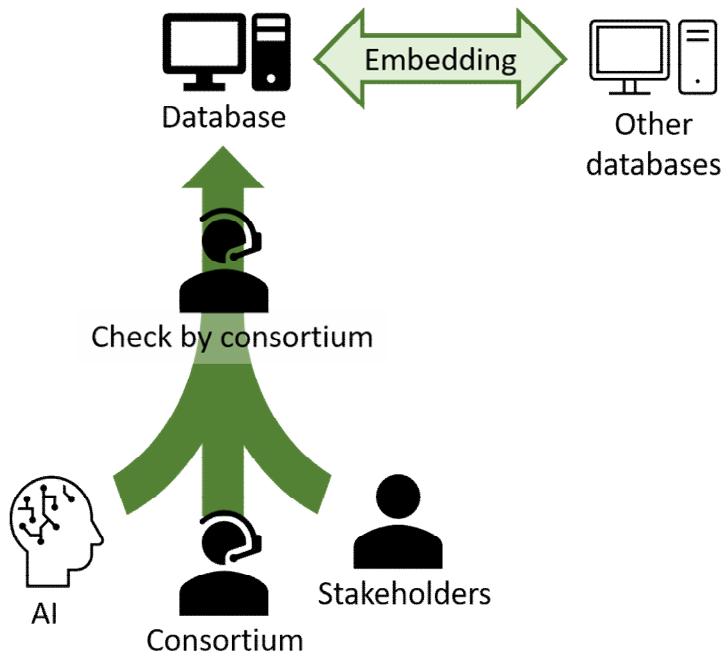

Figure 7: Hybrid model to populate and update the database and the embedding with other databases

Whereas contributions can originate from any of the three mentioned sources, the T4B Wiki-team (or more precisely: WP3 coordinator NOVA) is charged with monitoring and coordinating the process and supporting the volunteers providing external contributors. NOVA is also charged organising the automated contributors.

The T4B Wiki-team will supervise the process of early database population to ensure that no large discrepancies between coverage of technologies develop. Technologies that are more challenging to flesh out using external experts and automated methods will have to be further expanded by the Tech4BioWaste Wiki-team.

4.1.2 Basic database content

In Q3 2021 the consortium discussed and agreed on the proposed content and data fields of the biowaste valorisation technology database (see Deliverable D2.3). Among others, the database will contain the following information for each of several tens of conversion technologies:

- **Technology profile**: a short description of the technology.
- **Technology provider infobox**: an infobox will be provided per technology provider. The infobox will contain (a) general information, (b) technology and process details and (c) feedstock and products details. Although the main content of infoboxes is always the same, infoboxes can be customised depending on the specific technology.
- **Technology comparison tool**: an overview listing all (or selected) technology providers and the key aspects of their technologies in a comprehensive table. The database user will be able to sort the content of the comparison table upon her/his needs.

Details on the proposed database content are provided in D2.3 *Functional design for technology database*.

4.1.3 Early experience populating the database

To develop first experiences and to get a better insight if the hybrid model to populate and update the database would also work in practice, each of the three envisaged channels of contributors were tested, interviewed or otherwise explored to a certain degree:

- **Contributions from the T4B team:** The consortium explored the possibility to meet physically sometime soon after the 2021 summer holiday season, to sit together to populate the database with basic content. When it appeared impossible to find a suitable date, it was decided to arrange weekly edit-a-thons[6] on Monday afternoons, starting Monday 30 August. Working collaboratively during these edit-a-thons, and individually during the rest of the working week, the T4B consortium managed to reach its objective of populating the database with basic information on almost all technology categories[7] ahead of its large stakeholder event held in September 2021 in Brussels[8] ;
- **Contributions from volunteers (external contributions):** at the mentioned stakeholder event, close to 30 carefully selected stakeholders were interviewed in 1-on-1 meetings to assess their needs and their interest in contributing to the T4B technology database. Overall, there appeared large enthusiasm among the interviewed stakeholders, and the collaboration of a

[6] An edit-a-thon (sometimes written editathon) is an event where editors of online communities such as Wikipedia, OpenStreetMap, LocalWiki etc. edit and improve a specific topic or type of content.
[7] The degree of completing basic technology profiles was assessed as follows: primary processing technologies: 95% (42/44); secondary processing technologies 67% (10/15); hybrid processing technologies: 95% (21/22); overall score 90% (73/81).
[8] The 'Pitch Perfect and Boost the European Bioeconomy' event is a one day physical event of intense cross-border pitching, matchmaking and networking. It was held as a physical event at the Sheraton Brussels airport hotel on 28 September 2021.

significant number of them was secured (See Deliverable D2.1 *Needs and interest of stakeholders*, forthcoming). Individual companies providing technologies and their representing organisations (industry trade associations, networks/clusters, etc.) appeared equally enthusiastic.

- **Contributions from automated contribution:** due to lack of capacity, until now no practical experience has been gained yet using "bots" to extract or "harvest" relevant technology information from online sources (e.g. patent databases, news systems, open access publishing platforms such as OpenAIRE, etc.). How best to develop and apply such "bots" therefore remains to be explored at the time of writing (October 2021).

The conclusion is that when it comes the database population model, no major issues were experienced to date, nor are any foreseen at this stage.

4.1.4 Approach to further populating the database

To fill the technology database further, use will be made of all three identified categories of contributors (i. Internal contributors, ii. external contributors, iii. automated contributors). The most likely implementation scenario is that the focus will shift gradually over time, moving from an exclusive focus on Internal contributors in phase 1 to a larger emphasis on external contributors and automated contributors in phase 2. Concerning external contributors, it is anticipated that initially they may need a lot of coaching and mentoring (as foreseen in the grant agreement), but that once they gain more experience they will require (much) less support from the Tech4Biowaste Wiki-team.

Based on these assumptions, a viable approach for populating the T4B database was developed. The approach is described in Annex 1. The approach distinguishes four main database population phases, as follows:

1. Early population of the database
2. Completing the initial database
3. Testing, fine-tuning, Roll-out and early maintenance
4. Maintenance and expansion

It is planned that phases 1 and 2 will be completed before summer 2022, and that phase 3 starts aright after the 2022 summer break. Phase 4 will run beyond formal project duration). The tentative timing is summarised in Table 4.

Database population phase	**Q3/21**	**Q4/21**	**Q1/22**	**Q2/22**	**Q3/22**	**Q4/22**	**Q1/23**	**Beyond**
Phase 1: Early population of database	**XXXXX**	**XXXXX**						
Phase 2a: Externals populating the database			**XXXXX**	**XXXXX**				
Phase 2b: Technical bots populating database				**XXXXX**				
Phase 2c: Filling in key data(base) gaps				**XX**	**XX**			
Phase 3a: Testing and fine-tuning					**XXXXX**			
Phase 3b: Roll-out and early maintenance						**XXXXX**	**XXXXX**	
Phase 4: Maintenance and expansion								**XXXXX**

Table 4: Tentative planning of T4B database population, testing, roll-out and maintenance

4.1.5 Refining database population procedures

To streamline the process to populate and refine the database, clear working procedures will be defined, also describing the different types of user rights (administrator and editor rights). The consortium team will also set up a support and help desk (a) to coach and guide external contributors (b) to check and curate the information that is provided or collected, and (c) to implement final inspection and overall quality control. The consortium team will also stay responsible for providing database contributions itself, should the other contribution sources fail short.

The established working procedures etc. will be documented in a separate document, D3.2 Description of the working procedures for populating the database. This deliverable is due in January 2022.

4.2 Database governance

For the database, a well-designed governance structure is necessary, contributions need to be supervised and monitored and the quality input needs to be secured. This is especially important for the end of the public funding period. In general, two scenarios are likely to be implemented in the form of a minimum- and maximum-setup.

4.2.1 How to supervise and monitor contributions

As a minimum long-term setup, the training of new potential contributors can be made based on a quarterly period while article revision and customer service would be necessary on a monthly/weekly basis. The training for new contributors can be held online in the framework of a video-call in which the basic principles of the Tech4Biowaste database can be explained. A quarterly period ensures that enough participants are being recruited and take part in the training. The article revision will require up to four hours depending on the contributions to be reviewed. A monthly period will ensure that the database will be kept up-to date without losing any relevance for the stakeholders (technology providers and searchers). Customer service includes setting-up and managing user accounts and assistance for minor technical issues which will require one hour per week each for the Tech4Biowaste database and the RCC. A shorter time period ensures that potential contributors or members will not get the feeling of being left alone and thus prevents the platforms from being abandoned.

4.2.2 How to secure quality input on short & long term

Short-term, the quality input has to be monitored more frequently (e.g. on a weekly basis) since the content of the database is still small. A small content entails the risk that there are no or too few quantitative comparative values (e.g. numerical data on technologies, feedstocks, products) which could invite an exaggeration of the numerical data. However, due to the low availability of comparative datasets it will be difficult to identify such deception attempts. Furthermore, there are no or few qualitative contributions from technology providers that can serve as a benchmark for new contributors. Therefore, a more frequented revision of the contributions including detailed feedback loops are necessary to build up high-quality content.

Long-term, the quality input can be secured more easily since enough high-quality content will be available to easily identify deception attempts (e.g. automatically if values deviate strongly from the existing ones). Furthermore, the overall quality of contributions will later serve as a benchmark or guideline for new contributors. Under such conditions, the article revision would be necessary on a monthly basis as previously mentioned in chapter 4.2.1.

5 Business model

5.1 Cost of setting-up and maintaining the database

Setting-up costs are calculated based on WP3 which includes all necessary steps beginning from programming the database until the final delivery (Table 5). With that the setting-up costs are € 102,000 in total.

	[Months]	Cost [€]
WP3 Database implementation	**15**	**102,000**
T.3.1 Programming database, DST and online platform	2	13,600
T.3.2 Working procedures for populating the database	1	6,800
T.3.3 Recruiting volunteers populating the database	1	6,800
T.3.4 Training of volunteers populating the database	0.5	3,400
T.3.5 Applying artificial intelligence	2	13,600
T.3.6 Populate the database	6	40,800
T.3.7 Building Decision Support Tool and online portal	1	6,800
T.3.8 Beta testing of the database	0.5	3,400
T.3.9 Final delivery of the database	1	6,800

Table 5: Setting-up costs for the Tech4Biowaste database.

For the expected database maintaining costs after delivery the following aspects were considered:

Tasks related to the database:

- Database version upgrade, ~2x per annum, 12h/month, 144h/annum
- Database mirroring, ~2x per annum, 12h/month, 144h/annum
- Database security update, ~12x per annum, 2h/month, 24h/annum
- Wiki-training, 4x per annum, 8h/month, 96h/annum
- Customer service (account management, etc), 1h/month, 12h/annum
- Article revision, 4h/month, 48h/annum

Tasks related to RCC:

- Customer service (account management, etc), 1h/month, 12h/annum

Tasks related to database and RCC:

- IT infrastructure and hardware, 24h/month + 50€ fixed rate/month = 288h/annum + 600€ fixed rate/annum

Considering all listed tasks (Table 6), the maintaining cost will be approximately € 19,448.

Maintaining costs	Wiki [h/M]	RCC [h/M]	[€/M]
Database Version upgrades (2x/annum):	12	-	-
Database mirroring (necessary to avoid failures due to version upgrade) (2x/annum):	12	-	-
Database Security updates (12x/annum):	2	-	-
IT Infrastructure and Hardware	12	12	50
Wiki-training (4x/annum)	8		
Customer service (account management etc.):	1	1	
Article revision:	4		
Total [h/annum]	612	156	-
Total [d/annum]	76.5	19.5	-
Month rate [€]	5,890		
Total [€]	**15,019.5**	**3,828.5**	**600**
Total [€]	**19,448**		

Table 6: Maintaining costs for the database (wiki) and the proportionate costs for the Renewable Carbon Community (RCC).

5.2 Cost-recovery models considered

During the project, the T4B consortium will list and assess possible revenue models for possible application in the afterlife period of T4B (2023-2033). A positive assessment by the stakeholders is crucial in this respect.

5.2.1 Short term funding sources

No short-term income is pursued during the project period until 2023. The data platform is under construction under the full control of NOVA using the hybrid database population model hereby spending the available resources of the T4B project.

5.2.2 Long term funding sources

Any future integration model needs permanent funding sources. Keeping the database up to date will always require resources, both in terms of software updates and quality control of incoming content.

In phase 1 of the elaboration of a future business model, as described in 5.3. *Business Model*, the possible integration of the T4B technology platform within the Renewable Carbon Community is under discussion and evaluation. A thorough financial analyses still must be made in order to produce feasible financial plans and evaluate them for the sustainable operation of the database.

5.3 Business model

The final stage of the project first concerns research to sustain project results in the longer-term (at least ten years beyond the two-year project lifetime). To this end a business plan will be developed in a two-stage process and in consultation with stakeholders. For the governance structure a minimum and a maximum set-up will be developed. One of the specific challenges is the continuity of the technology database and keeping its relevance with up-to-date content after the end of the public funding period. Tech4Biowaste will look into possible scenarios by investigating and delivering insights into its associated governance structure and a potential business model, including the financial sustainability (cost structure and revenue streams), its unique selling proposition, the marketing channels and its further key activities, that can effectively be taken up and scaled-up beyond the end of the grant period.
In two stages a Business Plan (BP) will be developed for the sustainability phase (covering the 10-year project offspring period). Stage 1, involving consortium partners only, will yield a concise (internal) presentation showing outlines of possible business models (including key assumptions). Stage 2 will closely engage the different stakeholder groups in a co-creation process and will yield an iteratively validated and improved business scenario. Both exercises will provide (among others) the (i) identification of the legal, operational and organisational structure of the entity required to govern and operate the database post-project (including a roles and action plan for each partner within this structure); (ii) the services and the value propositions that will be provided by the database to members and users; (iii) a marketing plan clearly outlining the strategy and actions of the network for successfully delivering and capturing value; (iv) risk analyses incorporating market specific risks and network specific risks; and (v) thorough financial analyses in order to produce feasible financial plans and solutions for the sustainable operation of the database.

The result of stage 1 is the following. The Tech4Biowaste platform can be integrated into the Renewable Carbon Community (RCC) platform organised by nova-Institute. The platform aims to concentrate activities within the networks for renewable carbon utilisation and will foster activities surrounding the use of biomass, biowastes, CO2 and recycling / circular economy in a LinkedIn-like platform to strengthen networking and stakeholder engagement within this community. The activities started with the Renewable Carbon Initiative launched in September 2020[9] to actively work on solutions for companies to shift from fossil to renewable carbon resources and recycling. Within the platform several activities will be integrated starting with the Tech4Biowaste database but followed by several other topics. The integration can help to make the Tech4Biowaste database better known and reachable for stakeholders within the whole community.
This kind of integration will be two-fold. On the one hand, the consortium and all stakeholders will be integrated into the networking platform which is the core of the RCC. Members of the platform will have a profile and will be linked to different activities and working groups within the platform and can be active by sending information of their activities, place links to connected content and discuss on specific topics like it is known from other community platform like LinkedIn, xing, etc. The main difference to these is that the RCC will concentrate on topics around the use of renewable carbon sources and therefore will be a networking platform dedicated to exactly these groups of stakeholders. On the other hand, also the Tech4Biowaste wiki database can be integrated as a tool into the platform and will be reachable via the main navigation and additionally via an integration in the specific Tech4Biowaste group. This will guarantee that stakeholders - technology providers as well al searchers - will be able to find their way into the database.

[9] https://www.renewable-carbon-initiative.com

6 Conclusions and next steps

In the first 6 months of the project, the different parts of the feasibility study could be carried out and assessed.

The consortium succeeded in involving sufficient (30) stakeholders from relevant sectors in the concrete elaboration of the T4B technology platform. A number of them (10) have meanwhile become more intensively involved as members of the first testing panel. The interest from the group of relevant stakeholders is greater than expected. Two thirds of the involved stakeholders have the intention to actively participate.

The consortium succeeded in working out a first database set-up and structure, including the feedstock and product components in addition to the technology overview, and then tested it with a broad group of relevant stakeholders, including the members of the Advisory Board. The first reactions were predominantly positive and the comments and recommendations will be taken into account in the further development of the data platform towards a first beta version that will be ready and launched in the spring of 2022.

The intended functionalities of the database are technically implementable and all technical aspects of the platform are under control. A first automated link with the Pilots4U platform has been made and the bi-directional operation of the link is being analysed.

In accordance with the hybrid population strategy, the basic content could be completed in a short time with the help of the entire T4B consortium via intensive weekly edit-a-thons to make the platform presentable for external contributors who will be involved in the second phase.

Meanwhile, a first optional viable future business model, with the possible integration of T4B within the RCC, is under discussion and evaluation within the consortium.

In conclusion, the further elaboration of the Tech4Biowaste technology platform is undoubtedly feasible.

As a result, the consortium has already initiated an outlook overview that contains the current status and future planning for each work package. This outlook is included in annex 4.

7 References

European Commission 2021: : Biodegradable waste. Directorate-General for Environment (DG Environment) (Ed.), Download at https://ec.europa.eu/environment/topics/waste-and-recycling/biodegradable-waste_en

8 Annexes

Annex 1 Detailed programme of the 68 pitches of the co-organised event in Brussel
Annex 2 Survey documents used during the matchmaking sessions
Annex 3 Process steps in populating the Tech4Biowaste database
Annex 4 Outlook status project T4B end of October 2021

ANNEX 1: Detailed programme of the 68 pitches of the co-organised event in Brussels

Pitch Perfect and Boost the European Bioeconomy 2021

Cross-border Pitching, Matchmaking and Networking Event
28 September 2021, 10am – 5pm
Sheraton Brussels Airport Hotel

Plenary Opening Session (Galaxy I and II)				Exhibition in Catering Area
9:30	Registration and Coffee			
10:00	**Introduction to the organising innovation platforms**: Pilots4U (Stef Denayer), Tech4Biowaste (John Vos), BioeconomyVentures (Filippo Giancarlo Martinelli), Waste2Func (Sofie Lodens), Smartbox (Tanja Meyer) and Bio Base Connect (Wim Soetaert)			
10:20	**Keynote Lecture:** A venture capital perspective on the use of pilot plants in industrial biotechnology *by **Rob van der Meij, Capricorn Ventures***			
10:45	Short Break – Transformation of the room to pitch rooms			
Parallel Sessions				
	Pitch Room 1: Galaxy I	**Pitch Room 2: Galaxy II**	**Matchmaking room: Galaxy III**	
11:00	**Pitch Session 1** **INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY**	**Pitch Session 2** **INNOVATION SERVICES**	**Matchmaking session 1**	
12:30	Lunchbreak			
13:30	**Pitch Session 3** **INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY**	**Pitch Session 4** **INNOVATION SCOUTING**	**Matchmaking session 2**	
15:00	Coffee and Networking Break			
15:30	**Pitch Session 5** **INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY**	**Pitch Session 6** **INNOVATION SCOUTING AND INNOVATION SERVICES**	**Matchmaking session 3**	
Plenary Closing Session (Atrium)				
17:00	Closing remarks *by **Stef Denayer, Pilots4U***			
17:15	Networking drink			

Programme of the parallel sessions

	Pitch Room GALAXY I	**Pitch Room GALAXY II**
11:00 – 12:30	Pitch Session 1: INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY *Moderator: Nico Snoeck*	Pitch Session 2: INNOVATION SERVICES *Moderator: Stef Denayer*
11:00 – 11:04	Introduction	Introduction
11:04 – 11:10	Power to Protein: What if we could SUSTAINABLY create FOOD out of GREEN ENERGY? Stijn Boeren, Avecom, BE	INN-PRESSME - a project, open innovation test bed and ecosystem aiming to support European companies to meet sustainability goals Heli Kangas, VTT Technical Research Centre of Finland, FI
11:12 – 11:18	ENDOBIOS E-CHEM, B-TO-B service: Discovery of beneficial health values in natural extracts through chemistry Celso Almeida, Endobios Biotech, PT	Separation technologies and process design for biorefineries Arne Gröngröft, Deutsches Biomasseforschungszentrum GmbH, DE
11:20 – 11:26	B4Plastics - Redesigning tomorrow's plastics. Today. Sil Nevejans, B4Plastics, BE	LSIWC - sustainable non-food bioeconomy research center Janis Rizikovs, Latvian State Institute of Wood Chemistry, LV
11:28 – 11:34	FineCell: Making Advanced Cellulose for a biobased future Abir Bouledjouidja, FineCell Sweden AB, SE	The accelerator of your industrialisation Stéphane Soum, Pivert, FR
11:36 – 11:42	Next generation fungal textiles Iris Houthoff, Mylium BV, NL	Travel with us to Fraunhofer CBP Christine Rasche, Fraunhofer CBP, DE
11:44 – 11:50	Improved biocatalysts for waste conversion and bioproducts/biopolymers production Vincenza Faraco, University of Naples Federico II, IT	Bio Base Europe Pilot Plant: Ready for the Roaring Twenties! Hendrik Waegeman, Bio Base Europe Pilot Plant, BE
11:52 – 11:58	Superior yeast as a target and a tool Johan Thevelein, NovelYeast, BE	Green Biorefining Demonstration Scale Platform Thalles Andrade, Aarhus University, DK
12:00 – 12:06	Modular technology for conversion of wet waste biomass to sustainable fuels Ib Johanssen, Circlia Nordic aps/Bio2Oil, DK	Multipurpose commercial demonstration facility enabling rapid scale up of bioproducts Martin Kavšček, Acies Bio d.o.o, SL

12:08 – 12:14	Operational excellence in bio-manufacturing Damien Bertrand, DNAlytics, BE	VTT Bioruukki Pilot Centre - new offering by the open access pilot facility Mika Härkönen, VTT Technical Research Centre of Finland, FI
12:16 – 12:22	Direct processing of sugar beets to biofuels and chemicals Hans van Klink, Dutch Sustainable Development BV, NL	Mibiolab – Your experts for bioprocess development. Digital. Automated. Accelerated. Vanessa Schmitt, Research Center Jülich (IBG-1: Biotechnology) - Microbial Bioprocess Lab, DE
12:24 – 12:30	Microbial production of chitosan oligosaccharides: a path towards responsible producers and societies Chiara Guidi, Centre for Synthetic Biology, BE	Lab-, pilot- and industrial-scale systems for biotechnological processes Audrius Gegeckas, Bioenergy LT, LT
12:32 – 12:38	Transforming food protection by protein-based biocontrols Dieter Schouppe, Biotalys NV, BE	

13:30 – 15:00	Pitch Session 3: INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY *Moderator: Tanja Meyer*	Pitch Session 4: INNOVATION SCOUTING *Moderator: John Vos*
13:30 – 13:34	Introduction	Introduction
13:34 – 13:40	Ultrasonic biorefining to produce high quality hemicellulose, cellulose and natural lignin Miranda Lindsay-Fynn, Bio-Sep, UK	JRS as an established innovation & cooperation partner in bioeconomy Antonia Hantschel, J. Rettenmaier & Söhne GmbH & Co. KG, DE
13:42 – 13:48	Synthesis of new surfactants using enzyme from Biomass such as Brewery spent's grains Benoît Moreau, HEPH-Condorcet, BE	B2BE facilitator: Mobilizing primary sector in the Flemish bioeconomy Jasmine Versyck, B2BE Facilitator, BE
13:50 – 13:56	AmphiStar: Getting biosurfactants mainstream Bernd Everaert, AmphiStar, BE	Tech4Biowaste: Get your Technology out of the Dark Lars Krause, Tech4Biowaste project/nova-Institute, DE
13:58 – 14:04	BioCon pilot platform - upscaling lignin-first biorefinery Joost Van Aelst, KU Leuven, BE	NextGen Demo: Support and space for innovative demonstration projects in the circular industry Marleen Ramakers, Port of Antwerp, BE
14:06 – 14:12	Innovative Refining Technologies for Valorisation of Vegetable Oil Deodorizer Distillates Olga Gomez, Tecnalia, ES	BioeconomyVentures: raising disruptive bioeconomy ventures, startups and spinoffs to the top Filippo Giancarlo Martinelli, BioeconomyVentures/Irish Bioeconomy Foundation, IR
14:14 – 14:20	Cashew-shell biorefineries Pierluigi Ferri, Elmira Industrial Supplies, DE	We accelerate your transition to the bio-economy Wim Van Vooren, FLAMAC, BE
14:22 – 14:28	Capturing Carbon. Creating Value Babette Pettersen, LanzaTech Inc, BE	Advanced Biofuels Research Offering Maarten Van Haute, Kuwait Petroleum Research and Technology, BE
14:30 – 14:36	Unlocking the potential of enzymes to enhance food and chemicals Jordi Lopez, Enginzyme, SE	Feedstock valorisation by using continuous extraction and purification techniques Kristof Van Bellegem, Ajinomoto, BE
14:38 – 14:44	Biosurfactants for Gastric Wellness Matthew Twigg, Ulster University, UK	Fastering the industrialization of bioeconomy's innovations Johan De Coninck, IAR – The French Bioeconomy Cluster, FR
14:46 – 14:52	Biobased and biodegradable plastics from agri-food residues Gilles Crahay, PolyPea SRL, BE	ECBF: Capital for circular bioeconomy scale-ups Peter Nieuwenhuizen, ECBF, NL
14:54 – 15:00	From woody biomass to C6 polymers Patrick van der Meer, Chemelot InSciTe, NL	Industrial biorefineries grow by adding start-ups James Cogan, ClonBio Group Ltd, IRL
15:02 – 15:08	Carrara vs beer - Can panels made from beer residue compete with marble? Pieter Dondeyne, Circular Matters, BE	

15:30 – 17:00	Pitch Session 5: INNOVATIVE TECHNOLOGIES FOR THE BIOECONOMY *Moderator: Tanja Meyer*	Pitch Session 6: INNOVATION SCOUTING AND INNOVATION SERVICES *Moderator: Stef Denayer*
15:30 – 15:34	Introduction	Introduction
15:34 – 15:40	Metal-Organic Framework (MOF)-based route for Carbon Capture utilizing residual Biomass as a Feedstock Priyanshi Vadalia, CatOlyst Chemtech, NL	Renewed Chempolis Biorefinery demonstration plant enabling pure future Hytonen Keijo, Chempolis Oy, FI
15:42 – 15:48	Bioaromatics from lignin Tom Claessen, VITO, BE	Invitation: How do we best invest 35 MEuro in RISE' BioRefinery? Peter Alberius, RISE, Research Institute of Sweden, SE
15:50 – 15:56	Production of healthy plant proteins through fermentation Jens Legarth, Fermentationexperts, DK	Human capital to boost the biobased economy. Reflections on niche talent acquisition – An easy match or a challenge? Saskia Goeteyn, MindCapture (Cleantech Division), BE
15:58 – 16:04	Smart biodegradable aerogels for multiple applications Isaac Benito-Gonzalez, IATA-CSIC and AEROFYBERS, ES	Reinforcement learning for creating flowsheets Albert Mestre, Intemic, ES
16:06 – 16:12	Creator of Biobased Resins for High Performance Coatings Eric Van Nevel, Anacarda Ltd, BE	Standardisation to support bioeconomy from idea to large-scale application Jarno Dakhorst, NEN, NL

16:14 – 16:20	Zeroplast: Free of plastics, but works like it. Friedrich Breidenbach, Zeroplast, AT	Transforming the Scale-Up of Biobased Molecules Jere Koskinen, Mega Cellulose Oy, FI
16:22 – 16:28	Valuable ingredients from a global environmental problem Mikael Westerlund, Origin by Ocean, FI	Micro-Organisms for Mega-Opportunities Antonio Del Casale, Microbion, IT
16:30 – 16:36	EcoFLEXY, a microplastic-free alternative Paruntungan Sihombing, Cellugy, DK	Bridging innovation and feasibility Ema Nemet, Process Design Center BV, NL
16:38 – 16:44	Renasci 2.0: Waste-to-sugars, a sustainable feedstock for biobased chemistry Emile Redant, Renasci, BE	Highlights of BPF – what differentiates BPF from other pilots? Raimo van der Linden, Bioprocess Pilot Facility, NL
16:46 – 16:52	*In Silico* Engineering of Oxidative Enzymes Applied to Lignin Revalorization Processes Lur Alonso Cotchico, Zymvol Biomodeling SL, ES	Setting up a registration system for agricultural food waste Nele Loenders, Innovatiesteunpunt, BE
16:54 – 17:00	Extractions and applications of antioxidants from biomass Wouter De Weirdt, Tectero, BE	Accelerating Biobased Product Development Nicolas Becker, Toulouse White Biotechnology, FR

ANNEX 2: Survey documents used during the matchmaking sessions

TECH⁴ BIOWASTE

Survey Brussels technology provider

Task
T2.1

Work package
WP2

Survey data
28.09.2021

Survey place
Sheraton Brussels Airport Hotel

Company/organisation

Name

Our short intro about Tech4Biowaste

Which technologies are best suited to turn a specific biowaste stream into value?

Tech4Biowaste develops a dynamic Wiki-style database on relevant biowaste valorisation technologies. It covers technology readiness levels 4 and higher, relevant feeds (food waste & garden waste) and products. The database will contain up-to-date information, will be user-friendly, well maintained and accessible to everybody.

The database is under development. We are addressing the needs and interests of all stakeholders. Also you as a technology provider on the database.

- Show your technology
- Find the right feedstock for your technology
- Become visible for manufacturers of bio-waste derived products
- Find new business partners

This project receives funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101023200.

Bio-based Industries Consortium

Horizon 2020 European Union Funding for Research & Innovation

Task 2.1
Survey technology provider

Survey questions

1 Can you describe your technology in 1 minute in a KISS way (keep it simple straightforward)?

2 Can you indicate under which category your technology fits? Use technology scope P4U.

3 How and where is your technology findable on the internet today?

4 What details about your technology would you be able/willing to share without running up against your IP limits?

5 What do you think a platform should be able to do? Ask for features.

6 How is your technology different when compared with that of your competitors?

7 How much time and money would you be willing to spend to put your technology on a technology platform?

8 Are you interested in becoming more closely involved as a member of our first testing panel next week (yes/no)?

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Survey Brussels technology searchers

Task T2.1	**Work package** WP2
Survey data 28.09.2021	**Survey place** Sheraton Brussels Airport Hotel
Company/organisation	**Name**

Our short intro about Tech4Biowaste

Which technologies are best suited to turn a specific biowaste stream into value?

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The database is under development. We are actually addressing the needs and interests of all stakeholders. Also you as a potential user - searcher on the database.

- Search for technologies and technology suppliers
- Find the right application for your feedstock
- Find the right technology for the bio-waste derived product you are searching

This project receives funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101023200.

Survey questions

1 Do you often organise a search for technologies?

2 Can you describe your latest search, how you proceeded your search and what you found?...

Were you satisfied about it?

3 What are your favourite places to find appropriate technologies? Give us a good example.

4 What kind of information are you looking for when searching for specific technologies?

5 What elements of information about technologies makes you decide to start contacting people?

6 What do you think a platform should be able to do? Ask for features.

7 Are you interested in becoming more closely involved as a member of our first testing panel next week (yes/no)?

ANNEX 3: Process steps in populating the Tech4Biowaste database

Four (4) phases of populating the database are foreseen:
Phase 1: Populating the database with basic **technology profiles**, making sure that each biowaste valorisation technology is sufficiently covered.
Phase 2: Filling the lion's share of the database, in 3 partially overlapping steps, so that it is ready for broad dissemination and use:

1. Expanding the technology profiles with **additional info and details** originating from technology providers (or users), or their representative organisations
2. Scouting (further) **emerging technologies**, applying technical scripts and tools („bots")
3. Filling in **data gaps**, and 'completing' the initial database.

Phase 3: (Fine-tuning, roll-out and) early maintenance of the database during project implementation.
Phase 4: Maintaining the database during **project afterlife**, to keep an active and up-to-date database.
Because a flexible Wiki-system is adopted, the process of populating the database can run in parallel with database refinement without causing any major issues.

Phase 1: Tech4Biowaste team populating the database with basic information
Aim: Make sure that each of the (ca. 35-40) technology categories is covered.
Narrative: Future database contributors (users) may represent (search) any relevant technology. If we do not present at least some basic information on a given technology (in other words: the technology profile is empty) at an early stage this would demotivate prospective volunteers to contribute content.
Approach: The Tech4Biowaste Wiki-team fills each technology profile with initial information. To create and maintain momentum, and to ensure that basic profiles are completed for all biowaste valorisation technologies, weekly **edit-a-thons** are organised in which each Tech4Biowaste partner participates. Information to be use in the technology profile will be collected from the partners' existing knowledge base, online through a targeted Internet search, through exploration and analysis of technology overview/assessment studies, etc.
Timeline: Phase 1 was largely completed prior to the Matchmaking and Networking Event, 28 September 2021 in Brussels. Work in Phase 1 is expected to be fully completed in Q4, 2021.

Phase 2: Filling the lion's share of the database
Aim: The purpose of this second phase is twofold: (a) To fill the lion's share of the database and (b) to make sure that the basic technology profiles are elaborated into **comprehensive technology descriptions**. The latter contain, beyond the basic technology profile, detailed information on specific technologies/configurations, that will be presented in (a) **technology provider sections** and (b) **technology comparison tables**.

Phase 2a: Externals populating the database with detailed information
Narrative: The basic technology profiles will be expanded to include additional (general) information on the technology and, more importantly, specific details concerning technologies provided by various providers.
Approach: To reach out to a lot of technology providers, first and foremost the involvement of **ambassadors and multipliers** is deemed essential. These are organisations that have access to a large network of technology providers (or users) and that may operate at different levels (international, national, regional, or even local). Examples include: umbrella and/or representative organisations (such as industry

associations, clusters, or chambers of commerce), technology transfer officers, the Tech4Biowaste Advisory Board (AB) members, et cetera. To cooperate as ambassadors and multipliers, Tech4Biowaste will need to generate interest and confidence among these actors and organisations. Actions to this end include identifying candidate organisations and engaging the most relevant ones through an online or a physical meeting, to assess how they can and want to contribute to Tech4Biowaste implementation and promotion.
Building on the results from the above stakeholder engagement activity, and combining this with existing networks of the Tech4Biowaste partners (established contacts with key stakeholders across the whole bio-waste value chain), the Tech4Biowaste Wiki-team will subsequently approach and stimulate individual technology providers to act as **external volunteers** to contribute to the database. External volunteers are expected to add the following to the database:

- More information on the technology description
- More details from specific technology providers
- Potentially: New technologies that were missing in the database (filling gaps)

Timeline: The engagement with umbrella and/or representative organisations in Phase 2a can start in earnest as soon as Phase 1 is largely completed. Engagement with individual technology providers to act as external volunteers to contribute to the database can start in earnest in early 2022.

Phase 2b: Technical bots populating the database with additional information
Aim: Make sure that emerging technologies are also identified and that a full picture of emerging technologies is presented in the Tech4Biowaste database.
Narrative: To scout emerging technology developments, technical scripts and tools („bots") will be applied for automatic collecting of content on new technology options from several online sources (e.g. patent databases, news systems, open access publishing platforms such as OpenAIRE, etc).
Approach: A full assessment of online sources to be used remains to be made. Among others, the Tech4Biowaste consortium will make use of the **DWPI patent database**. This type of resources can be used to scope new developments (emerging technologies) and technology trends. The nova-team will develop automated scripts that will return information and data that can be adapted and added to the database.
Timeline: It is foreseen that preparations will be made in Q1, 2022 (e.g. developing a detailed approach) and that actual implementation will take place in Q2, 2022.

Phase 2c: Tech4Biowaste team filling in key remaining data gaps
Aim: To refine the database to a version that is ready for testing, broad dissemination and use.
Narrative: A dedicated and targeted effort will be made to fill key remaining gaps so that the database will be 'complete' and reach its final form. This final form will be maintained and expanded upon after the project ends (in Phase 4).
Approach: Similar activities at those listed in the earlier phases may be deployed, but in a focused manner. In addition, patent databases will be researched to generate leads for missing technologies or technology providers. In this manner, the data gaps can be filled to ensure a fully populated database.
Timeline: Phase 2 activities should be largely completed by the end of the summer of 2022. Phase 2c will be implemented in the period May-July 2022 (M14-M16) i.e. right before the 2022 summer holiday season.

Phase 3: Testing, fine-tuning, and roll-out during project implementation
Aim: To test and to roll-out a ready-to-use version of the database; to collect and process early feedback from database users

Narrative: For quality reasons and impact considerations, the external validation of the database is considered key.
Approach: A Testing Panel (to be put together during project year 1), consisting of (future/candidate) database users, will be engaged to test the operation of the database in the widest sense. Feedback from the testing panel will be processed before wider dissemination of the database takes place.
Timeline: Database testing can start in M17-M18 (Aug-Sep 2022) i.e. right after the 2022 summer holiday season. This will allow for database dissemination to start in October 2022 and to run for a six-month period.

Phase 4: Maintenance and expansion during Tech4BioWaste project afterlife
Aim: To maintain an active and up to date database that provides value to technology providers and seekers
Narrative: A fully functional database has been set up that can be maintained with minimal effort. No further input from the Tech4BioWaste consortium is required and the database will be kept up to date by the use of external volunteers.
Approach: By integration of the database to other frameworks, such as the Renewable Carbon Initiative, the database will get attention and interest from third parties that can become **external volunteers** to add new developments and correct out of date information. Experts at nova will ensure the quality of the delivered data.
Involvement: As the project period is over the Tech4BioWaste consortium as a whole is no longer formally involved. During the project afterlife the database will be managed by external volunteers and by Tech4Biowaste partner NOVA.
Timeline: Phase 4 is foreseen to run for as long as a decade after Tech4BioWaste project completion, i.e. from March 2023 until February 2033.

ANNEX 4 Outlook status project T4B end of October

WP1: Stakeholder engagement

Main objective: Bringing the network of stakeholders alive. Status: ongoing. All WP1 deliverables due in 2021 are completed

T1.1: Technology scoping and categorisation	item (c): Conduct a **patent search** using bots
T1.2: Mapping of European stakeholders	**Stakeholder directory** (Excel sheet) to be expanded and maintained
T1.3: Stakeholder engagement mechanisms	Address the question how to get the most out of stakeholder groups (→ expand SEP)
	Align with Communication and Dissemination (C&D) planning in WP5
T1.4: Interaction with stakeholders	Presentation of **initial results** (database design; set-up online platform) (linked to WP2/WP5).
T1.5: Interaction with advisory bodies	Organise periodic meetings of, and engage, **Advisory Board** (next meeting: 13 Jan 2022)
	Set-up and activate the **Testing Panel**
Next deliverables (due M12 = March 2022):	**D1.7** Annual synthesis report on stakeholder engagement
	D1.8 Annual synthesis report on interaction with external advisory bodies

WP2: Database preparation and feasibility study

Status: completion of WP2 activities is foreseen in M7 (October 2021).

Milestone MS2 ("what type of feedstock the database will cover") was reported to have been met.

Key result: a feasibility study endorsing the direction of the database development, describing a realistic business model and defining the database content (necessary, optional and preferred data).

WP3: Database implementation

Status: ongoing. Formally started in M4; de facto in M1. All WP3 deliverables due in 2021 are completed.

Seven tasks (**Tasks 3.1 thru 3.7**) shall be continued or be initiated in 2021/2022, covering:

- Programming of database structure and decision support tool;
- Defining working procedures for database populating;
- Recruiting and training of volunteers populating the database;
- Develop and apply artificial intelligence (AI) tools for database populating;
- Populating (filling) the database and the decision support tool.

Next deliverables & milestones (due in M10 = January 2022):

- D3.1 Description of the technical set-up and programming of the database

WP3: Database implementation

Database to be completed before summer 2022 to allow Beta-testing in Q3, 2022.

Tentative planning of T4B database population, testing, roll-out and maintenance

Database population phase	Q3/21	Q4/21	Q1/22	Q2/22	Q3/22	Q4/22	Q1/23	Beyond
Phase 1: Early population of database	XXXXX	XXXXX						
Phase 2a: Externals populating the database			XXXXX	XXXXX				
Phase 2b: Technical bots populating database				XXXXX				
Phase 2c: Filling in key data(base) gaps				XX	XX			
Phase 3a: Testing and fine-tuning					XXXXX			
Phase 3b: Roll-out and early maintenance						XXXXX	XXXXX	
Phase 4: Maintenance and expansion								XXXXX

WP4: Business plan for long-term continuity of database

Status: Formal start of WP4 activities is planned in M13 (April 2021), but considering a Milestone is due in the same month the work will have to start earlier.

T4.1: Long-term database continuity

- A thorough analysis of the pros and cons of different business models, associated governance structure/s, and of various approaches for the sustainability phase will be conducted during iterative business plan modelling. Building i.a. upon the insights drawn in WP1 on stakeholders' needs analysis, interests and perceptions.

Next deliverables and milestones

- MS7 A concise presentation showing outlines of possible business models (due April 2022):
- D4.1 Continuation Model detailing mechanisms allowing LT database maintenance; documenting results of a thorough analysis of the pros and cons of different business models & approaches for the sustainability phase (due June 2022)

WP5: Dissemination, communication & exploitation

Status: ongoing. All WP5 deliverables due in 2021 are completed,

T5.2 External Communication Plan

- Organise next workshop to promote the involvement of stakeholders and technology providers for the database (see WP1) and to generate interest for the content for technology seekers and interested parties.
- Other events to communicate on the Tech4Biowaste database and to disseminate results,
- Update promotional materials (e.g. project brochure) ?

T5.4 Promotion campaign

- 1st (social media) campaign, to inform on the technology database, and on how stakeholders can contribute to it.

WP6: Project management

Status: ongoing. All WP6 deliverables due in 2021 are completed.

Key project management tasks

- Coordinate the project; coach the work package leaders.
- Organise biweekly meetings (on Wednesday mornings).
- Prepare the 1st annual report.

Next deliverables & milestones (due in M12 = March 2022):

- D6.3 Technical Review Report.