

Biotechnology and Bio-Based Products Perceptions in the Community of Madrid: A Representative Survey Dataset

Juan Romero-Luis ^{*}, Manuel Gertrudix , María del Carmen Gertrudis Casado and Alejandro Carbonell-Alcocer 

Faculty of Communication Sciences, Universidad Rey Juan Carlos, 28933 Madrid, Spain; manuel.gertrudix@urjc.es (M.G.); carmen.gertrudis@urjc.es (M.d.C.G.C.); alejandro.carbonell@urjc.es (A.C.-A.)

* Correspondence: juan.romero@urjc.es

Abstract: (1) Background: Bioeconomy aims to reduce dependence on non-renewable resources and foster economic growth through the development of new bio-based products and services. Achieving this goal requires social acceptance and stakeholder engagement in the development of sustainable technologies. The objective of this data article is to provide a dataset derived from a survey with a representative sample of 500 citizens over 18 years old based in the Community of Madrid. (2) Methods: We created a questionnaire on the social acceptance of technologies and bio-based products to later gather the responses using a SurveyMonkey panel for the Community of Madrid through an online CAWI survey; (3) Results: A dataset with a total of 82 columns with all responses is the result of this study. (4) Conclusions: This data article provides not only a valuable representative dataset of citizens of the Community of Madrid but also sufficient resources to replicate the same study in other regions.

Dataset: The dataset is accessible via the following link: (<https://www.mdpi.com/article/10.3390/data8050084/s1>).

Dataset License: CC-BY

Keywords: social acceptance; biotechnology; bio-based products; bioproducts; circular economy; bioeconomy; biorefinery; questionnaire; science communication



Citation: Romero-Luis, J.; Gertrudix, M.; Gertrudis Casado, M.d.C.; Carbonell-Alcocer, A. Biotechnology and Bio-Based Products Perceptions in the Community of Madrid: A Representative Survey Dataset. *Data* **2023**, *8*, 84. <https://doi.org/10.3390/data8050084>

Academic Editor: Enrico Blanzieri

Received: 5 April 2023

Revised: 21 April 2023

Accepted: 26 April 2023

Published: 1 May 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Summary

Bioeconomy is a topic of growing interest and importance worldwide. The European Union continues to prioritize the development of a sustainable bioeconomy [1], aiming to reduce dependence on non-renewable resources and foster economic growth through the development of new bio-based products and services [2]. The implementation of a new bioeconomy could mean the generation of new green jobs and an increase in the annual revenue in the European Union. To do so, the proliferation of biorefineries is needed due to their potential for converting waste biomass into value-added products and their capability to reduce waste, increase resource efficiency, and create new revenue streams [3]. Even though biorefineries still face some problems that are being studied to be solved [4,5], there are many technological advances that allow the development of biofuels or value-added products based on a large variety of sources such as microalgal [6,7] and seaweed [8], lignin [9], rice straw waste [10] or food waste [11], among others.

In addition to the potential environmental and economic benefits, there is also growing recognition of the importance of social acceptance and stakeholder engagement in the development of sustainable technologies [12–14]. Understanding the trends and preferences of biotechnology and their bio-based products in regional communities is becoming a priority in local areas for the implementation of bioeconomy on the local scale [15,16].

In this direction, the BIOTRES project, which seeks to improve the life quality for citizens in the Community of Madrid by fostering the bioeconomy through the development of biorefineries to produce bioproducts and the co-production of bioenergy, considers the importance of understanding the social perspectives of bioeconomy and bio-based products to achieve its goal. Therefore, its 10th objective stipulates the elaboration of a techno-economic and environmental study of the technologies studied in the project. Consequently, a survey was designed and distributed among 500 overaged citizens of the Community of Madrid. The aim of this project task was to broaden the knowledge of the citizens' perceptions about biotechnologies (and their bio-based products) in order to better understand the feasibility of their implementation. Thus, this innovative approach in the Community of Madrid helps to obtain information about social acceptance that facilitates decision-making for the implementation of biotechnology. In addition, this data paper enables the replicability of the survey in other regions and in the Community of Madrid to elaborate longitudinal studies in the future.

The objective of this data article is to supply the raw results of the conducted survey on social acceptance of technologies and bioproducts and to provide further details on the methodology used to design it and collect the responses to facilitate the replicability of the study.

2. Data Description

This dataset contains all responses to the survey conducted. A total of 532 responses were submitted, of which only 500 were fully completed and, thus, considered valid. Further information about the identification of the unique identifiers of the uncompleted responses is listed in S1.

2.1. Survey Structure and Design

The questionnaire was designed through a collaborative process between academics from different disciplines, such as Environmental Biotechnology and Communication. Its structure was based on previous studies on public perception and social acceptance of other renewable energies [17], as well as bioproducts derived from biowaste [18]. It is composed of 21 questions that were structured in 6 different sections (Table 1). The original version (Spanish) and the English version of the questionnaire are available in S2.

Table 1. Questionnaire sections and their respective questions.

Section Topic	Questions
Sociodemographic questions	1 to 7
Attitudes towards sustainability	8 to 10
Attitudes and perceptions about waste sorting at source and waste treatment	11 and 12
Attitudes and perceptions regarding the acceptance of biofuels	13 to 15
Attitudes and perceptions regarding the acceptance of biorefinery facilities	16 to 19
End of survey	20 and 21 *

* Questions 20 and 21 were the only non-mandatory questions included in the questionnaire.

The last section only included two questions that were meant to gather additional information on the opinion of the respondents and the contact details for those interested in receiving further information about the study's results.

Question 4 relates to the respondent's level of education and uses the National Classification of Education (CNED-P-2014) [19], which is based on the International Standard Classification of Education (ISCED-2011) [20] and used by the Spanish National Statistics Institute (INE), to elaborate the different values of the response (Table 2). This classification allows comparison between countries:

- Levels 0–2: preschool, elementary school, and first stage of secondary education.

- Levels 3–4: second stage of secondary and post-secondary education.
- Levels 5–8: first and second cycle of higher education and doctorate.

Table 2. Relationship between CNED-P-2014 levels of education and the values of question 4 of the questionnaire.

CNED-P Levels of Education	Question 4 Answer Values
Levels 0–2	Without study Preschool Elementary school
Levels 3–4	Bachelor’s degree—Intermediate Degree of Professional Training Superior Degree of Professional Training
Levels 5–8	University Degree University Master’s Degree Doctorate

2.1.1. Types of Questions Included in the Questionnaire

The authors have developed a typology of questions used to gather information in the questionnaire in order to facilitate the comprehension of the dataset. This typology is based on the type of answers and the nature of the action that respondents must carry out to answer the respective question. The type of question determines the representation of the data in the dataset and, therefore, its interpretation.

- **One choice question:** Respondents can only choose one of the options provided as possible answers. Data are displayed in a single column in the dataset, and the value corresponds to the selected answer.
- **Likert scale question:** Respondents could only choose one of the following options: Completely disagree; Slightly disagree; Neither agree nor disagree; Slightly agree; Completely agree; and N/A. Data are displayed in a single column in the dataset, and the value corresponds to the selected answer.
- **Open-ended:** Respondents could include the response in a text box. Sometimes the text is restricted to certain characters (such as numbers only). Data are displayed in a single column in the dataset, and the value corresponds to the included answer.
- **Multiple choice question:** Respondents can choose one or more options. Data are displayed in different columns, and the number of columns is equal to the number of options. If the response value is empty, then that value has not been selected. If the response value is the same as the option, then the value has been selected.
- **Ordering question:** Respondents are asked to rank several provided options. Data are displayed in different columns, and the number of columns is equal to the number of options. The value displays a number that corresponds to the ranking given to the respective option.

2.2. Dataset Structure

There is only one dataset available in .csv format, in two different languages (Spanish and English). The dataset includes a total of 82 columns of which 4 correspond to those generated by the survey tool used to distribute the questionnaire (SurveyMonkey) [21], and 78 correspond to the survey questions.

S3 contains the dataset structure information needed to interpret the data included in the dataset. The document is considered fundamental and should be checked out before approaching the dataset.

3. Methods

The representative survey was aimed at residents of the Community of Madrid aged over 18 years old. The sample size is composed of 500 valid records, with gender and age

quota, with a sampling error for the whole sample of $\pm 4\%$ and a confidence level of 95.5% (2 sigmas), $p = q = 0.5$.

3.1. Sample

To define the sample, INE (Spanish National Statistical Institute) data on the population of the Community of Madrid in 2021 were considered, which was 6,751,251 people, with the distribution included in Tables 3 and 4.

Table 3. Gender distribution of Community of Madrid residents according to INE 2021 demographic data.

Gender	Amount	Percentage
Male	3,229,700	47.84%
Female	3,521,551	52.16%

Table 4. Age distribution of Community of Madrid residents according to INE 2021 demographic data.

Age Range	Amount	Percentage
15–24	692,175	12.02%
25–34	822,466	14%
35–44	1,068,563	19%
45–64	1,962,938	34%
Over 65	1,213,096	21%

3.2. Data Collection Method

The collection method used was an online CAWI (computer-assisted web interview) survey using a SurveyMonkey panel for the Community of Madrid. SurveyMonkey platform recruits from a diverse online population of over 2.5 million people from different countries. Panelist profiles are frequently updated to ensure they are current, fraud detection is used to prevent duplicate responses, and participation is incentivized with charity donations and sweepstakes [22]. In addition, the platform ensures that all participants accept their usage policies, and respondents were also asked to agree on the terms and the informed consent previously approved by the Ethics Committee of Universidad Rey Juan Carlos, registration number 1702202006120, the 15 April 2020.

The questionnaire was distributed only in the Spanish language, and data were gathered between 1st and 31st October 2022.

3.3. Data Export and Treatment

Data were exported using the SurveyMonkey XLS export option [21]. Then, the columns included by the SurveyMonkey system that did not contain relevant information were discarded and deleted from the dataset: `collector_id`, `ip_address`, `email_address`, `first_name`, `last_name`, `custom_1`, and `collector_type_source`. Next, all values were translated to generate the English version of the dataset.

4. User Notes

Before starting to work with the dataset researchers must first consider removing the invalid responses. In order to do that, S3 must be downloaded to obtain the unique identifiers (`respondent_id`) of the responses that were considered invalid due to their incompleteness.

The first three rows included in the dataset were included by the authors to facilitate the comprehension of the data. The first row indicates the data label, a short description that helps identify what the column is referring to. The second is the question ID. Additionally, the third is the question type (please see Section 2.1.1 for further information about the questionnaire question typology).

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/data8050084/s1>, S1: Invalid responses to be removed from the dataset before analysis; S2: Questionnaire on social acceptance of technologies and bioproducts; S3: Data structure and basic information to interpret the data.

Author Contributions: Conceptualization, J.R.-L. and M.G.; methodology, J.R.-L. and M.G.; validation, M.G.; formal analysis, J.R.-L. and M.G.; investigation, J.R.-L., M.G., M.d.C.G.C. and A.C.-A.; writing—original draft preparation, J.R.-L. and M.G.; writing—review and editing, A.C.-A. and M.d.C.G.C.; supervision, M.G. and M.d.C.G.C.; project administration, M.G.; funding acquisition, J.R.-L., M.G. and A.C.-A. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Community of Madrid (ID 501100006541) and the European Regional Development Fund (ID 501100000780) under the BIOTRES- CM project S2018/EMT-4344; by the Ministry of Science and Innovation and the European Union (PID2021-127019OB-I00) under eCOMCIENCIA project; by the Predoctoral Research Grant of the Rey Juan Carlos University' own program (ID 501100007511) under the registration number PREDOC 20-008; and by the Spanish Ministry of Science, Innovation and Universities (ID 501100003176) Teacher Training program (FPU) under award number FPU18/02161.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Universidad Rey Juan Carlos (protocol code 1702202006120, 15 April 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not available.

Acknowledgments: Appreciation to Mario Martín Gamboa and Javier Dufour Andia for their involvement in the design process of the data collection instrument and its validation and revision.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. European Commission. *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions The European Green Deal*; European Commission: Brussels, Belgium, 2019.
2. McCormick, K.; Kautto, N. The Bioeconomy in Europe: An Overview. *Sustainability* **2013**, *5*, 2589–2608. [\[CrossRef\]](#)
3. Stegmann, P.; Londo, M.; Junginger, M. The circular bioeconomy: Its elements and role in European bioeconomy clusters. *Resour. Conserv. Recycl.* **2020**, *6*, 100029. [\[CrossRef\]](#)
4. Vance, C.; Sweeney, J.; Murphy, F. Space, time, and sustainability: The status and future of life cycle assessment frameworks for novel biorefinery systems. *Renew. Sustain. Energy Rev.* **2022**, *159*, 112259. [\[CrossRef\]](#)
5. Cerca, M.; Sosa, A.; Gusciute, E.; Murphy, F. Strategic planning of bio-based supply chains: Unlocking bottlenecks and incorporating social sustainability into biorefinery systems. *Sustain. Prod. Consum.* **2022**, *34*, 219–232. [\[CrossRef\]](#)
6. Siddiki, S.Y.A.; Mofijur, M.; Kumar, P.S.; Ahmed, S.F.; Inayat, A.; Kusumo, F.; Badruddin, I.A.; Yunus Khan, T.M.; Nghiem, L.D.; Ong, H.C.; et al. Microalgae biomass as a sustainable source for biofuel, biochemical and biobased value-added products: An integrated biorefinery concept. *Fuel* **2022**, *307*, 121782. [\[CrossRef\]](#)
7. Kumar, A.; Baldia, A.; Rajput, D.; Kateriya, S.; Babu, V.; Dubey, K.K. Multiomics and optobiotechnological approaches for the development of microalgal strain for production of aviation biofuel and biorefinery. *Bioresour. Technol.* **2023**, *369*, 128457. [\[CrossRef\]](#) [\[PubMed\]](#)
8. Dussan, K.; Dijkstra, J.W.; Luzzi, S.; van Zandvoort, I.; van Hal, J.W. Seaweed versatility for biorefinery: Blessing or burden? *Curr. Opin. Green Sustain. Chem.* **2023**, *39*, 100728. [\[CrossRef\]](#)
9. Lara-Serrano, M.; Sboiu, D.M.; Morales-Delara, S.; Campos-Martin, J.M. Selective Fragmentation of Lignocellulosic Biomass with ZnCl₂-4H₂O Using a Dissolution/Precipitation Method. *Appl. Sci.* **2023**, *13*, 2953. [\[CrossRef\]](#)
10. Rathour, R.K.; Devi, M.; Dahiya, P.; Sharma, N.; Kaushik, N.; Kumari, D.; Kumar, P.; Baadhe, R.R.; Walia, A.; Bhatt, A.K.; et al. Recent Trends, Opportunities and Challenges in Sustainable Management of Rice Straw Waste Biomass for Green Biorefinery. *Energies* **2023**, *16*, 1429. [\[CrossRef\]](#)
11. Paini, J.; Benedetti, V.; Ail, S.S.; Castaldi, M.J.; Baratieri, M.; Patuzzi, F. Valorization of Wastes from the Food Production Industry: A Review Towards an Integrated Agri-Food Processing Biorefinery. *Waste Biomass Valorization* **2022**, *13*, 31–50. [\[CrossRef\]](#)
12. Kiresiewa, D.Z. Improving the Public Acceptance of Bio-Based Products and Processes at Regional and Local Level. 2020. Available online: <https://www.ecologic.eu/18039> (accessed on 2 April 2023).
13. Paula, L.; Birrer, F. Including Public Perspectives in Industrial Biotechnology and the Biobased Economy. *J. Agric. Environ. Ethics* **2006**, *19*, 253–267. [\[CrossRef\]](#) [\[PubMed\]](#)

14. Bearth, A.; Kaptan, G.; Kessler, S.H. Genome-edited versus genetically-modified tomatoes: An experiment on people's perceptions and acceptance of food biotechnology in the UK and Switzerland. *Agric. Hum. Values* **2022**, *39*, 1117–1131. [\[CrossRef\]](#)
15. Bezama, A.; Ingrao, C.; O'keeffe, S.; Thrän, D. Resources, Collaborators, and Neighbors: The Three-Pronged Challenge in the Implementation of Bioeconomy Regions. *Sustainability* **2019**, *11*, 7235. [\[CrossRef\]](#)
16. Duque-Acevedo, M.; Belmonte-Ureña, L.J.; Terán-Yépez, E.; Camacho-Ferre, F. Sustainability and circularity in fruit and vegetable production. Perceptions and practices of reduction and valorization of agricultural waste biomass in south-eastern Spain. *J. Environ. Manag.* **2022**, *316*, 115270. [\[CrossRef\]](#) [\[PubMed\]](#)
17. Segreto, M.; Principe, L.; Desormeaux, A.; Torre, M.; Tomassetti, L.; Tratzi, P.; Paolini, V.; Petracchini, F. Trends in Social Acceptance of Renewable Energy Across Europe—A Literature Review. *Int. J. Environ. Res. Public Health* **2020**, *17*, 9161. [\[CrossRef\]](#) [\[PubMed\]](#)
18. Eskelinen, T.; Sydd, O.; Kajanus, M.; Gutiérrez, D.F.; Mitsou, M.; Disla, J.M.S.; Sevilla, M.V.; Hansen, J.I. Fortifying Social Acceptance When Designing Circular Economy Business Models on Biowaste Related Products. *Sustainability* **2022**, *14*, 14983. [\[CrossRef\]](#)
19. INE. National Classification of Education. CNED. Available online: https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736177034&menu=ultiDatos&idp=1254735976614 (accessed on 1 April 2023).
20. UNESCO. International Standard Classification of Education (ISCED). 2017. Available online: <https://uis.unesco.org/en/topic/international-standard-classification-education-isced> (accessed on 3 April 2023).
21. Survey Monkey Help. XLS (Excel) Exports. Available online: <https://help.surveymonkey.com/en/surveymonkey/analyze/xls-exports/> (accessed on 1 April 2023).
22. SurveyMonkey. Market Research Solutions Data Quality. Available online: <https://www.surveymonkey.com/market-research/data-quality/> (accessed on 1 April 2023).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.