



## D6.1

# Social attitudes towards circularity of Building Products

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## Executive Summary

Scientific literature shows that citizens and other key actors agree that solutions to environmental problems require changes in human behaviour and habits. However, despite decades of effort and campaigns, studies continue to find a wide gap between overtly pro-environmental social attitudes and behaviour that is not always pro-environmental. This is where environmental psychology, which has looked at the interaction between people and the environment since the late 1960s, can help us understand this paradoxical situation, and thereby guide actions or policies aimed at reducing this gap.

If there is a gap between attitudes and behaviour when it comes to familiar environmental challenges (recycling, consumption, climate change, etc.), what will it be like when it comes to new aspects such as the circularity of construction products, on which there are not many studies available?

Some of the factors that explain pro-environmental behaviour are what Gifford calls the “dragons of inaction”. These are general types of barriers that may be found when promoting this kind of behaviour, including the use of secondary materials from and in construction.

The lack of specific literature has led to a more general theoretical basis for defining this field of work and the need to develop a specific methodology from almost zero, based on collecting information using a questionnaire designed specifically for this purpose. This questionnaire included the various scales that were important in the literature review carried out. The questionnaire was applied to a sample of 605 people randomly drawn from the Basque population. The procedure followed to carry out this study and the campaign of surveys undertaken are set out in chapter 3 of this document, and the results are given in chapter 4.

The first conclusion to note is that there is a somewhat negative social perception of the construction sector, as it is associated with a high consumption of resources and a low degree of recycling. Secondly, it is difficult to establish profiles of the population, possibly due to the low level of public awareness regarding the circularity of construction products. The environmental profiles identified (-deniers and very committed-) were poorly represented in the sample population, which would confirm that the gap between attitudes and behaviour in our context is very wide, and that there is a big margin for improvement in the pro-environmental habits of the population. That is a good reason for promoting pro-environmental behaviour, through both information and awareness-raising campaigns with specific contextual intervention programmes and facilitators.

We should not forget that this is a new approach to a line of work of great interest and importance; therefore, the conclusions presented converge into one of a general nature, namely, the need to keep working on this subject in order to make progress with this line of research.

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## Acronyms

CCC: Climate Change Communication

DIPB: Dragons of Inaction Psychological Barriers

EE: Environmental Education

ESD: Education for Sustainable Development

SDG: Sustainable Development Goals

## 1. Theoretical basis. Conceptualization of the study.

Our society is currently facing a number of large-scale environmental challenges, not least climate change. Surveys of citizens show that they are broadly aware; according to a study conducted in France, Germany, the UK and Norway, scepticism is low and the vast majority believe that climate change is at least partly due to human activity (Steentjes et al., 2017). Here in Spain, 84% of the population agrees that “unforeseen changes in the climate are occurring due to human actions related to the environment and nature”, and 83% believe that “something needs to be given up right now in order to live better in the future” according to the CIS (2020). In the Basque Country, 85% of the population is also somewhat or very much in agreement with the idea that “in order to fight climate change, we all need to give up some of our comforts” (Gabinete de Prospección Sociológica, 2017).

Scientific literature shows that ordinary citizens, along with other actors and leaders at different levels, agree that solutions to these problems require changes in human behaviour and habits (Schultz and Kaiser, 2012; Swim et al., 2009). However, despite decades of efforts and campaigns by both institutions and citizens' associations, studies show that there is a gap between attitudes and behaviour: we display overtly pro-environmental attitudes, but these often do not translate into pro-environmental behaviour (Kollmuss y Agyeman, 2002; Lorenzoni et al., 2007). Environmental psychology can be used for reflection and research in order to understand this somewhat paradoxical situation.

Firstly, we should bear in mind that pro-environmental behaviour is not a one-dimensional construct. Older studies that tried to understand pro-environmental concerns or behaviours addressed them with one-dimensional scales (Stern, 2000), but human behaviour is complex and it is difficult to find people who act in the most pro-environmental way possible in all the different ‘domains’ of behaviours that seek to protect or not harm the environment (Steg and Vlek, 2009). Different types of pro-environmental behaviours do not necessarily correlate with each other, and their behavioural backgrounds may well be different (Gatersleben, 2018). In other words, we do not engage equally in all types of environment-related behaviours; we often “specialise” in certain sustainable behaviours, but fail to practise others. Moreover, the factors that can predict, and be useful in promoting, pro-environmental behaviours in different domains (e.g. recycling and waste, energy consumption, mobility, consumption and shopping, etc.) are not necessarily the same.

Secondly, another aspect that characterises the mismatch or “gap” between attitude and behaviour is inaction. Although most of us believe that we need to do more to tackle climate change, most of us are not changing our behaviour on a day-to-day basis. Why are we not acting, why are we not changing our habits, despite our level of awareness and knowledge of the need for these changes? There is a line of research in the field of environmental psychology dedicated to identifying and analysing the psychological barriers that slow changes in habits down (e.g. Blake, 1999; Lorenzoni et al., 2007). One of the most comprehensive

studies in this respect was by Gifford (2011), who described up to 30 of these psychological barriers. There was no instrument that reliably measured the extent of these barriers in the population until 2019, when we saw the DIPB (“Dragons of Inaction Psychological Barriers” de Lacroix et al., 2019). This tool is currently available in English, and has been adapted to Spanish and Basque (Aliri et al., in press).

Lastly, to complete the complexity of this area of research and intervention, we need to bear in mind that citizens have different behavioural profiles, from the most committed people who already do practically everything in their power to reduce their impact on climate change, to the complete opposite who make behavioural decisions without ever taking the environment into account. These two profiles, which are at the extremes of the continuum, are in the minority; between them, there is a much larger group that is in favour of protecting the environment, but who do not behave as sustainably as they would like for a variety of reasons, and who sometimes "specialise" in certain environmentally-friendly actions, without managing to change others. An example of this would be a family that recycles its waste perfectly, but continues to use their private car for their daily commute.

If we want to encourage citizens to change their habits and routines in order to curb climate change, and make the necessary political and institutional changes, we need to provide a proper definition of the behaviour, or behaviours, that we want to promote. We will also need valid and reliable instruments to understand how these barriers are holding us back, right here and now. Lastly, we will need evidence of the best strategies to promote pro-environmental behaviour that can be adapted and applied to our context so that we can overcome barriers and bring about the necessary behavioural change in the population, bearing in mind that there are different profiles in the population, and sometimes we will need to adapt messages and actions to the various characteristics of these profiles.

This project aims to provide tools to tackle these three areas ( defining the behaviours to promote, understanding the potential barriers and defining strategies to overcome them and encouraging people to adopt these behaviours) in relation to construction projects that use secondary materials, i.e. materials recovered from construction and demolition, which are incorporated into building new facilities and buildings using the logic of a circular economy.

## 2. Perception and attitudes towards the circularity of construction products and their use

Firstly, for a project such as this one, we need to decide what perceptions, attitudes and behaviours of citizens we want to know so that we can understand their potential barriers and factors that might promote them.

When we think about building with secondary materials, there are a number of direct decisions, measures and actions that citizens will take at different levels. On the one hand, their institutional representatives will be able to promote or regulate this type of construction, and on the other, the construction companies will be the ones who will ultimately undertake their projects with these secondary materials, or with others. In this sense, the role of citizens is limited to reacting to the decisions and measures that others take: they will perceive the actions of institutions and companies either positively or negatively, and the outcome of decisions at that level will be more acceptable or less acceptable to them, as the case may be. For example, public subsidies for sustainable construction may be perceived either more positively or less positively, or people may feel that it is more acceptable or less acceptable for public buildings or roads to be built with secondary materials. Therefore, one of the focuses of interest for this work will be the public's perception of buildings in which secondary materials are used and the measures that can promote them.

However, there is also behaviour at an individual level that is carried out by a significant percentage of citizens in relation to construction. Many people buy a home at least once in their lifetime, particularly in a socio-cultural context that values buying a property over renting. This is behaviour in which decision-making incorporates elements at many levels, and it also has a major environmental impact in the medium term. Where we live largely determines how much we consume, how much we throw away, how much and how we move around, etc. At present, we are not in a situation where houses built with secondary materials are a common option on the market, so it is not possible to directly analyse whether the population is likely to opt for a house built with these materials or not. Therefore, the second focus of interest in this paper will be on behavioural intention in this respect, i.e. whether or not people would opt for this type of building material when purchasing a house.

With these two focuses of interest - the public's perception of construction using secondary materials and the measures that can promote them, and behavioural intention to purchase a house built using secondary materials - we can carry out a study of the current situation, by analysing which barriers hinder positive perceptions and behavioural intention. Furthermore, future strategies and measures to promote both elements can be outlined at a later stage.

As such, we have proposed that they should be seen as key elements to be studied in conjunction with the rest of the limiting or facilitating elements presented in this document.



## 4. Barriers to accepting secondary materials

We pointed out in the introduction that in the face of climate change there are serious difficulties in taking action, even though the public is aware that it is a pressing problem. There is a line of research in environmental psychology that tries to answer the question, “Why does a person who is aware of the causes and consequences of climate change, and who has at least some knowledge of the problem, not make more decisive changes in their habits and lifestyle?”

Our current knowledge in this respect will also apply to the field of perception and behavioural intention in terms of construction with secondary materials.

### 4.1. Psychological barriers

The most comprehensive theory in this line of work, in terms of the number and diversity of barriers compiled, is that of Gifford (2011). He described around 30 psychological barriers in the context of climate change that stand in the way of people changing their habits and routines and prevent them from moving towards more sustainable lifestyles. These barriers are metaphorically known as the “dragons of inaction”. These psychological barriers do not affect all environment-related behaviours or all people in the same way.

The barriers identified so far are grouped into seven general categories

1. **Limited knowledge.**
2. **Ideology and technophilia.**
3. **Comparison with others.**
4. **Invested costs.**
5. **Distrust and denial.**
6. **Perceived risks.**
7. **Limited behaviour.**

Several of the barriers described above may be present when dealing with accepting building with secondary materials. A large number of economic, sociological, political, organisational, technical and environmental barriers were identified in a paper that looked at the barriers to a paradigm shift from a linear approach to the circular economy in the construction industry (Charef et al., 2021). Among the sociological variables, they mention psychological aspects and aspects related to people's behaviour, in this case, within organisations in the construction industry, such as lack of awareness of the need to change, resistance to change and certain belief systems. These factors can easily be related to the type of barriers described in this document, and they can also be found in citizens, even though they may not be involved in the industry.

Another work that looked at the difficulties of using recycled materials in architecture (Munn and Soebarto, 2004) also found barriers that can be related to the classification described, such as: lack of social relevance, lack of

information, lack of interest in customers, developers and architects, lack of governmental support, and higher costs in the short term, even though they are more efficient in the long term. Once again, there is a lack of awareness by the public, who are potential customers, regarding the environmental impact of this industry, lack of information and lack of interest in demanding buildings made of more sustainable materials, as well as the barrier that may mean a higher initial outlay and, therefore, taking an economic risk when opting for these materials.

These are common problems across the board related to how citizens engage with the circular economy (Cerulli-Harms et al., 2018). Consumers are generally willing to engage in circular economy practices, but the actual engagement, in terms of changing habits in everyday life, is rather low. The barriers to further engagement are again similar to those mentioned above: lack of information on durability and whether the product is easily repairable, and lack of sufficiently developed markets to make purchasing easy and practical. An important finding of this work is that repair decisions are easily disrupted if organising the repair, i.e. the tasks that need to be carried out to send the product for repair, requires a lot of effort and involves inconvenience. Two lessons can easily be drawn from these findings: information must be provided, but contexts must also be changed if a large majority are to change their consumption behaviour, by making it easy and convenient to opt for circular economy practices. The work also found that the price-quality ratio is both a motivation and a potential barrier to decisions linked to the circular economy, along with convenience. In this respect, there are certain profiles that are willing to pay more for products that are more durable and more easily repairable. However, information is not always readily available.

These findings may apply to accepting buildings with secondary materials: they are not yet easily accessible, there is still a lack of information about them, they may be more expensive, and there would need to be assurances about their durability and return on investment. But, in addition to this, when we talk about buildings in which we are going to spend time, or even live, another area of motivation or possible concern emerges: the safety of these buildings.

Therefore, this document suggests a number of potential important barriers that need to be explored in terms of the perception of buildings in which secondary materials are used and the measures that promote them, and the willingness to purchase a house built with these materials. They are as follows:

- Lack of knowledge about these types of materials.
- The fact that people feel that they do enough for sustainability in other areas and that they do not need to take sustainability into account in construction.
- Environmental aspects are considered irrelevant for home buying decisions.
- The use of these materials is perceived as an irrelevant environmental improvement.
- It is perceived as unfair that this decision has to be taken for private homes, as it is companies that have the greatest impact on the environment, and it should be governments and companies that need to take action in this area.

- ❑ Secondary materials are perceived as being less healthy, less durable, of lower quality and less safe.
- ❑ There is a perception that there is insufficient experience in the use of these materials.
- ❑ It is more expensive to buy houses built using these materials.

## 5. Measures to promote the acceptance of buildings made of secondary materials

The different strategies outlined in this section can be used to analyse potential predictive and/or promotional factors in relation to the circularity of construction products, and to propose actions in the future to improve the social acceptance of these buildings, and the intention to opt for them over other less sustainable materials.

Firstly, from the perspective of communication to provide reliable information, there is no doubt that in this case the public lacks sufficient information. In this case, there is a lack of knowledge even in the industry itself. Therefore, the design of information campaigns, targeted at the public we want to address, will be unavoidable. The lack of information about the quality of these materials, their health and safety, their durability, their low impact on the environment when used... are aspects that can act as barriers, but if this information is communicated properly, it can help to overcome them.

In this sense, it will be necessary to take the profiles of citizens, and the specific barriers they present, into account in order to target messages more clearly at sustainability, or at medium-term economic efficiency and cost-effectiveness, safety, etc.

Another barrier identified in the third point of this document is the lack of awareness on the environmental impact of building and the need to reduce it. On this point, awareness-raising and communication actions are an ideal way of making citizens aware of the need to include the dimension of sustainability in their house buying decisions, and improving the acceptance of measures that stimulate sustainable building by institutions.

Action programmes that include strategies such as setting commitments and targets may also be of interest in the area of specifically promoting sustainable house buying. The chances of opting for secondary materials will be higher if, when making a high impact decision such as buying a house, we commit to incorporating a number of dimensions related to the impact of its construction and future efficiency, with the aim of keeping our impact below a number of thresholds. We can also use models. Particularly in the case of innovative circular economy measures, such as building with secondary materials, which are still

largely unknown, linking an information and awareness-raising campaign with well-known figures who are credible and sharing the values that we want to represent could be a good option. Social standards could also be engaged: in this case, the idea of an emerging standard could be useful. We will increase the potential of the action if buying buildings made of secondary materials is presented as a growing trend in society, particularly among people similar to the profile we want to target.

We must not forget the contextual changes that favour adopting the behaviour we are trying to promote. In a decision as carefully considered as buying a house, options such as nudging are probably not very interesting. But establishing facilitators, incentives and encouragements could be. After all the other initiatives that can be built around communication, raising awareness and promotion with programmes, it is likely that the public would be in favour of regulations and incentives for the construction industry to encourage the use of secondary materials. However, if we also want to promote the purchase of houses built with these materials, direct incentives for this behaviour will be more useful. Direct subsidies, tax rebates, and even simplified and faster purchasing procedures could be interesting options for creating a favourable context for decision-making and, ultimately, the behaviour we are looking for.

In this regard, taking the above into account, we can consider the following as possible favourable or motivating factors in the field of construction with secondary materials:

- Raising awareness of the environmental impact of the construction industry.
- Taking individual responsibility for sustainability.
- Sufficient information and perception that secondary materials are of high quality, safe, healthy and efficient.
- Sufficient information and perception that using these materials significantly reduces the impact on the environment.
- Making buildings made of these materials more affordable.
- Ensuring that there are public subsidies for using these materials with more extensive guarantees.

## 6. Need for a specific psychosocial study on our environment

Once again, it is worth remembering that different citizens have different profiles, and that if we want to maximise the impact of measures to promote building with secondary materials, actions should be targeted at the profile we want to work with. Consequently, it would be ideal if we could carry out a study to help characterise the profiles of the population in terms of socio-demographic factors and their attitudes and behaviour towards the environment in general, and towards building with secondary materials in particular. These population profiles, together with an analysis of which barriers and motivators may be more important when it comes to proposing measures that are most likely to have a positive impact on citizens.

Therefore, all the information resulting from reviewing scientific literature and reflecting on the issues raised in this document has been used to design a psychosocial study based on collecting information by means of a specially devised questionnaire, which includes different scales that are important after reviewing the literature in this section.

The questionnaire that was devised is presented in **Chapter 1**. The population of reference in this study were Basque citizens and the sample used was 605 people randomly selected from the population of the Basque Autonomous Community.

**Chapter 2** of this document describes the procedure and the campaign of surveys conducted, and **Chapter 3** describes the main results from this study. Finally the conclusion of the study are presented.

**Annex I** shows the main graphs in the form of a power point presentation.

The questionnaire was structured around the following sections:

1. Presentation of the study
2. Socio-demographic information
3. Environmental perspective (profile)
4. Past and future habits
5. Perception of the construction sector
6. Use of secondary materials
7. Barriers to and facilitators for buying a house made of secondary materials
8. Need for information
9. Globalisation
10. Trust

The different scales used within each of these sections are set out below.

## 7. Questionnaire

*Below, you will be presented with a series of questions related to construction and sustainability in our context. There are no right or wrong answers. The aim is simply to collect citizens' opinions within the framework of the ICEBERG project funded by the European Commission. ICEBERG is a four-year project within the European Union's Horizon 2020 Framework Programme for Research and Innovation. It will include the participation of several Basque organisations, such as the Basque Government's public environmental management company - Ihobe or Fundación TECNALIA Research & Innovation. The aim is to offer innovative solutions based on the circular economy for the production of high-value materials from the most common construction and demolition waste (CDW). The main objective of ICEBERG is to develop and demonstrate new intelligent and cost-effective circular solutions for a better recovery of secondary raw materials from construction. Note: All your answers will be treated anonymously in accordance with the Personal Data Protection and Guarantee of Digital Rights Law (Organic Law 3/2018) and the General Data Protection Regulation (GDPR).*

*Thank you for participating.*

There was a reminder note on every page of the questionnaire that "*All your answers will be treated anonymously in accordance with the Personal Data Protection and Guarantee of Digital Rights Law (Organic Law 3/2018) and the General Data Protection Regulation (GDPR)*"

## 7.1. Socio-demographic information

In this section, information was collected on gender, age, residential and housing data, educational level, employment status, and work sector:

1. *Gender:*

- Female*
- Male*
- Non-binary*
- Other*

2. *Age:* \_\_\_\_\_

3. *Postal code for where you reside:* \_\_\_\_\_

4. *In relation to your home...*

- I am responsible for the property (rent or purchase) and contribute to its payment/maintenance*
- I am not responsible for the property. I live with my parents, relatives, etc.*

5. *The property referred to in the previous question is:*

- Privately owned*
- Rented*
- Social housing*
- Shared flat*

6. *How many years have you been living in this property?* \_\_\_\_\_

- If less than a year, how many months?* \_\_\_\_\_

7. *Highest level of studies completed:*

- Without studies*
- Primary education*
- Secondary education*
- Vocational training*
- University education*
- Master's degree or PhD*

8. *Please indicate your main activity:*

- Self-employed*
- Paid employment*
- Unpaid work (taking care of the home, family, etc.)*

- Student*
- Retired or pensioner*
- Unemployed*

9. *Do you work in any of these areas?*

- Construction*
- Recycling*
- None of the above*

## 7.2. Environmental perspective (profile)

The following scale was used to determine the profile of each person in terms of their relationship with the environment:

*Which of the following statements best reflects your personal situation in relation to the environment and climate change?*

- I try to respect the environment, but it will be ineffective unless the big polluters (companies, industries) do the same.*
- I try to respect the environment and I can see positive results.*
- I try to respect the environment, but it will be ineffective unless other people do the same.*
- I would like to do more but there are many disadvantages (time commitment, financial cost, etc.).*
- I would like to do more but I don't know what to do.*
- I am not concerned about the environment.*
- I don't think the environment is in danger.*

## 7.3. Environmental habits

The following scale was used to assess past habits:

*How often have you performed the following actions in your daily life over the past six months?*

|  | <i>Never</i>             | <i>Rarely</i>            | <i>Quite often</i>       | <i>Often</i>             | <i>Every day</i>         |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <i>Separate waste/rubbish so that it can be recycled</i>                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Use public transport, cycle or walk instead of using a private vehicle</i>              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Reduce energy consumption at home</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Reduce the generation of waste/rubbish</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Extend the lifetime of consumer products (e.g. cars, household appliances...)</i>       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Buy local products for your daily needs even if you have to pay a bit more for them</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Consider environmental aspects in everyday purchases and consumption</i>                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

And to assess future habits:

*Over the coming year, do you intend to do any of the aforementioned actions more frequently? Please tick all those actions that you think you will do more frequently:*

- Separate waste/rubbish so that it can be recycled.*
- Use public transport, cycle or walk instead of using a private vehicle.*
- Reduce energy consumption at home.*
- Reduce the generation of waste/rubbish.*
- Extend the lifetime of consumer products (e.g., cars, household appliances...).*
- Buy local products for your daily needs even if you have to pay a bit more for them.*
- Consider environmental aspects in everyday purchases and consumption.*

## 7.4. Perception about the construction sector

The following scale was used to assess the social perception of the construction sector:

*Please indicate to what extent you agree with the following statements related to the construction sector:*

|  | <i>Strongly disagree</i> | <i>Disagree</i>          | <i>Neither agree nor disagree</i> | <i>Agree</i>             | <i>Strongly agree</i>    |
|--|--------------------------|--------------------------|-----------------------------------|--------------------------|--------------------------|
| <i>A large number of raw materials are required</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>A large amount of waste is generated</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>In our region, the construction sector recycles the vast majority of the waste it generates</i>                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The use of recycled materials in construction is common practice</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The use of recycled materials in construction is a practice that would help in the fight against climate change</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |



## 7.6. Attitudes towards the use of secondary materials

Attitudes towards the use of secondary materials were assessed for different types of buildings using the following scale:

*Today, new products can be manufactured with recycled materials from construction and demolition waste (new concretes, new bricks, etc.). Products are also reused from a previous construction, which is known as secondary use of construction materials. The remaining questions are related to the use of such materials.*

*To what extent do you agree that these secondary materials should be used in the construction of the following infrastructures?*

|   | <i>Strongly disagree</i> | <i>Disagree</i>          | <i>Neither agree nor disagree</i> | <i>Agree</i>             | <i>Strongly agree</i>    |
|---|--------------------------|--------------------------|-----------------------------------|--------------------------|--------------------------|
| <i>Your home</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Public buildings, such as health centres, libraries...</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Kindergartens and schools</i>                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Workplaces, factories, offices, etc.</i>                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Civil works (roads, airports, etc.)</i>                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          | <input type="checkbox"/> | <input type="checkbox"/> |

## 7.7. Pros and cons of buying a house made of secondary materials

A number of barriers relating to buying a house made of secondary materials were assessed by means of the following scales:

*Imagine you are buying a house and you have the option to choose a house built with secondary construction materials. A number of barriers that people have indicated as possible reasons that would put them off choosing homes built with such materials are listed below. Please indicate whether the following reasons would put you off choosing a home built with such materials:*

|   | <i>It would put me off</i> | <i>It would not put me off</i> | <i>I don't know</i>      |
|---|----------------------------|--------------------------------|--------------------------|
| <i>If these materials were sufficiently healthy but not optimum</i>       | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |
| <i>If these materials were less resistant, but strong enough</i>          | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |
| <i>If these materials were sufficiently safe but not optimum</i>          | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |
| <i>If these materials were of sufficient quality, but not optimum</i>     | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |
| <i>If these materials were more expensive</i>                             | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |
| <i>If there were insufficient experience in the use of such materials</i> | <input type="checkbox"/>   | <input type="checkbox"/>       | <input type="checkbox"/> |

*Can you think of any other arguments against the use of these materials? If so, please*

explain. \_\_\_\_\_

The following scale incorporates another set of psychological barriers that may influence the purchase of a house made of secondary materials:

*Imagine you are buying a house and you have the option to choose a house built with secondary construction materials. To what extent do you agree with the following statements?*

|   | Totally agree            | Agree to some extent     | Disagree to some extent  | Totally disagree         | Don't know               |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <i>Environmental aspects are irrelevant for me in home buying decisions</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Use of such materials is an irrelevant environmental improvement</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>I don't have enough knowledge of such materials to make this decision</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>I do enough for sustainability in other areas and this would not be necessary</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>It is unfair that we have to make this decision in private homes, as it is companies that have the biggest impact on the environment</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>It is up to administrations and companies to act in this area</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

We also asked about facilitators, elements that could favour the use of these materials in construction, using the following scales:

*Now, we will show you some aspects that people have indicated would favour the use of secondary construction materials. Please indicate whether or not the following reasons would be an incentive or motivation for you to choose properties built out of these materials:*

|  | <i>It would be an incentive for me</i> | <i>It would not be an incentive for me</i> | <i>I don't know</i>      |
|--|--|--|--------------------------|
| <i>If the construction were cheaper</i>  | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |
| <i>If there were public subsidies for construction using these materials</i>   | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |
| <i>If the guarantees on constructions with these materials were more comprehensive</i>   | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |
| <i>If there were a significant improvement in the environment through the use of these materials</i>   | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |
| <i>If there were a significant improvement in the environment through the use of these materials, even if buying the house is more expensive</i> | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |
| <i>If there were a certificate or label that identifies constructions made with these materials as being more sustainable</i>                    | <input type="checkbox"/>               | <input type="checkbox"/>                   | <input type="checkbox"/> |

Can you think of any other arguments in favour of the use of these materials? If so, please explain \_\_\_\_\_

## 7.8. Need for information

The need for information was included through the following items:

*If secondary materials were mainly used in the construction of different buildings in the future, to what extent do you agree that information should actively be provided on the following questions?*

|   | Strongly disagree        | Disagree                 | Neither agree nor disagree | Agree                    | Strongly agree           |
|---|--------------------------|--------------------------|----------------------------|--------------------------|--------------------------|
| <i>If secondary materials have been used in its construction</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The origin of the secondary materials</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The properties of these materials in comparison with the conventional materials they are replacing</i>                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The reduced environmental impact of the construction due to the fact that it is partially constructed with secondary materials</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |

## 7.9. Globalisation

The following questions were also asked about the potential widespread use of these materials:

*In the globalisation of the use of secondary materials obtained from construction and demolition waste to what extent do you agree with the following statements?*

|  | Strongly disagree        | Disagree                 | Neither agree nor disagree | Agree                    | Strongly agree           |
|--|--------------------------|--------------------------|----------------------------|--------------------------|--------------------------|
| <i>The technical &amp; environmental performance of these materials is the same as conventional materials</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Technical-environmental controls on these materials should be more demanding than for conventional materials</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>There should be a certificate or label to ensure the quality of these materials</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Projects that have used these materials should be given visibility in order to promote their use</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Research and development in new uses of secondary materials should be encouraged</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Use of a minimum amount of secondary materials should be administratively enforced in all possible constructions</i>                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>The image of secondary materials obtained from construction and demolition waste needs to be improved in order to encourage their use in construction</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Specific technical-environmental regulations on secondary materials must be established</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Clear and daring public policies need to be put in place to promote the circular economy in the</i>   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/> |

|  |                          |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <i>construction sector.</i>  |                          |                          |                          |                          |                          |
| <i>Educational programmes on the circular economy need to be developed for society as a whole</i>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Communication campaigns need to be developed to improve social perception of recycled materials in general and secondary materials from construction in particular.</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## 7.10. Trust in stakeholders

Finally, the following items were included to reflect the level of trust in key groups:

*To what extent do you trust the following sources to provide reliable information on construction with secondary materials?*

|   | <i>I totally distrust them</i> | <i>I am slightly suspicious of them</i> | <i>I neither trust nor distrust them</i> | <i>I trust them up to a point</i> | <i>I totally trust them</i> |
|---|--------------------------------|---|--|-----------------------------------|-----------------------------|
| <i>Scientists who are independent from universities or research centres</i> | <input type="checkbox"/>       | <input type="checkbox"/>                | <input type="checkbox"/>                 | <input type="checkbox"/>          | <input type="checkbox"/>    |
| <i>The media</i>  | <input type="checkbox"/>       | <input type="checkbox"/>                | <input type="checkbox"/>                 | <input type="checkbox"/>          | <input type="checkbox"/>    |
| <i>Political representatives</i>  | <input type="checkbox"/>       | <input type="checkbox"/>                | <input type="checkbox"/>                 | <input type="checkbox"/>          | <input type="checkbox"/>    |
| <i>Professionals from the construction sector</i>                           | <input type="checkbox"/>       | <input type="checkbox"/>                | <input type="checkbox"/>                 | <input type="checkbox"/>          | <input type="checkbox"/>    |
| <i>People close to me (friends, family...)</i>                              | <input type="checkbox"/>       | <input type="checkbox"/>                | <input type="checkbox"/>                 | <input type="checkbox"/>          | <input type="checkbox"/>    |

## 8. Campaign

The campaign of surveys was carried out in the Basque Country by means of an on-line survey of the population aged 18 and over.

The work was carried out by a company specialising in opinion polls with pre-trained personnel. This company was GAIA Investigación y Consultoría (<https://www.gaiainvestigacion.com>).

605 surveys were completed through computer-based interviews in July 2022.

### 8.1. Database

The database with the information collected is contained in an EXCEL file, which is attached to this deliverable. It was converted into a .SAV file in order to carry out advanced statistical analyses with SPSS.

## 8.2. Profile of participants

The sample was gender-balanced, with about half stating that they were male (47.9%) and the other half female (51.6%). Only 0.5% were non-binary.

The age of the participants ranged between 19 and 83, with an average age of 48, and the largest group being those aged over 60 (27.9%), followed by those aged between 40 and 49 (21.8%).

The majority of participants are responsible for the home in which they live (82.2%), and reside in a home that they own (86.8%).

As far as educational level is concerned, the majority of people had either completed university (50.6%) or secondary education (48.1%), while there was only a marginal percentage (2.3%) of people with a low level of education (primary education or less).

In terms of employment status, most of the participants were either working (69.7%, of which 63.4% were employed), had retired or were pensioners (19.9%).

Lastly, it should be noted that the percentage of people working in the fields of construction and/or recycling was low. More specifically, only 5% of the sample (30 people) had a job related to these sectors.

## 9. Results

This chapter presents the results obtained in the psychosocial study on **Social Perceptions and Attitudes Towards the Circularity of Construction Products**. Its content is structured in **four sections**. Section 1 presents the descriptive results of the different scales used, and the aggregate variables that have been constructed based on them. Section 2 discusses the gender comparison for the descriptive results. Section 3 focuses on the significant differences between the different groups based on socio-demographic variables, including gender. This section analyses the potential profiles found in the sample from the Basque Country. Section 4 presents the results of the multivariate analyses of the relationships between the different dimensions considered and their predictive capacity on the dependent variable of this study: **Social Attitudes Towards the Circularity of Building Products**.

### 9.1. Descriptive analyses

We can make two main observations in relation to respondents' **views on the construction sector** and its use of materials and generation of waste. On the one hand, most of the sample believes that the use of secondary materials in

construction helps in the fight against climate change, but that this sector generates a lot of waste and requires a lot of raw materials. **More specifically, 74.9%, 68.2% respectively agree or strongly agree with the views stated.** On the other, a large part of the sample strongly disagrees or disagrees with the views that the industrial sector in our region recycles most of the waste it generates and that the use of recycled materials is a common practice in the construction sector. The percentages for this were 32.4% and 41.5% respectively. Therefore, it can be seen that the people surveyed have a negative view of the construction sector in terms of its impact on the environment, as they believe that on the one hand they need a lot of raw materials and on the other that they do not recycle enough.

In relation to **attitudes towards the use of secondary materials in different types of construction**, we can conclude that in general the vast majority of people who took part in the study agree or strongly agree with the use of secondary materials in the different types of construction considered.

In this case we have created an aggregate variable called **Social attitude towards the circularity of construction products (mean)** which shows the level of agreement with the use of secondary materials in the different types of construction analysed, by calculating the mean of the previous five questions. This variable was considered to be the one that needed to be explained. In this sense, we can see that the overall mean level of agreement would be 4.24 on a scale of 1 (strongly disagree) to 5 (strongly agree), i.e. a fairly high level of agreement.

We asked about the possible barriers and incentives that people may have when buying a house made of secondary materials, so that we could analyse the pros and cons of making such a purchase. As far as the **impediments to the use of secondary materials when buying a house** were concerned, the safety of these houses, experience in using these materials, the strength of the materials, the price and the quality of the houses made of these materials were taken into account. Accordingly, the two most widespread barriers were the lack of experience in using secondary materials and the lower safety of these materials.

Although we will recommend that this scale be modified to improve it in future studies (see the chapter on conclusions), we have created an aggregate variable with the sum of all the barriers reported by the participants so as not to lose this information.

As far as **incentives** or possible incentives **for buying a house made of secondary materials** were concerned, we found that the acceptance of the different incentives was quite wide, i.e. in general more than half of the respondents indicated that the reasons given would be an added motivation to buy a house made of secondary materials. Four of the six aspects indicated (that

warranties would be more extensive in buildings made of these materials; that there would be public subsidies for construction using these materials; that there would be a significant improvement in the environment as a result of using these materials; and that construction would be cheaper) would be an incentive for more than 80% of the sample.

In this case, two aggregate variables were created, one by adding the sum of the questions that took the more economic/practical incentives into account (that construction would be cheaper, that there would be public subsidies and that warranties would be more extensive); and the other by calculating the mean of the questions that took more environmental incentives into account (whether the use of these materials would lead to an improvement in the environment).

The level of agreement with five of the main psychological barriers to behavioural change was analysed in relation to the **psychological barriers** that people may have when making decisions about **buying a house made using secondary materials**. More specifically, the barriers, which in this case were adapted to refer to buying a house made of recycled materials, were: that the fact that we have adopted certain pro-environmental behaviours does not mean a significant environmental improvement; that we do not have enough knowledge to be able to adopt certain pro-environmental behaviours; the fact that we already do enough in other areas means that we do not have to adopt specific pro-environmental behaviours; that it is unfair that I have to adopt a certain behaviour when companies have the biggest impact on the environment; and that it should be companies and authorities/governments that should make the change, not me. A general statement was added to these barriers, which referred to the denial of the relationship between environmental aspects and home buying decisions. As can be seen in **¡Error! No se encuentra el origen de la referencia.**, the majority of the sample agreed quite strongly or strongly agreed with the statements about the lack of knowledge and the unfairness of the fact that these decisions have to be taken by private households rather than by companies and authorities/governments, showing that the two most prevalent barriers are lack of knowledge and the belief that it is others (companies and authorities/governments) who should act.

In this case, the sum of the responses that represented a barrier, i.e. those responses of fairly strongly or strongly agree, was calculated in order to analyse how many psychological barriers the respondents had in relation to the use of secondary materials, with the exception of the first more general item, which will be used in subsequent analyses on an individual basis. On average, respondents were found to have slightly more than two barriers.

When analysing the level of agreement in relation to the **necessary information** that should be provided when mostly secondary materials are used in the construction of different buildings, we concluded that a large part of the sample agreed or strongly agreed with all the ideas proposed, which shows that in general they all agree that the use of these materials should be reported, as well as the improvements that using them entails.

In this case, the aggregate variable created summarised the degree of agreement with all these items, showing that the average level of agreement in reporting the use of these materials was very high. More specifically, the average was 4.02 on a scale of 1 (strongly disagree) to 5 (strongly agree)

When analysing the **attitude towards the widespread use of secondary materials in construction or universalisation**, it can be seen that in general the people surveyed agreed or strongly agreed with the statements assessed. The lowest level of agreement was with the statement "*Technical and environmental controls on these materials should be more stringent than for conventional materials*", and even then 56.9% of the sample agreed or strongly agreed.

In this case, the aggregate variable created summarises (measures) the degree of agreement with the items referring to the generalisation of the use of secondary materials, showing that the mean agreement with these items is very high. More specifically, this is an average of 4.05 on a scale of 1 (strongly disagree) to 5 (strongly agree).

Lastly, we analysed the level of **trust** that people had **in different sources of information**. We found that in general, respondents were more trusting of information if it came from a person involved in science, a construction professional or people close to them such as friends or family members. More specifically, the percentages for those people who they indicated that they would partly or fully trust were 75.3%, 51.7% and 54.9% respectively. By contrast, people tended to distrust the information given by political representatives, with 72.4% of people either totally or partially distrusting it.

In this case, two aggregate variables were created: one with the mean of the items that referred to media and political information sources **-sources of information with a low level of trust** -and the other encompassing all other sources of information **-sources of information with a high level of trust**.

The majority of the sample agreed that construction requires and generates a large amount of material and waste, but they neither agreed nor disagreed that the sector recycles or makes use of recycled materials. On the other hand, they did agree that the use of recycled materials in construction helps in the fight against climate change.

In general, the majority of respondents would strongly agree with the use of secondary materials in the various buildings and infrastructures considered. It should be noted that the percentages decreased somewhat in the case of housing, with slightly less acceptance among women (37.2%) than men (41.4%), and in the case of kindergartens and schools. For the latter, the lower percentage (47.6 %) was predominantly among men compared to the other infrastructures mentioned.



As far as impediments to buying a house made of secondary materials were concerned, we found differences by gender **¡Error! No se encuentra el origen de la referencia.**

For men, lack of experience in using these materials would be the main impediment (80.8%), followed by less safe (66.4%) and more expensive (66.3%) materials. Meanwhile, for 84.3% of women, the greatest impediment was that the materials were less safe, followed by the lack of experience in using them (80.6%), the fact that the materials were not as strong (68.9%) and that they were more expensive (67.9%). Therefore, women were more concerned about the safety and strength of these materials.

In terms of incentives, the most important was the availability of more extensive warranties on buying these homes, followed by the significant improvement in the environment and the availability of public subsidies. The responses were similar for both genders.

Of all the incentives, the one that was chosen least was the significant improvement if it meant it was more expensive to buy a house, and this option was even less popular among men (56.9%) than among women (69.9%).

Similar results were found for men and women in relation to **psychological barriers**. Environmental aspects and the use of secondary materials were important when it came to making decisions about buying a house.

In addition, there is very little knowledge about these materials to make this decision and it was considered unfair to have to make this decision for private homes, as companies are seen as the ones that cause the biggest impact on the environment.

Most of the participants strongly agreed on the need for information on different aspects of the use of secondary materials in building construction. There are hardly any differences by gender, or between the different questions asked. .

In general, participants agreed or strongly agreed on the different aspects of the universalisation of secondary materials. For both genders, the aspect of “Technical and environmental controls on these materials should be more stringent than for conventional materials” produced less agreement.

Independent technicians from universities and research centres were the social group most trusted by the participants, followed by professionals from the construction sector and their immediate family and friends.

By contrast, political representatives were the least trusted sources of information. Lastly, even though the most frequently chosen option in the case of the media was neutral, respondents showed more distrust than trust in this sector. As far as gender was concerned, there were no significant differences, although we noted that women were more confident in construction sector professionals than men.

## 9.2. Multivariate analyses: relationships between variables

A predictive model was developed with the aim of predicting social attitudes towards the circularity of construction products (criterion variable), with data collected through the degree of agreement with the use of secondary materials in the construction of different buildings and infrastructures.

This model included the following predictor variables: beliefs about the construction sector, impediments to and incentives for the use of secondary materials when buying a house, psychological barriers, necessary information and universalisation or attitude towards the widespread use of secondary materials. This predictive model was statistically significant ( $F(8,401)=25.37$ ;  $p<0.001$ ) and the effect size was of a high magnitude ( $R^2=0.32$ ), indicating that 32% of the variance in our criterion variable was explained by the model created. More specifically, three predictor variables were found to be statistically significant. Consequently, the results obtained showed that as certain beliefs about the construction sector (that it uses a lot of raw materials, generates a lot of waste and that the use of recycled materials in this sector would have a beneficial impact on the environment) increase, the impact of economic incentives on buying a house made of secondary materials and agreement with the generalisation of the use of secondary materials in construction (universalisation) also increases, as does agreement with the use of secondary materials in the construction of different types of infrastructures, including homes.

Attempts were also made to build predictive models using socio-demographic variables, as well as variables related to more general pro-environmental behaviours (both actual behaviours and behavioural intention), but these models were not effective in predicting agreement with the use of secondary materials to build different types of infrastructures.

## 10. Conclusions

The most significant findings of the study presented in this paper on Social Attitudes Towards the Circularity of Building Products are presented and discussed below. Firstly, we will focus on the methodological conclusions, and then move on to the more substantive conclusions.

As far as the methodological aspects of this work and its scientific and social importance are concerned, it should be noted that studies on social attitudes and behavioural intentions regarding circularity in building materials are lacking at a local level and scarce at an international level. Therefore, a virtue of this work is that it provides a first approach in our context to the field of study, and it is also worth highlighting its novelty as the first study that explores it in depth from a psycho-environmental perspective. As this is a new work, a first approach, it does, of course, have its limitations. In this sense, perhaps the most noteworthy aspect is that it is not possible to include a **specific behavioural** scale for using

secondary materials in construction in this study as the purchase of houses built with secondary materials is not an option, for the time being. Therefore, as mentioned in the introduction, we have had to limit ourselves to perceptual and attitudinal aspects.

This has led us to set the **(social) perceptions and attitudes** of citizens towards the circularity of construction products as a **criterion variable** for this study, collected by means of the degree of agreement with the use of secondary materials to construct different buildings and infrastructures, including houses.

Another aspect that needs to be highlighted is the **need to improve the questionnaire**, which is logical in the first steps of a line of work, particularly when the starting point is a lack of specific social knowledge. Some of the improvements that will need to be addressed in future work include: 1) A specific scale for the behavioural intention of possibly buying a house made of secondary materials should be included. This scale should appear in the questionnaire before the scales for barriers and facilitators; 2) The scale for impediments to the use of secondary materials in housing should be reworded and differentiated from the scale for psychological barriers, relating them to safety, strength, cost, etc., parallel to the scale for facilitators, as the statements are not clear and can be confusing; 3) The scale for psychological barriers could be reformulated towards general environmental barriers and, in any event, the response scale needs to be reformulated, including the option “neither agree nor disagree” like the rest of the agree/disagree response scales; 4) The first item on the scale for trust in information sources should be reworded more clearly: “Independent scientists from universities or research centres”.

Focusing on the more substantive aspects of this work, we would like to point out that the people from the Basque Country who took part in this study had a **somewhat negative view of the construction sector** in terms of its impact on the environment, as they believe that this sector consumes a lot of raw materials and that it does not recycle enough. This is by no means a disadvantage, as the work showed that public awareness of circularity in construction and secondary materials is still very limited. Raising awareness of the negative environmental impact of this industry could be a motivating element for receiving information and education on circularity, something that would be necessary for future measures aimed at fostering positive attitudes and even behaviours related to circularity.

As the literature review revealed, it would be interesting to have **population profiles** to guide future measures and policies on the circularity of building materials. **It was not possible to define population profiles** in this study with the sample used from the Basque Country **based on socio-demographic and residential variables**. The socio-demographic factor that led to the biggest differences in the main scales in the questionnaire was **gender**. The differences related to gender showed that women had a slightly more sustainable overall stance on the environment, more ingrained pro-environmental habits, found more incentives for using secondary materials in houses, but also more impediments, and were somewhat more trusting of the different sources of information considered. However, the effect sizes were not very large (Cohen's  $d < 0.3$ ).

The difficulty in defining population profiles is possibly due to the **low level of public awareness** on the **circularity of building materials**. This low level of knowledge, which as we saw in the theoretical bases is one of the major categories of psychological barriers, prevents the general population from forming different opinions, which would be the basis for social profiles. Therefore, in the absence of such profiles, it is difficult to target measures at different population groups in order to optimise changes in attitudes and behaviour.

However, it is also possible that the **socio-demographic and residential variables** considered are not particularly relevant in our geographical and cultural context, in relation to environmental profiles in general, and on the circularity of building materials in particular. The presence of denialism in the media has reduced considerably in our country in recent years, to the point of practically disappearing (Domínguez et al., 2017), and it is possible that the small percentage of people we can classify in this category is more related to variables not included in this work, such as ideology or political positioning (Wullenkord, 2022).

Despite not being able to define profiles based on socio-demographic aspects, it is true that the results showed small to moderate differences based on some variables, with gender differences being particularly notable, in line with a classic result in scientific literature on pro-environmentalism (Elert & Lundin, 2022).

Given the impossibility of configuring socio-demographic profiles, it was considered that it might be interesting to use another scale of a psychosocial nature, i.e. the scale relating to people's **overall environmental stance**, to try to define **profiles** that would make it possible to guide future measures to change attitudes and behaviours specific to the use of secondary materials.

The results showed that people we have labelled “**deniers**” showed less positive attitudes, and lower behavioural intentions and habits and behaviours in relation to both the environment in general and the use of secondary building materials. This manifested itself in the fact that this group displayed less pro-environmental behaviour and less intention to engage in pro-environmental behaviours, a lower level of agreement with the use of secondary materials in the construction of different infrastructures (private homes, public buildings, kindergartens, etc.), more impediments to buying a house made of secondary materials, and a lack of incentives or incentives to buy houses made of secondary materials. They also showed a lower level of agreement with the universalisation or widespread use of secondary materials in construction and a lower level of trust in relation to the information that may be provided by scientists, professionals in the sector and people close to them (friends, family) about building with secondary materials.

Another group that was identified, which could be a candidate for profiling, was the group of people who stated that they engaged in all pro-environmental behaviours (sorting waste, reducing waste generation, shopping sustainably, etc.) on a daily basis, which was referred to as “**very committed**”. People in this group were somewhat more in agreement with using economic incentives to increase the acceptance of the circularity of construction products, with a higher trust in information from both the media and politicians, which are generally interest groups that generate a low level of trust.

Nevertheless, it should be noted that these two **groups were under-represented** in the sample used, accounting for between 2 and 3% of the sample. This result confirmed the idea that there is a **lack of knowledge** in the general population about the circularity of construction products and their use in different buildings and infrastructures, which, as previously mentioned, is still hypothetical in many cases.

However, we need to bear in mind that if 2-3% of the general population did, in fact, fit one of these profiles (deniers vs. highly committed), we would be talking about a considerable number of people. It is true that they are at the two extremes of the normal curve of attitudes towards the environment and pro-environmental awareness, but we have already established in the introduction, and mentioned above, that denialism is very low, percentage-wise, in our country. We also know that most people have a passive/active profile: they value environmental protection positively, but their personal behaviour in this respect is limited. If the percentage of people we classified as very committed, i.e. acting on a daily basis in different domains to protect the environment, is as low as that of deniers, we would be confirming that there was a **very large gap between attitudes and behaviours in our context**, and a **very large margin for improvement in the pro-environmental habits** of the population.

This consideration should lead us to a second reflection on how the majority of the population views the environmental and climate challenge in general and circularity in construction in particular. The perceptions and attitudes of the majority of the population are very much in line with the scientific discourse of sustainability, but the translation into behaviours and habits is very limited: in the field of construction we might also find that this effect is close to social desirability, in terms of the perception of the problem and the degree of agreement with circularity as a project, but this would not be a guarantee that the majority of the population will continue to behave in a way that in practice makes it possible for circularity to become more widespread. Again, this would be an argument in favour of **specifically promoting these behaviours**, not only **with information** (results have already shown the lack of knowledge among the general population about the circularity of construction products) **and by raising awareness**, but also with specific intervention programmes and contextual facilitators.

Finally, going deeper into those **predictor variables** that have proved to be more important in explaining social attitudes towards the circularity of construction products, our criterion variable has turned out to be **beliefs about the construction sector**, the **incentives for using secondary materials when buying a house**, and the **universalisation of the use of secondary materials**. Consequently, the more negative the beliefs about the construction sector -, consumption of a lot of raw materials, generation of a lot of waste, etc. -, the more agreement there was on using economic incentives when buying a house made of secondary materials and on the universalisation of secondary materials in construction, and the more positive the attitudes towards using secondary materials in building different types of infrastructures, including houses

These results would help us to specify the variables on which information and awareness-raising initiatives, and **intervention and facilitation programmes**, should be based. The evidence from this work suggests that it is key to strengthen

beliefs about the impact of the construction sector and the benefits of circularity in this area: information and awareness-raising aspects need to be focused on this aspect.

It is important not to lose sight of which **information sources and channels** will be most efficient in this regard: let us not forget the widespread distrust of political representatives as far as other sources are concerned. Another issue that we can address through information and awareness raising are positive attitudes towards the widespread use of secondary materials. Again, looking at information sources will be key. However, as stated in the introduction, and corroborated by this result, information and raising awareness may not be sufficient to achieve the objectives; it may require the targeted promotion of behaviours. In our results, the incentives incorporate this element.

The role of **incentives** suggests that it is essential to provide an appropriate context, which facilitates decision-making in favour of secondary materials and circularity. These incentives would allow us to **overcome the barriers identified** and to choose materials that allow circularity. Let us not forget that a large part of the sample felt that it was unfair to have to make this decision for private homes, as they believed that it is companies that have the greatest impact on the environment. The combination of strengthening aligned beliefs and a favourable context with incentives for taking the decisions sought would make it possible to overcome this barrier.

**In conclusion, let us not forget that this is a first approach to a line of work of great interest and importance; therefore, all these conclusions converge in one overall conclusion, namely, the need to carry on working on this subject in order to make progress along this line of research.**

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