



The results of the survey of general public of use of challenges connected to residue of glass fibers

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1. Introduction

Informative: glass fiber is a chemical inorganic fiber obtained from molten glass of a special composition. This glass contains quartz sand, limestone, kaolin, calcium fluoride (fluorspar), boric acid, sodium sulfate and iron.

Glass fibers are an essential part of our everyday life (think of wind power generators, airplanes, cars, boats, etc.). They are strong, stiff and much lighter than other traditional materials. Glass fibers are 6-10 times stronger than steel, and composites made from these fibers are 2.5-3 times lighter than steel while showing excellent mechanical properties. Thus, they are important in the areas where material needs to be strong and light - especially in the different transportation industries since weight directly correlates with fuel consumption and greenhouse gas emissions. Additionally, the glass fiber used in wind turbine blades can make larger span turbines, which generate significantly more green energy. They are also crucial in manufacturing other smaller everyday items - bathtubs, furniture, slides for kids, different sports equipment etc. They can help reduce the negative effects on the environment if used properly. To reduce the adverse effects even further, industry, scientists, and policymakers are working together to reduce waste produced during the manufacturing of different glass fiber products. One example of such work is the project GlassCircle, which is funded by the Interreg Baltic Sea Region program. More about the project you can read on the official project webpage: <https://interreg-baltic.eu/project/glasscircle/>.



To find out citizens' opinions and level of knowledge regarding the circularity of glass fiber production there as a survey about glass fiber residue of the general public was carried out.

The survey was conducted in two parallel processes, both in Latvia and outside Latvia, in the Baltic Sea region countries — the project partner countries. In Latvia, the target audience was primarily reached through the communication channels of the GLASS CIRCLE project's partner municipality — Valmiera Municipality. Information was published on the municipality's website and social media platforms and distributed to local cooperation partners.

Information about the survey was disseminated through other project partner organizations for participation in the survey outside Latvia.

The survey was translated into two languages — Latvian and English- with a greater emphasis on communication and respondent outreach directed at participants from Latvia compared to those outside Latvia. Importantly, the primary focus for obtaining survey results was through Valmiera Municipality — where Valmiera Glass, a large fiberglass production plant, is located.

2. Results of the survey about glass fiber residue of the general public

However, as seen in Figure 1, the emphasis on Valmiera Municipality's communication channels and the presence of the fiberglass factory in Valmiera explains why the number of respondents from Latvia exceeded the number of respondents from outside Latvia. A total of 90 respondents participated from Latvia, compared to 56 from other countries.

Of the respondents from Latvia, 71.1% were women and 25.6% were men. Among respondents from other countries, 60.7% were men and 37.5% were women. In Latvia, females were more active, while in other countries, males were more active in responding to the survey.

The results show an overall very close gender ratio, with around 40% male participation and 60% female participation.

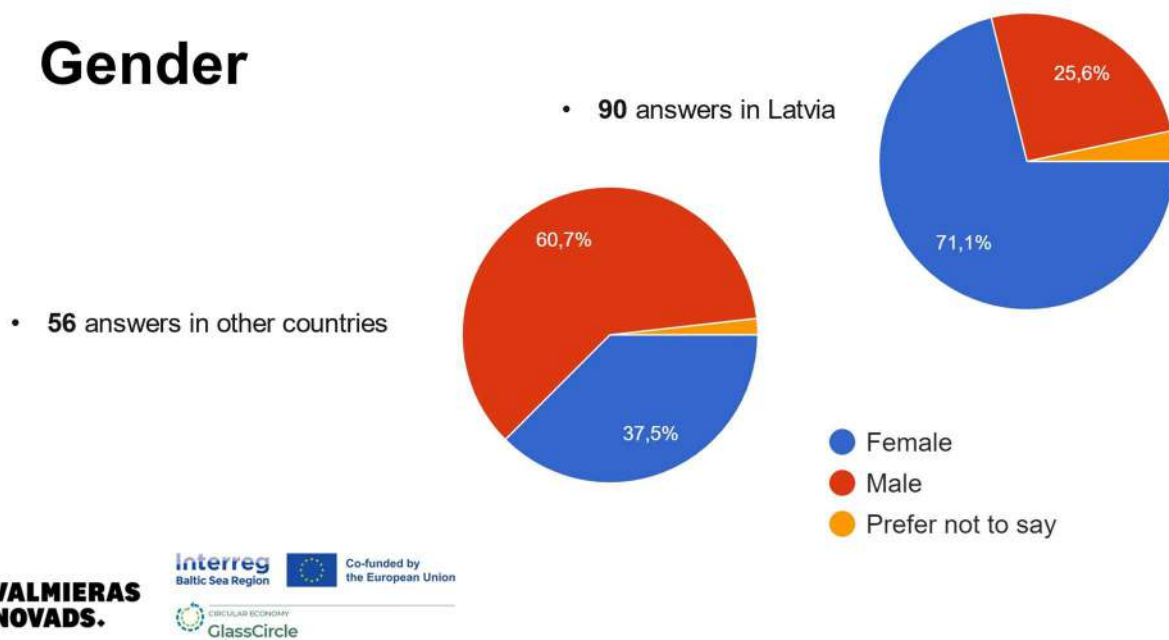


Figure 1. The distribution of gender between responders

The age distribution of the responders can be seen in Table 1. The most active group was the age group between 31 and 64, classically the age of the workforce, that could own real estate, which is the typical range of the main target audience of the project. The next group is 18-30, mostly pupils, students and the young workforce. This indicates that the survey results are well aligned with the overall objective of the project proposal.

Table 1: Age distribution of survey responders

Age region, years	<18	18-30	31-64	>65
The percentage of responders	1.1%	21.1%	76.7%	1.1%

Educational level

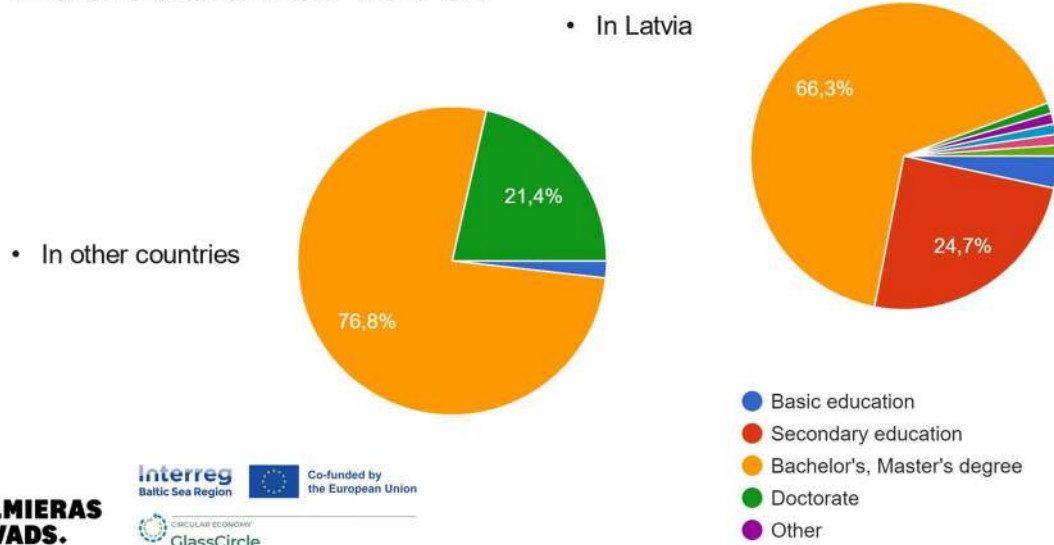


Figure 2. The distribution of education level between the responders

Considering the survey dissemination method, as highlighted in Figure 2, the responses regarding respondents' education levels are also logical. Since the project partners include higher education institutions and research institutes, 21.4% of responders from other countries held a doctoral degree or were doctoral students. In comparison, 76.8% had a bachelor's or master's degree. Among Latvian



respondents, the majority — 66.3% — had a bachelor's or master's level education, and 24.7% had a secondary-level education. Since the survey outside Latvia was distributed through the partner media channels, which mostly consisted of professional platforms, e.g., LinkedIn and university webpages, it is not surprising that the education level outside Latvia was significantly higher. In Latvia, the news was spread through the Valmiera Municipality homepage and social media channels, which allowed more widespread coverage, and thus, we obtained results also from local schools etc. The use of flyers with barcodes linked to the survey placed in public places (bus stops, advertisement boards) in Sweden (Lulea, Pitea) and Denmark (Herning) resulted in only 3 new responses. In the future, more personal approaches must be used to obtain more answers to such surveys.

Place of residence

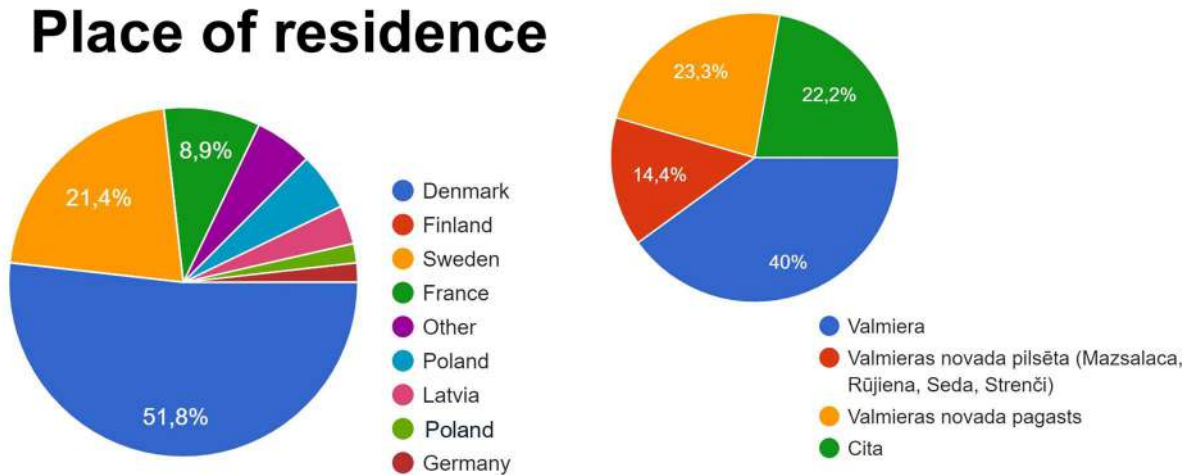


Figure 3. *Place of residence of responders*

As presented in Figure 3, only one-quarter — 22.2% — of Latvian respondents reside outside Valmiera Municipality.

Valmiera Municipality, the direct audience of the municipality's communication channels, has 53,203 residents, according to the Latvian Office of Citizenship and Migration Affairs as of October 1, 2024. The

municipality's administrative center, Valmiera State City, also home to SIA VALMIERA GLASS, has a population of 24,233 residents.

Accordingly, the largest proportion of respondents in Latvia comes from Valmiera City — 40%. Additionally, 14.4% of Latvian respondents represent one of the smaller towns in the municipality, while 23.3% are residents living in the municipality's rural areas, villages, or parishes.

The majority of respondents from other countries — 51.8% — represent Denmark. Additionally, 21.4% of respondents are from Sweden, and 8.9% are from France.

In what field are you employed?

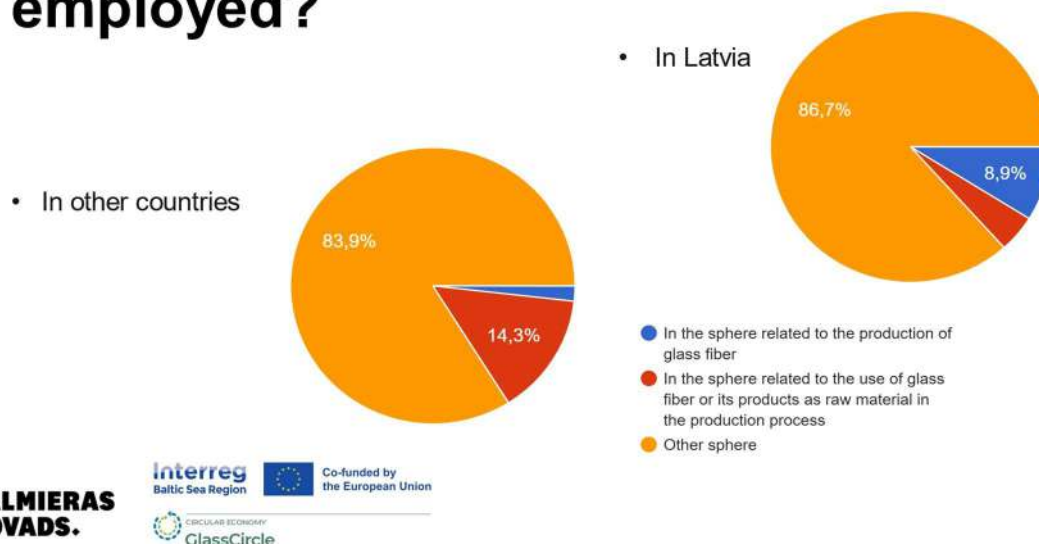
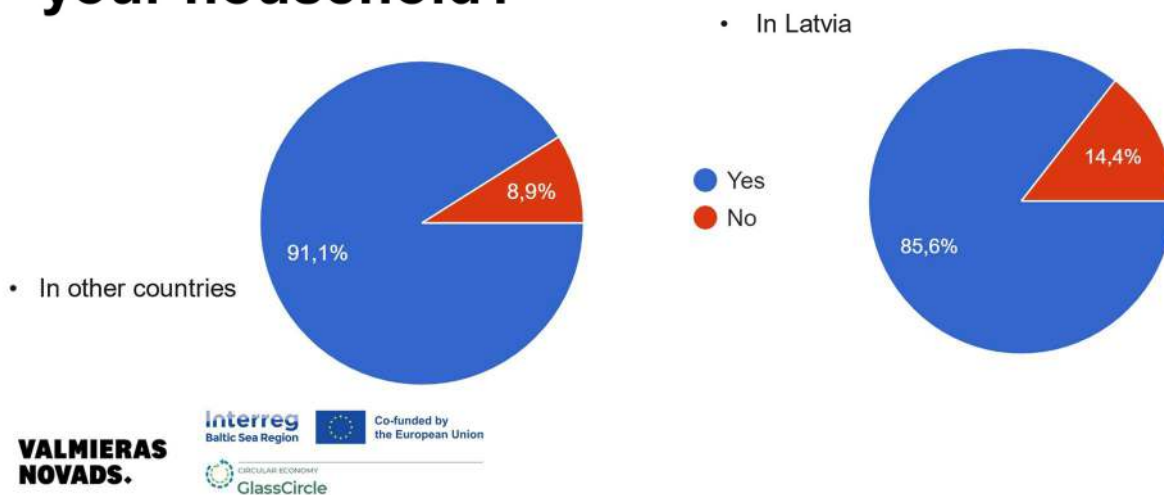


Figure 4. *The distribution of responder's Employment*

Given the significance of the fiberglass industry in Valmiera City and Valmiera Municipality, the proportion of respondents employed in the fiberglass sector, as presented in Figure 4, is higher among Latvian respondents than those from other countries. Specifically, 8.9% of Latvian respondents work in a fiberglass production facility, which is important for this particular survey to analyze the knowledge among different audiences. Conversely, among respondents from other countries, a higher proportion is employed not in fiberglass production but in sectors related to manufacturing products using fiberglass as a raw material. Such respondents accounted for 14.3% of participants from other countries. It can be seen that in both cases there is approximately 14% familiar with the glass fiber industry.

Is waste sorting carried out in your household?



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Figure 5. *The traditions of waste sorting within the households*

The question about waste sorting in the survey was posed as an introductory baseline question, indirectly setting the tone for the subsequent questions regarding the importance of waste reduction and the transition to a circular economy. It should be noted that given the low population density, which significantly increases waste management costs, not all households in Latvia — especially those living in rural homesteads and smaller populated areas — have access to convenient separate waste collection. Nevertheless, the high percentage of the respondents indicated that they practiced waste sorting within their households (see Figure 5), which shows the positive mindset of the general population towards waste sorting. Thus, if the responders are keen on sorting within their households, similar practices can be implemented within the industry with low resistance from the employees. One of the project's goals was to introduce waste sorting within the companies, accelerating the transition towards the circular economy. Although an economically beneficial solution for the glass fiber residue has not yet been widely implemented, the possibility of such a solution in the near future would give these companies a competitive edge over others.



Name any products or objects that are made using fiberglass that you know

- Some parts in body of cars, water tanks;
- Boats;
- Wind turbine blades, water tanks, pipes;
- Hockey sticks;
- Windmill wings, car parts, flags, building materials - glass wool, resin additive (tanks), roofing;
- Cables for internet supply, tension link for geotechnical anchors;
- Sports equipment, glides, wind mills;
- Aircrafts;
- Flask for household gas;
- Beer kegs, Propane gas bottle, Bikes, Golf rackets, boats, planes etc.



Figure 6. Respondents' knowledge inquiry question

In order to analyze the responder's knowledge of glass fiber and its importance to modern-day humans, a general question about different glass fiber applications was given (see Figure 6). This allowed us to identify the knowledge gaps within the responders and educate them about the wide application range of glass fibers and the problems connected to their end-of-life disposal poses for society and the environment. All the items within this question were produced using glass fibers, thus easily identifying the applications with which the responders are least familiar.

As presented in Figure 7, Latvian respondents were most knowledgeable about the use of fiberglass materials in the production of boats and water transport vehicles, as well as about the importance of fiberglass raw materials in the production of construction materials.

They were less knowledgeable about the importance of fiberglass raw materials in producing design items and military equipment. Furthermore, only 53% of Latvian respondents knew that fiberglass is often a crucial component in the production of wind turbines.

Overall, respondents from Latvia proved to be more knowledgeable about fiberglass as a raw material for the production of various items, as the overall knowledge levels about fiberglass as a material were lower among respondents from other countries.

Select the items you know they contain glass fiber!

• In Latvia

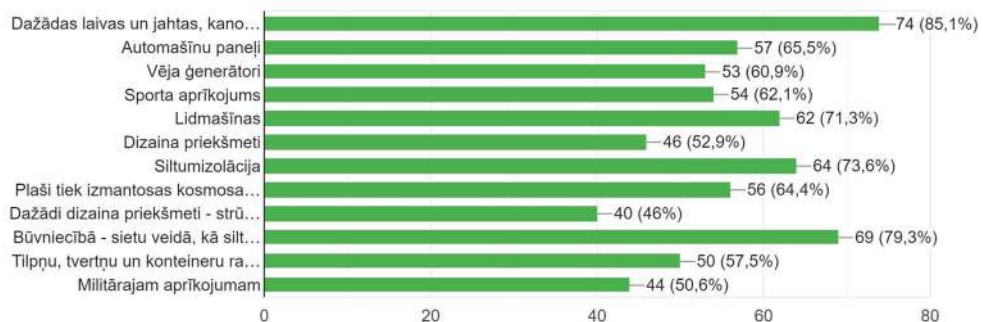


Figure 7. The knowledge of glass fiber use in different applications within the responders of Latvia

However, respondents from other countries (see Figure 8) were most knowledgeable about the significance of fiberglass in producing water transport vehicles. They were relatively more informed about fiberglass's role in producing wind turbines, airplanes, and sporting equipment.

After the educational section about fiberglass items, the next section of questions focused on fiberglass in the respondents' daily lives. Respondents were asked to provide information on whether there were any items containing fiberglass in their household.

Responders from Latvia are more knowledgeable than people outside Latvia. This is interesting since the education level showed significantly higher education for people working outside Latvia. This could signify that the proximity of Valmiera Glass has been key for people to gain knowledge about the use of glass fibers.



Select the items you know they contain glass fiber

- In other countries

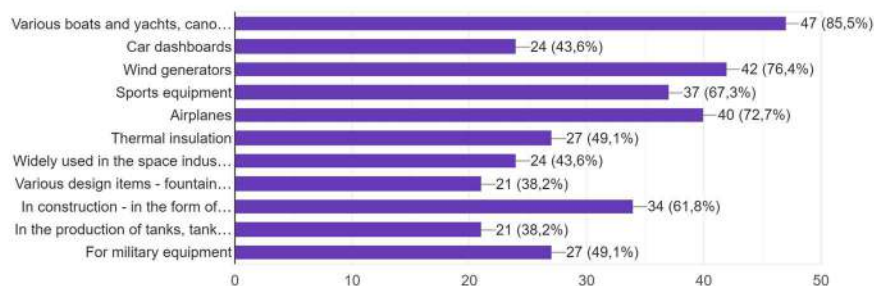


Figure 8. The knowledge of glass fiber use in different applications within the responders outside Latvia

Due to the high number of applications, it is most likely that all households have something from glass fibers. However, 36.7% of Latvian respondents and more than half — 51.9% — of respondents from other countries, as presented in Figure 9, were unaware of whether their households contained items made from fiberglass. Meanwhile, 57.8% of Latvian respondents and 39.3% of respondents from other countries were firmly convinced that products of fiberglass origin were present in their households. It can also be seen that Latvians are more aware of the different applications of glass fiber and more informed about the origin of the items within their homes.

This again proves that people around Glass fiber manufacturing are more knowledgeable about the use and applications of glass fibers.

Nevertheless, it also showed that there is a large number of people who are unaware of the use of glass fibers. This knowledge gap has to be addressed, especially for the companies that would like to openly talk about the residue they have and the challenges they face. Without proper knowledge, the general public could turn negative towards companies that are using glass fibers, without the proper knowledge of how important it is for their everyday lives. This issue has also been why companies do not like to

publicly share information about their residue amount. Often, companies are afraid of the social backlash. Thus, they like the idea of participating in the database but would not share the information publicly. To move forward, this issue has to be addressed delicately to avoid a situation when companies are punished for moving toward a circular economy.

Do you have anything in your household that contains fiberglass?

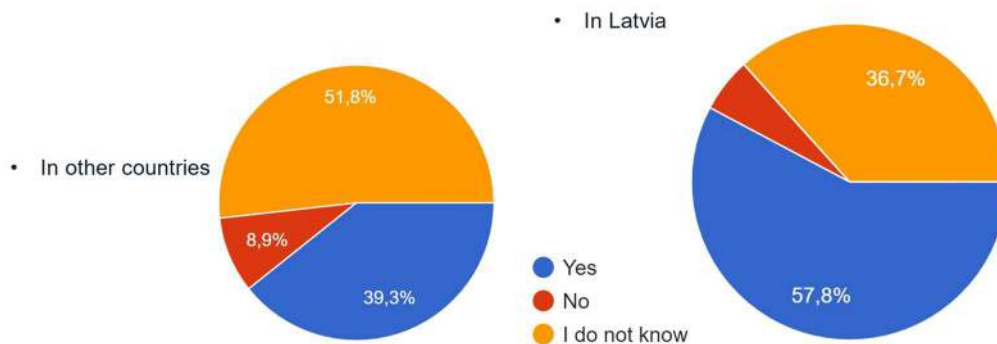


Figure 9. The knowledge about the use of glass fibers in their households between the responders

The next section of the question was focused on the glass fiber manufacturing plant in Valmiera municipality. Latvian respondents were asked whether they were aware of a large fiberglass production facility in Valmiera, to which nearly all respondents gave an affirmative answer (see Figure 10).

Respondents were also asked to share their opinions on their attitudes toward the factory. More than 70% of respondents had a positive view of it, while 23.9% had no opinion. The positive attitude of respondents may be attributed to the previously positive communication about the factory's significance in strengthening economic development.

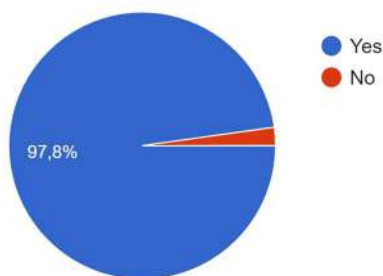
This overall positive answer to the plant is one of the reasons why so many companies are hesitant to talk about the residue they produce. However, it can be used to companies' advantage and even further improve their image to the general public if the company properly advocates and shows their willingness



to improve and work towards a more circular economy (participating in similar projects, press releases showing that they care about the environment etc).

The very small negative opinions currently lack a deeper explanation — whether they are related to the factory's internal policies and actions, its economic image and activities, or any external disturbances that the factory may have caused to the respondents.

Did you know that there is a large glass fibre production plant in Valmiera?



What is your opinion of this plant?

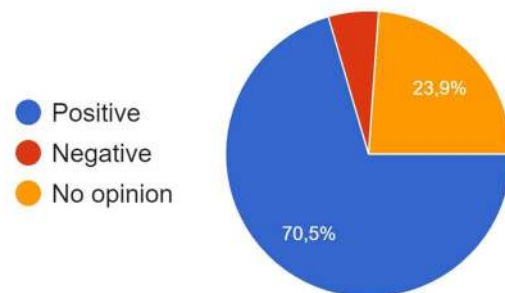


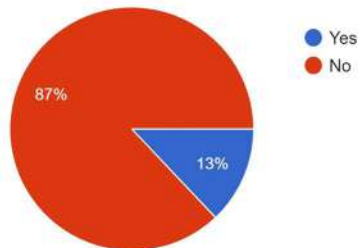
Figure 10. The knowledge of Valmiera Glass and attitude towards this company

In contrast, as shown in Figure 11, only 13% of respondents from other countries live near a fiberglass factory or a factory producing products from raw materials.

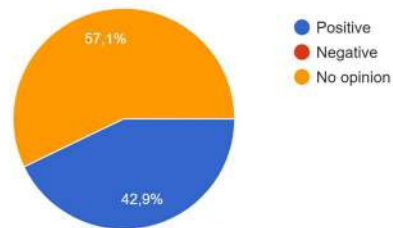
Among them, 42.9% of respondents had a positive opinion about the factory, while 57.1% had no opinion. Interestingly, no respondents expressed a negative opinion about the factory's operations. This again shows that the overall view of these factories is mostly positive.



Is there a fiberglass factory near where you live?



What is your opinion about this factory near where you live?



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Figure 11. The knowledge of glass fiber manufacturers and their opinions about these factories



Do you know what surpluses occur in the glass fiber production process?

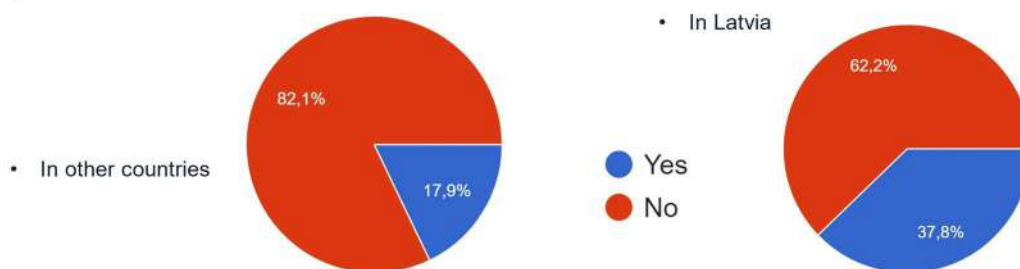


Figure 12. The knowledge about the residue generated within the glass fiber industry

Next, the questions related to the circular economy followed. Specifically, respondents were asked whether they knew the types of surpluses generated during the fiberglass production process (see Figure 12).

Given that a larger proportion of Latvian survey respondents are employed in the fiberglass sector, their knowledge about surpluses of the fiberglass production process is slightly higher than that of respondents from other countries.

However, in Latvia and other countries, most respondents are not informed about the surpluses of fiberglass production. The level of awareness regarding the possibilities for utilizing fiberglass production leftovers was also relatively low.

Nevertheless, it is highly interesting that even though a large number of respondents knew about the residues produced within the glass fiber manufacturing plants, the view of these factories nonetheless was positive. This, again, is a good indication for companies to be more open about the surpluses they generate within the manufacturing processes.



Have you heard where it is possible to use the leftovers from the fiberglass production process?

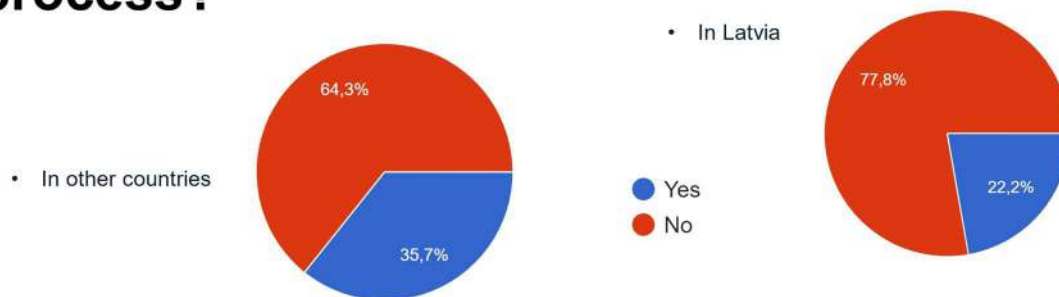


Figure 13. *The knowledge about the use of residue glass fibers*

Only 22.2% of Latvian respondents and 35.7% of respondents from other countries were aware of the possibilities for utilizing fiberglass production leftovers (see Figure 13).

The lack of knowledge can be attributed to the relatively small number of such solutions available, which particularly emphasizes the importance and necessity of the GlassCircle project in promoting the transition to a circular economy. If there were available solutions or databases where companies can exchange information about their residue, the number of residues would significantly decrease.

Next, respondents were asked to name any specific companies they were aware of that use fiberglass as a raw material in producing their products.

Do you know of a company that uses fiberglass as a raw material in their production? (in other countries)

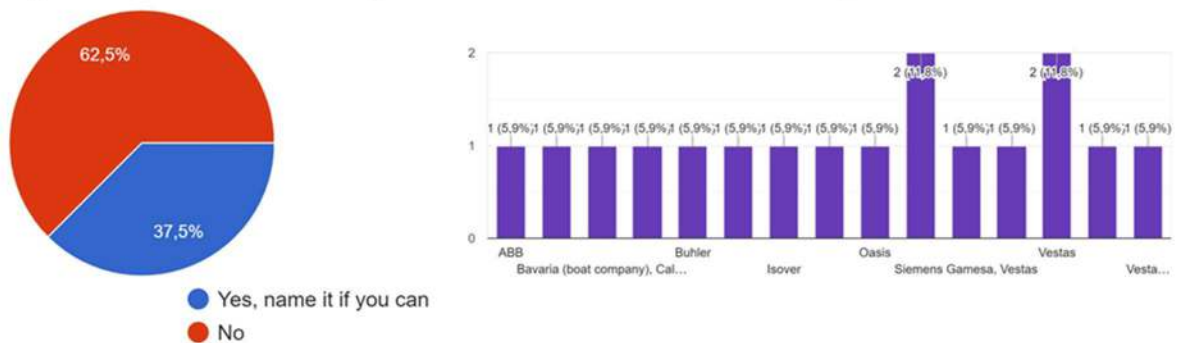


Figure 14. Knowledge about the companies that use the glass fibers in their manufacturing

As presented in Figure 14, 37.5% of respondents from other countries were aware of such companies and were able to name them.

Among those, the most well-known companies included:

1. ABB,
2. Bavaria (a boat manufacturing company),
3. Buhler,
4. Isover,
5. Oasis,
6. Siemens Gamesa,
7. Vestas
8. and others.

Do you know of a company that uses fiberglass as a raw material in their production? (in Latvia)

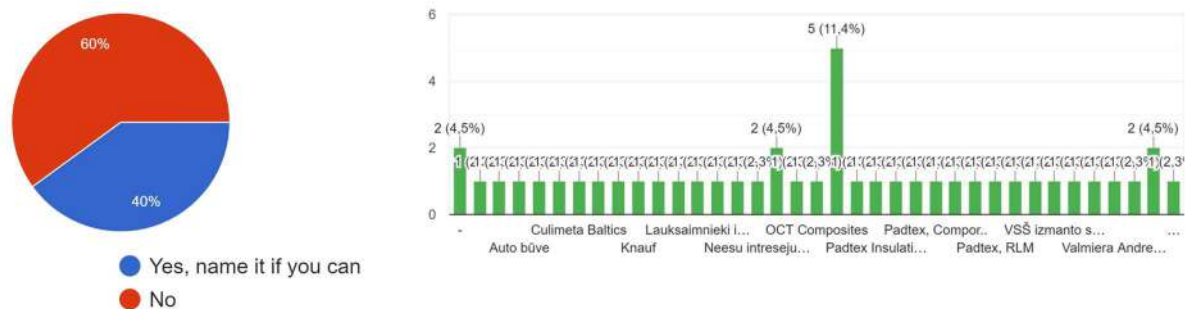


Figure 15. The knowledge of glass fiber use in Latvia

Similarly, as presented in Figure 15, 40% of Latvian respondents could name companies that produce products from fiberglass raw materials. Among these companies, the most notable were Culimeta Baltics, Knauf, OCT Composites, Padtex, Padtex Insulation, Valmiera Glass, and others.

Respondents were asked to provide suggestions for the reuse or repurposing of fiberglass production waste or its use after recycling. Their answers are presented in Figure 16.

Respondents provided a wide range of answers to this question, but these could be grouped into three main categories: the use of materials in construction and building, the production of new products, and general ideas about fiberglass waste and by-products.

The responses provided by respondents regarding construction and building offer solutions that can all be analyzed further, and each requires in-depth research to find viable solutions. The proposed solutions include incorporating fiberglass into cement, insulation materials, and others.

Respondents suggested storage tanks, decorative items, and outdoor public space furniture as completely new products.



Proposals for reuse or re-purpose of glass fiber production waste

◆ In construction and building

- Clean and grind to obtain amorphous silica powder for production of building materials;
- Composite Materials for Construction;
- Reinforcement in Concrete;
- Manufacture of Insulation Materials;
- modular urban green spaces;
- biofiltration systems for water,
- energy efficient house component

◆ New products

- furniture in public places , sun and rain protectors in cars' and bike's parkings;
- Storage boxes
- Products for decoration;

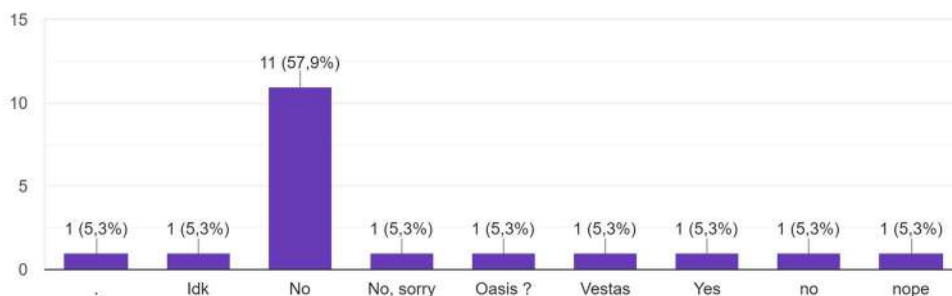
◆ General ideas

- Recycling into New Fiberglass Products;
- Meld them individually down to raw materials;
- Energy generation

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Figure 16. Summary of ideas for repurposing

Do you know of a company that uses waste surpluses of glass fibers in their production?



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Figure 17. The knowledge of companies using fiberglass residue



The final question of the survey was about whether respondents were aware of specific companies that use fiberglass waste in their production. Only two respondents had an idea about such companies.

As presented in Figure 17 the following two companies were mentioned:

- 1) Oasis;
- 2) Vestas.

But there were no respondents who could confidently name such companies.

The response to this question also reinforces the significance of the Glass Circle project and its necessity in alignment with the European Union's transition to a circular economy and waste management policy objectives.



3. Conclusions

Given the location of SIA VALMIERA GLASS in Valmiera, its significance to the economy of the Valmiera and Vidzeme regions, the considerable number of employees working for the company, as well as the existing ecosystem of businesses producing fiberglass as a raw material around it, the majority of Valmiera and Valmiera municipality residents are well-informed about the fiberglass industry in the region. At the same time, only a minority of respondents are informed about the existing ecosystem of businesses associated with the fiberglass industry.

The educational section of the survey also highlights that only a small portion of respondents possess substantial knowledge about fiberglass products, their properties, and the challenges associated with their recycling. Despite the positive attitudes and actions toward segregated waste collection, awareness regarding the volume of fiberglass waste and recycling opportunities remains limited. The survey results further reveal a significant gap in knowledge about the circular economy possibilities for fiberglass.

Despite the currently limited opportunities for fiberglass waste recycling and the resulting large volume of landfilled fiberglass waste—which could potentially impact waste management fees in the future—the company’s positive influence on the regional economy and its favourable public image serve as the foundation for the overall highly positive attitude of respondents toward the company.

Evaluating the survey results, it can be concluded that the transition to a circular economy is linked to a complex set of factors, where education and raising awareness about products, materials, production processes, and choices play a crucial role in fostering the necessary changes. The transition to a circular economy, including in the fiberglass sector, must be actively promoted, with targeted efforts at all levels, and policymakers should establish specific steps and mechanisms to facilitate this transition.

The survey results demonstrate that the transition to a circular economy involves a complex interplay of interconnected factors, where coordinated and facilitative efforts with all stakeholders must not be underestimated. Equally significant is the role of education and explanatory and justificatory work in driving this transition forward.