D 2.4. Report from pilots on private house design & construction and DIY renovations by inhabitants

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SUSTAINABLE WATERS
NonHazCity 3

NonHazCity

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Contents

Abbreviations

DIY:	Do-it-Yourself
ED:	endocrine disruptors
HS:	hazardous substances
PFAS:	per- and polyfluoroalkyl substances
PVC:	polyvinyl chloride
SDS:	safety data sheet
VOC:	volatile organic compounds

Introduction

This technical report describes process and results of the piloting activity (GoA 2.4) developed within the NonHazCity3 (NHC3) project ("Reducing hazardous substances in construction to safeguard the aquatic environment, protect human health and achieve more sustainable buildings"). This activity tested project solutions: DIY guide "Toxfree, Circular, and Climate-Friendly Renovation of My Home", Check(ED) App for inhabitants and Fact sheets for professionals.

The developed solutions aim to reduce hazardous substances (HS) in construction. The solutions are based on a three-pillar approach—circularity, climate neutrality, and toxic-free construction—to minimize HS emissions from materials, buildings, and sites, thereby protecting aquatic ecosystems and human health.

1. Solutions tested

DIY guide "Toxfree, Circular, and Climate-Friendly Renovation of My Home"

The DIY guide helps private users plan and carry out safe, sustainable renovations. It includes lists of building materials (e.g. flooring, paints) with their risk levels for hazardous substances, along with guidance on circularity and climate impact. The guide also covers topics like indoor air quality, energy efficiency, legal and health considerations, and waste management. It even offers tips on hiring professionals committed to low-toxicity practices. Overall, it's a practical tool for creating a healthier, eco-friendly home.

The DIY guide can be accessed via the following link: D1.3_DRAFT_Renovation-and-Construction_Guidebook_2023_updated-compressed.pdf

Check(ED) App

Check(ED) is a health-focused application designed to help users assess their exposure to endocrine disruptors (EDs) in their homes. With its latest enhancement, the app includes a cutting-edge feature to monitor harmful substances present in construction materials, particularly after renovations. Using advanced algorithms, Check(ED) analyses data in real time to estimate exposure levels to EDs—chemicals known as "hormonal cheaters" that can contribute to risks such as obesity, infertility, and cancer. Understanding these factors enables informed decisions that promote health and environmental sustainability.

The Check(ED) App can be accessed via the following link: CheckED

Fact sheets

The NHC3 fact sheet series is designed for construction professionals, offering insights into chemical safety, material circularity, and building energy efficiency. They highlight the NHC3 three-pillar approach, identify substances of concern in construction materials, and explain the links between chemicals and health. The sheets also outline key considerations from design to construction, pinpoint "hot spots" in buildings—areas with higher risks of toxicity,

emissions, or heat loss—and provide guidance on ecolabels, building certifications, and useful databases, including the NHC3 Catalogue.

Fact sheets can be accessed via the following link: NHC3_D1_3_Fact-sheets-for-professionals.pdf

1.1. Methodology

Aim and Scope

In total the project tested three solutions.

- DIY guide and the Check(ED) App are consumer focused tools across renovation and construction settings in Latvia, Lithuania, Sweden and Germany. The goal was to evaluate the clarity and comprehensibility of the information presented and its effect on consumer's ability to make sustainable choices.
- Project also tested a set of Fact sheets aimed at professionals.

Project Pilots

- **Pilot No. 6**: The Check(ED) App, an exposure analyser for EDs, was tested by doing interviews and through online questionnaire, as well as student test at Kaunas University of Technology.
- **Pilot No. 7**: The DIY guide was tested to help consumers select building materials for DIY projects, focusing on chemical content, climate impact, and circularity. There were several piloting cases accompanying renovation works by inhabitants.
- **Fact sheets** were scheduled for testing by architects and young construction professionals (wood building programme) at Vidzeme University of Applied Sciences.

Participant Selection and Target Group

Participants to DIY guide and Check(ED) App testing were private homeowners planning DIY renovations or construction. All piloters were actual implementers of renovations or renovation planning. Renovations ranged from small scale (painting the walls) to selection and replacement of roof. For Check(ED) App additional testing was engaged online.

Recruitment and promotion used different channels: 1) own social networks; 2) private and organization's connections; 3) involved other organizations with larger audiences, e.g. BEF Germany collaborated with a construction store, promoted the project in a trade-fair for sustainable consumption and had an info-stand at a university in Hamburg. The Stockholm City organised info days. Ecodesign Competence Centre and Nomads Architects in Latvia did recruitment via Mother's club informing about healthy choices for renovation of children's rooms. In Lithuania BEF Lithuania recruited its pilot cases via an ecological construction online group and on its social media channels. Recruitment and information outreach were supported by campaign materials from an awareness-raising campaign and information on social media.

For fact sheets professional connections were used to find interested architects and young professionals (e.g. Auraplan professional network, students from Vidzeme University of Applied Sciences).

Piloting and evaluation

Data was gathered using standardized templates, with supporting internal documentation for process records.

DIY guide included structured questionnaire.

The Check(ED) App was tested both online and in interview setting.

Fact sheet's evaluation was done using structured questionnaire.

Additional activities, such as expert support from architects, were gathered in the process and feedback collected to improve the outputs. All feedback was collected, structured and given to the authors for improvement.

Pilot implementers received expert support and documentation of their renovation intentions and process. Their decision-making process and influencing factors were analysed at the end of the pilots.

2. Pilot results

2.1. DIY guide

DIY guide was tested in a real life setting on people that were doing renovations or who planned reconstruction works. It was tested in 4 countries: Latvia, Lithuania, Sweden and Germany. All 16 cases involved architect's or expert's consultation provided by the involved project partners. There were developed case documentation templates and questionnaires to gather feedback from the participants.

Number of cases per country:

- Latvia – 6
- Lithuania – 4
- Sweden – 2
- Germany – 4

2.1.1. DIY piloting cases

Table 1 below shows the summary of the cases descriptions per country.

Table 1. DIY cases in summary

Country	Case 1	Case 2	Case 3	Case 4
Germany	Renovate the 1920s brick single-family house and remove the 10 auxiliary buildings, with plans to add individual tiny houses at a later stage.	Paint the bathroom wall in a dark blue or petrol colour, use renter-friendly adhesive tiles, and consider a Wabi Sabi style for the living and bedroom areas.	In an old farmhouse, insulate and cover the floor using materials such as cork, tiles, or a pourable layer over the existing tile surface.	Repaint the apartment walls and install new flooring.
Lithuania	Interior work in a private house, including building partitions with plasterboard and acoustic insulation, likely finished with decorative clay.	Building a private house, assess the chemical content of existing materials, consult manufacturers, and select health-friendly options for future use, such as coatings, adhesives, sealants, and plasters.	Furnish a semi-finished flat in a new construction apartment building, choose flooring and paint using a DIY guide.	Interior and facade work in a private house, with some materials already purchased. Select an alternative to stretch ceilings, lay flooring, tile the bathroom, repaint walls, and complete other interior finishes.
Latvia	Redesign the apartment layout to improve functionality and update the wall and floor finishes in the other rooms. Update the finishes and plumbing in the existing bathroom.	Renovate the interior of the co-working space in a Soviet-era educational building, including wall painting and custom furniture construction. Refurbish wall finishes, existing doors and furniture.	Repair or replace the existing roof in a private house and prepare it for full renovation.	Evaluate the impact of external structural elements and finishing materials on mould formation and select materials that align with moisture control and design objectives.
	Case 5	**Case 6**		
	Combine rooms by removing some interior walls, update finishes, insulate exterior walls, enlarge the bathroom, and add a balcony using reused electric poles.	The client is combining two adjacent apartments to create a larger unit. The renovation also includes soundproofing to reduce corridor noise.		
Sweden	Renovate the shower corner in a single-storey house by replacing the old tray, screen, and mixer with a new shower cubicle, mixer, hose, and nozzle.	House renovation using eco-friendly and health-conscious materials.		

2.1.2. Results of the DIY guide testing

The DIY guide testing utilized structured questionnaires tailored to each section of the guide. Respondents were DIY case holders who had the option to answer all questions or only those relevant to specific chapters. Below, we present the questions together with an aggregated summary of the responses by each chapter of the DIY guide.

1.1 CARE ABOUT THE ENVIRONMENT	
Why do you care about the environmental issues in relation to building renovation?	• Respondents care about environmental issues in renovation mainly due to health concerns, the desire to protect nature, and responsibility toward future generations. Some also mentioned aesthetic preferences for natural materials and practical efforts like recycling and minimizing waste.
Which additional arguments did you find in the guide for caring about environmental issues in relation to building renovation?	• The guide highlighted the environmental impact of materials, the importance of labelling and reuse, and health risks from substances like PVC. It also raised awareness about emissions from material production and encouraged more sustainable choices.
Do climate change issues concern you when choosing building materials? Why?	• Opinions varied: some considered climate impact when choosing materials, citing benefits like reduced emissions and better indoor air quality. Others prioritized health, cost, or practicality, and some felt their individual choices had minimal climate impact.

1.2 IMPACTS FOR HEALTH	
Are you now aware that building materials may contain harmful substances?	• Most respondents indicated that they are now aware that building materials may contain harmful substances. While some already had prior knowledge—particularly about paints and solvents—many noted that the guide increased their awareness, especially regarding plastics, vinyl flooring, and chemical additives. A few mentioned that despite this awareness, technical performance might still influence their product choices.
What possible impact on health do you now consider the most significant?	• Participants identified a range of health concerns related to harmful substances in building materials. The most frequently mentioned were endocrine disruption, respiratory and reproductive system effects, allergies, cancer risks, and impacts on vulnerable groups such as pregnant women and infants. Several responses emphasized the importance of maintaining a toxin-free home to support long-term well-being and life quality.

1.3 BEFORE STARTING	
Did you know that you have the right to ask about the presence of particularly dangerous substances in your products?	• Most respondents were not aware that they have the right to ask about the presence of dangerous substances in building materials. Some expressed scepticism about whether sellers would provide useful answers or felt unsure about what to ask. A few participants mentioned that they trust their craftsmen to make informed choices, while others learned about this right through the guide or assumed it was self-evident.
Is it important for you to collect and save documentation about the building materials you use in your renovation?	• Opinions were mixed on the importance of saving documentation about building materials. Some respondents considered it useful, especially for future purchases or matching materials. Others saw it as unnecessary, particularly for rental properties or when only aesthetic consistency was a concern. A few participants noted they only keep documentation when it serves a practical purpose.

1.4 ECOLABELS AND DECLARATIONS	
Is the difference between different labels and eco-labels clearly described?	• Responses were mixed regarding whether the guide clearly explained the differences between various labels and ecolabels. While many respondents felt the explanation was clear or mostly clear, others found the information overwhelming or difficult to read.
Is it clearly described why to prefer products with ecolabels?	• Most participants agreed that the guide conveyed the importance of choosing ecolabeled products, though some felt the reasoning could have been more explicitly stated. Several respondents noted that the message was implied through the guide's overall focus on environmentally friendly choices, even if not always clearly articulated.

2.1 WALLS	
What possible air pollution from wall materials should you watch out for?	• Respondents identified several potential pollutants from wall materials, with volatile organic compounds (VOCs) and formaldehyde being the most frequently mentioned. Silica dust and heavy metals were also noted. Some participants expressed uncertainty about specific chemical names and their sources, highlighting the complexity of identifying hazardous substances.
Which would be a better choice for walls - regular gypsum or wood-based panels (MDF, plywood and CLT)? Why?	• Some preferred wood-based options like MDF, plywood, or CLT due to their lower greenhouse gas emissions and perceived sustainability. Others favored gypsum drywall, citing its environmental friendliness or concerns about emissions from wood processing. A few responses reflected uncertainty or lack of a clear preference.
Is the information in this section clear and understandable?	• Most respondents found the information in the section clear and understandable.
Will you use the information about the wall materials for the material selection?	• The majority of participants indicated they would use the information when selecting wall materials. Some planned to apply it partially, depending on the function of the space or the practicality of alternatives. A few requested more specific guidance, such as alternatives to OSB boards or clarification on the safety of embedded materials.

What is your decision regarding the material selection and why?	• Decisions about wall materials were influenced by factors such as existing structures, practicality, health considerations, cost, and naturalness. Several respondents emphasized a preference for natural materials, though they acknowledged challenges like higher costs and maintenance. Others prioritized functionality.

2.2 Paints	
What is recommended to pay attention to the most when choosing paints?	• Respondents emphasized the importance of paint composition, eco-labels, and the presence of harmful substances like VOCs and solvents. Many noted the need to avoid toxic chemicals and preferred natural, plastic-free, and environmentally friendly options. Some also considered practical aspects like adhesion, drying time, and ease of cleaning tools.
What harmful chemical substances are most commonly found in paints?	• The most frequently mentioned harmful substances were VOCs, heavy metals, formaldehyde, and solvents. Several participants specifically recalled VOCs as a key concern.
Is the information in this section clear and understandable?	• Most respondents found the information clear, though a few noted that the chemical terminology was difficult to understand without a background in chemistry. Some requested more detailed comparisons between paint types (e.g., clay vs. lime) and clearer guidance on choosing the best option.
Will you use the information about paints for the material selection?	• Many participants said they would use the information when selecting paints, either fully or partially. Some appreciated the overview provided by the guide, while others felt they needed more specific guidance.
What is your decision regarding the material selection and why?	• Decisions varied depending on project needs and environmental values. Some planned to use natural or homemade paints, such as lime- or clay-based options, while others preferred zero-VOC or water-based paints. Several respondents highlighted the benefits of lime paint for kitchens due to its antimicrobial and moisture-regulating properties.

2.3 FLOORING	
Which aspects do you pay attention to the most when choosing flooring?	• Respondents prioritized durability, ease of maintenance, natural composition, and comfort when selecting flooring. Practical aspects such as repairability, suitability for the room's function, and cost-effectiveness were also important. Some participants also considered health impacts and whether the flooring could be installed independently.
What harmful chemical substances are most commonly found in flooring materials?	• The most commonly mentioned harmful substances were VOCs, formaldehyde, phenol, toluene, and PFAS. Participants noted that these chemicals can be found in synthetic linoleum, laminate, ceramic coatings, and textile floor backings. Awareness of these risks was often linked to information provided in the guide.
Is the information in this section clear and understandable?	• Most respondents found the information clear and understandable. However, a few noted that the content could be better adapted for general users. Suggestions included adding categories for self-installation and price to the comparison tables for easier decision-making.
Will you use this information about the flooring for the material selection?	• Many participants indicated they would use the information when selecting flooring, either fully or partially. Some appreciated the overview and found the tables helpful.
What is your decision regarding the material selection and why?	• Decisions leaned toward natural and durable materials such as wood, ceramic tiles, and stone. Some preferred hardwoods like oak or ash for their longevity, while others mentioned sustainable options like click linoleum or vinyl alternatives without PVC. A few respondents emphasized familiarity, aesthetics, and ease of maintenance as key reasons for their choices.

3.1 ROOFING MATERIALS	
Have you generally considered the environmental impact of exterior surfaces before?	• Responses showed that only a few participants had previously considered the environmental impact of exterior surfaces like roofing. Most admitted they had not thought about it before, indicating a gap in awareness prior to engaging with the guide.
Is it important for you whether there are harmful chemicals in the roofing material?	• Most respondents agreed that the presence of harmful chemicals in roofing materials is important to them. While some were certain about this concern, others were unsure but open to considering it, reflecting varying levels of awareness and prioritization.
Is the information in this section clear and understandable?	• The majority found the information in this section clear and understandable. One participant noted a factual inaccuracy regarding the lifespan of wooden shingles.
Will you use this information about the roofing materials for the material selection?	• Several participants indicated they would use the information when selecting roofing materials, either fully or partially. Others found it interesting but noted that practical factors like cost, durability, and maintenance needs would ultimately guide their decisions.
What is your decision regarding the material selection and why?	• Material choices varied, with some respondents favoring ceramic tiles, sheet metal, or fibre cement. Decisions were influenced by factors such as durability, health impact, tradition, and noise levels.

3.2 WALLS, FACADES, TERRACES	
Is the information in this section clear and understandable?	• Most respondents found the information in this section clear and understandable. However, one participant noted that the guide lacked information on windows and doors, which they expected to find in the guide.
Will you use this information for the material selection?	• Several participants indicated they would use the information for selecting materials, either fully or partially.
What is your decision regarding the material selection and why?	• Material choices varied based on project type and personal preferences. Some respondents aimed to preserve historic materials, while others preferred untreated wood, lime-cement plaster, clinker facades, or fibre cement sheets. Others chose to continue using plastered facades due to their low toxicity and familiarity.

3.4 COATINGS, ADHESIVES, SEALANTS	
Is the information in this section clear and understandable?	• Most respondents found the section clear and understandable. However, a few participants expressed confusion, particularly regarding exterior facade paints.
Will you use this information for the material selection?	• The majority of participants indicated they would use the information for selecting materials. However, a few expressed reservations related to technical reasons and market availability for sustainable choices.
What is your decision regarding the material selection and why?	• Material selection decisions varied widely. Some participants aimed to choose less harmful options based on the guide's tables. A few respondents were still undecided and felt more research was needed.

4.1 ENERGY EFFICIENCY	
Is the information in this section clear and understandable?	• Most respondents found the information in this section clear and understandable.
Does it help you to make any decision?	• Responses were more mixed regarding the section's usefulness for decision-making. While several participants found it helpful, others felt it only partially supported their decisions or not much at all. One respondent noted that although many important aspects were covered, the guide could place more emphasis on preventive maintenance measures. This indicates that while the content is generally informative, its practical application could be enhanced with more actionable guidance.

4.2 INDOOR AIR QUALITY	
Is the information in this section clear and understandable?	• All respondents found the information in this section clear and understandable.
Does it help you to make any decision?	• Most participants indicated that the section helped them make decisions, either fully or partially. Some noted that the information reinforced what they already knew, while others mentioned specific actions they would take as a result. These responses highlight the section's practical impact on everyday choices related to indoor environments.

5. CIRCULARITY, WASTE	
Was the information helpful in facilitating waste sorting?	• Most respondents found the information helpful for facilitating waste sorting. A few participants noted that they already rely on municipal resources for recycling guidance. Overall, the guide was seen as supportive, though its relevance varied depending on the respondent's role and prior knowledge.
Do you think it´s difficult to sort renovation waste?	• Opinions on the difficulty of sorting renovation waste were mixed. Several participants felt it was not particularly difficult, while others highlighted significant challenges. These included the need for advance planning, proper worker training. Some noted that sorting can be time-consuming, physically difficult and costly, especially in typical construction workflows. A few respondents mentioned specific concerns, such as the difficulty of disposing of non-sustainable paint.
Has the information inspired you to choose recycled or reused materials in your renovation?	• Many respondents reported being inspired by the information to consider using recycled or reused materials in their renovation projects. Some were already incorporating such practices, like reusing wood, packaging, or fixtures. Others expressed interest in using different materials for various purposes. However, a few participants noted that the information had limited impact because their materials had already been purchased or they had already planned to recycle. This suggests that while the guide can influence material choices, timing and project stage play a significant role.

OVERALL	
Do you think the publication is well designed for your needs in DIY renovation?	• Most respondents felt the guide was well-designed for their DIY renovation needs, describing it as comprehensive and helpful for directing further research. Positive feedback highlighted the guide's structure, visual elements like comparison tables, and its ability to provide an overview of sustainable renovation. However, several participants noted areas for improvement, such as the need for clearer language, more real-life examples, and better organization. Some found specific sections confusing—particularly those

	related to wet rooms, paints, and chemical terminology—suggesting that simplifying technical content and improving navigation would enhance usability.
What is your most important discovery when reading the guide?	• Respondents shared a range of valuable insights gained from the guide. Many appreciated the emphasis on health and sustainability in renovation, recognizing that renovation is not just aesthetic but also impacts well-being. Others highlighted the usefulness of comparison tables, the variety of material options, and the importance of avoiding harmful substances. Some discovered new alternatives, such as substitutes for linoleum, or became more aware of eco-labels and the complexity of environmental and health considerations in building materials.
Was there anything too difficult to understand?	• While many found the guide understandable, a few respondents pointed out specific challenges. These included complex terminology, especially chemical names, and difficulty navigating dense sections. Some noted that while the content wasn't inherently difficult, the layout made it hard to find relevant information quickly. Suggestions included simplifying language, adding clearer headings, and using more visual aids like cross-sections to illustrate material use in context.
What would you like to get more information about?	• Participants expressed interest in learning more about several topics, particularly the health effects of building materials, environmentally friendly paints and insulation, and the responsibilities of suppliers regarding hazardous substances. Others requested practical additions such as case studies of ecological homes, DIY suitability, waste management, and even how to clean tools like paintbrushes. A recurring theme was the desire for clearer, more accessible information and expanded comparative tables.
Have you acquired new information from reading this guide? What information?	• Most respondents reported learning new and useful information from the guide. Key takeaways included the significance of eco-labels, the environmental and health impacts of various materials, and specific product categories like glues and sealants. For some, the terminology was difficult to understand.

2.1.3. Summary findings on DIY guide testing

The DIY guide testing results indicate a generally high level of user appreciation and satisfaction with the DIY guide. We found several main positive and negative feedback points from piloting cases summarised in a list below.

Positive findings

- The guide was greatly appreciated, prompting reflection on aspects of renovation that users had not previously considered.
- The reference to self-empowerment tools—such as eco-labels and material databases—was seen as highly useful.
- Color-coded sections and comparison tables made it easy to identify key information and served as a helpful starting point for further research.
- Users valued the overview of different products, including their specific pros and cons, along with practical tips that made the topic approachable.
- The guide was described as visually appealing and well-balanced in terms of information density, making it enjoyable and accessible to read.
- Several respondents noted that eco-labeled products they had already used performed well, and they were motivated to continue replacing conventional materials with environmentally assessed alternatives in future renovations.

Negative findings

- Some users found the guide overwhelming, noting that the language and structure were too demanding for non-experts.
- Cork was identified as a missing flooring material in the content.
- Key tips should be made more visible.
- A self-assessment table at the beginning was suggested to help users identify their priorities.
- Users requested clearer comparisons between similar materials (e.g., clay vs. lime paints), including advantages, suitability for specific spaces, and cost factors.
- The information on flooring materials was not specific enough, that would help users make more informed decisions.
- Concerns were raised about product waste, such as leftover silicone sealant and paint, which had to be discarded as hazardous waste despite efforts to minimize use.
- Some find it difficult to find sustainable products recommended by the guide in regular DIY stores.

2.2. Check(ED) App

Check(ED) App feedback was collected by 6 detailed interviews and 51 responses from online questionnaire. Additionally, 12 doctoral students from Kaunas Technical University tested the app and gave the feedback. Feedback questionnaires were attached as a separate google link in all languages and available after finishing the check.

Feedback questions regarding Check(ED) App have been summarized in Table 2.

Table 2. Questions on feedback of the Check(ED) App

No.	Question
1	Did you understand the questions?
2	Did you understand the meaning of symbols and texts completely?
3	How difficult or easy was it to answer the questions?
4	Did you have most of the information you needed for your answers?
5	Was the information given (hints, descriptions, recommendations) understandable?
6	Did you understand the results?
7	Did the results inform you about the sources of EDs that you were not aware of before?
8	Did you understand the recommendations on the choice of more sustainable construction materials?
9	Will you use the recommendations on more sustainable construction materials to improve your home environment?
10	Would you recommend this app to others?
11	What measures could you imagine to take after going through your household with CheckED in order to reduce your exposure to endocrine disruptors from construction materials?
12	Is there anything you would suggest improving to make the app better?

2.2.1. Results of the online questionnaire

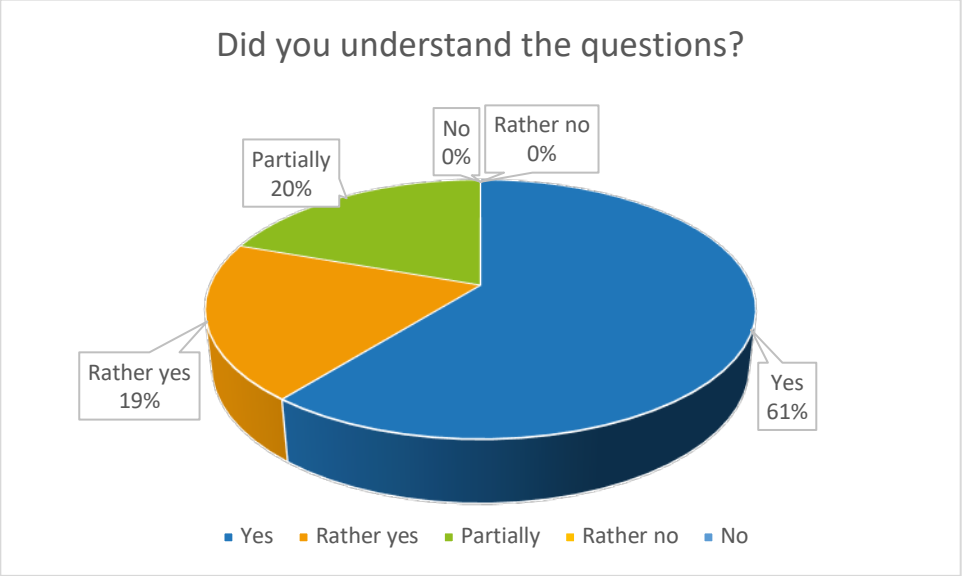

Figure 1. Responses to question 1: Did you understand the questions?

Based on the survey results (Figure 1), 60% of respondents indicated full comprehension of the questions ("Yes"), while 25% reported a general understanding ("Rather yes"). A smaller portion, 10%, selected "Partially", suggesting limited clarity. Notably, no respondents selected "Rather no" or "No", indicating a high overall level of question clarity.

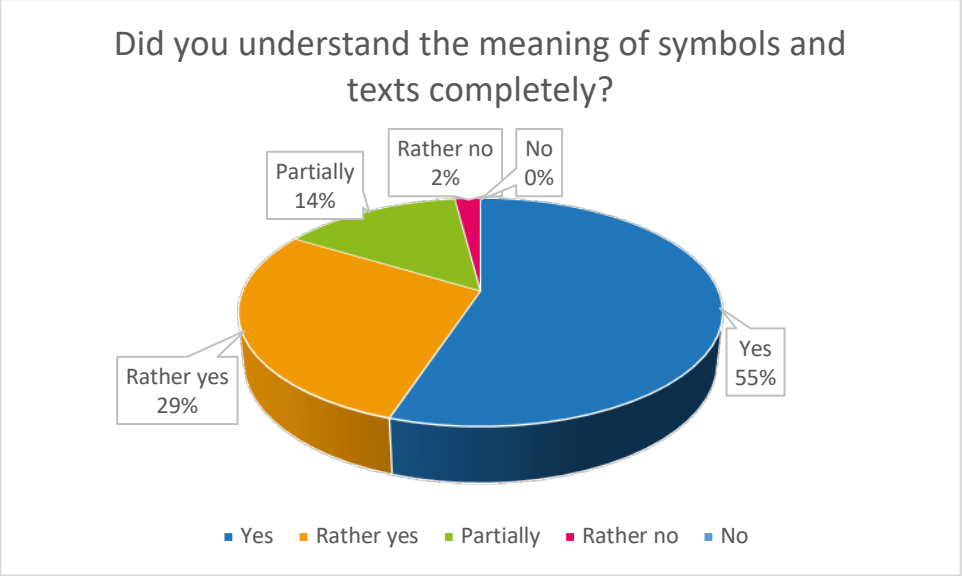

Figure 2. Responses to question 2: Did you understand the meaning of symbols and texts completely?

Figure 2 illustrates that 55% of respondents fully understood the symbols and texts ("Yes"), while 29% indicated general understanding ("Rather yes"). Partial comprehension was reported by 14% ("Partially"), and only 2% selected "Rather no". No respondents reported complete misunderstanding ("No").

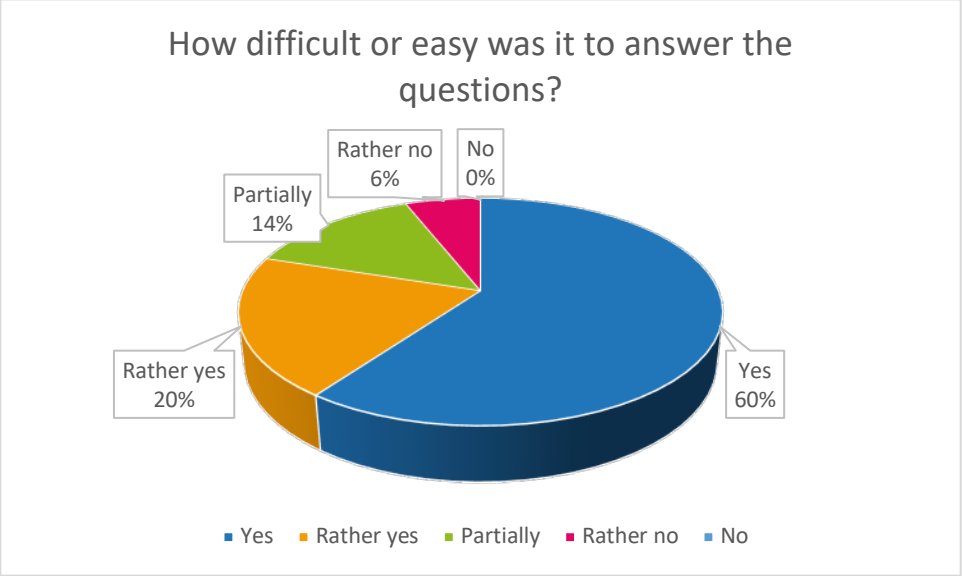

Figure 3. Responses to question 3: How difficult or easy was it to answer the questions?

Figure 3 shows that 60% of participants found the questions easy to answer ("Yes"). An additional 20% reported they were mostly easy ("Rather yes"), while 14% experienced partial difficulty ("Partially"). A small portion (6%) found the questions rather difficult ("Rather no"), and no respondents indicated complete difficulty ("No").

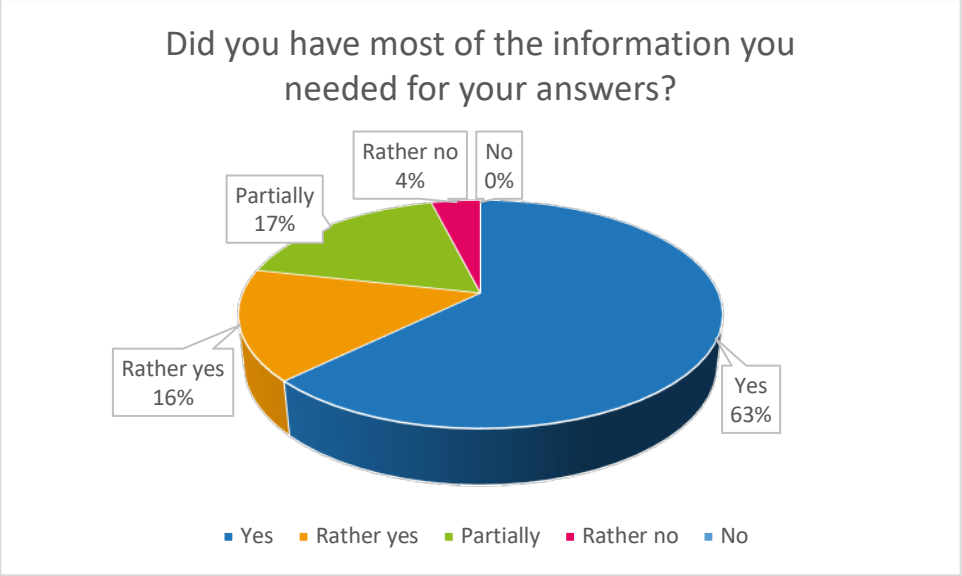

Figure 4. Responses to question 4: Did you have most of the information you needed for your answers?

Figure 4 shows that 63% of respondents confirmed they had all necessary information ("Yes"), while 16% indicated they mostly did ("Rather yes"). Partial information was reported by 17% ("Partially"), and 4% selected "Rather no". No respondents indicated a complete lack of information ("No").

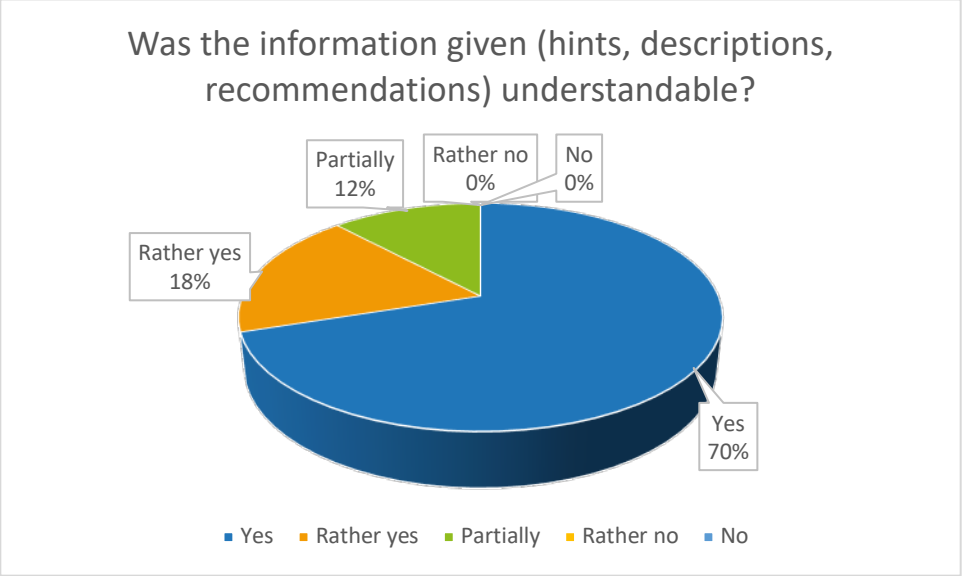

Figure 5. Responses to question 5: Was the information given (hints, descriptions, recommendations) understandable?

Figure 5 illustrates the level of understanding of the provided information, including hints, descriptions, and recommendations. A substantial majority (70%) found the information clear ("Yes"), while 18% reported it was mostly understandable ("Rather yes"). Partial clarity was noted by 12% ("Partially"), and no respondents indicated significant confusion ("Rather no" or "No").

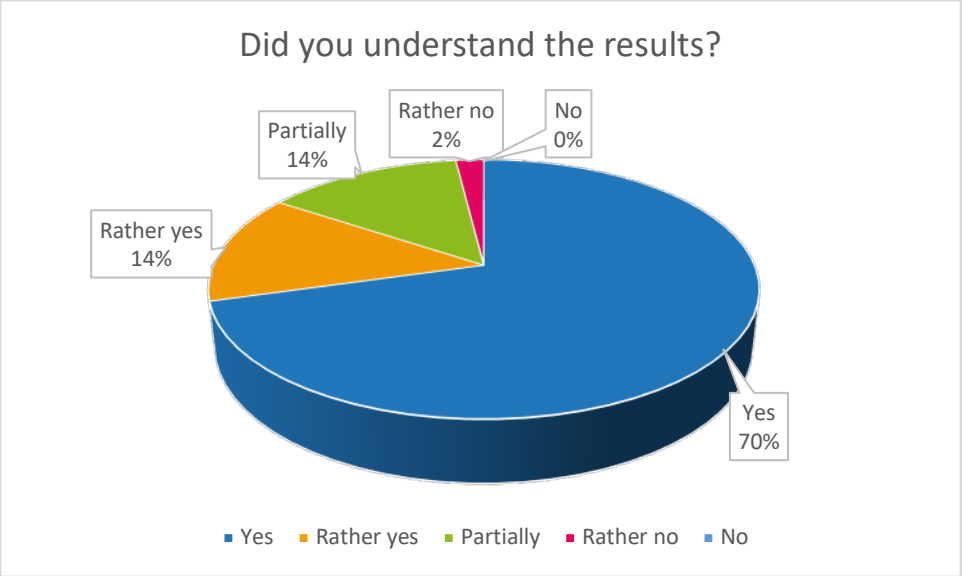

Figure 6. Responses to question 6: Did you understand the results?

Figure 6 shows that 70% of respondents reported full understanding of the results ("Yes"), while 14% indicated general comprehension ("Rather yes"). Another 14% experienced partial understanding ("Partially"), and 2% selected "Rather no". No participants reported complete lack of understanding ("No").

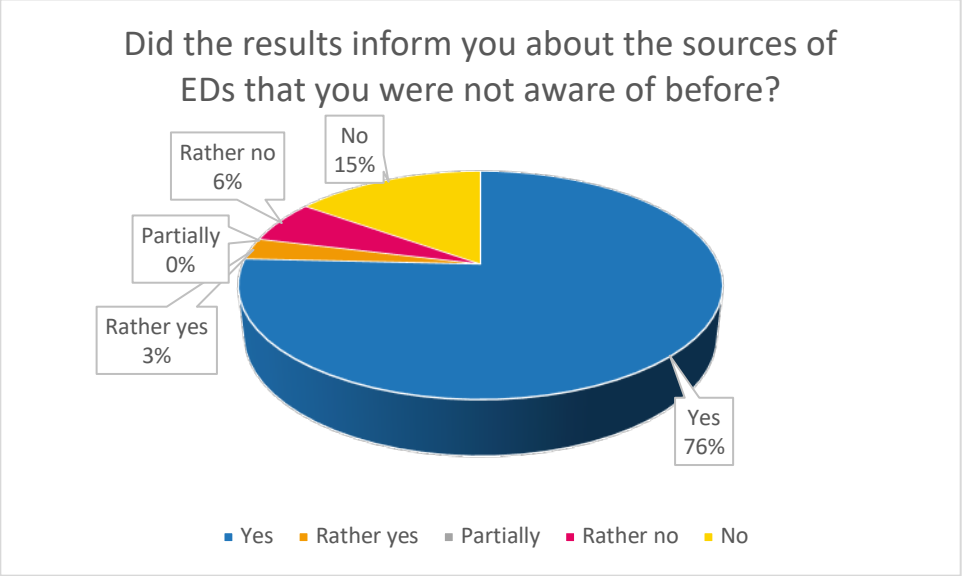

Figure 7. Responses to question 7: Did the results inform you about the sources of EDs that you were not aware of before?

Figure 7 shows that 76% of respondents reported gaining new insights from the results ("Yes"), while 3% indicated general agreement ("Rather yes"). A notable 15% responded "No", suggesting the results did not provide new information for them, and 6% selected "Rather no". No respondents chose "Partially".

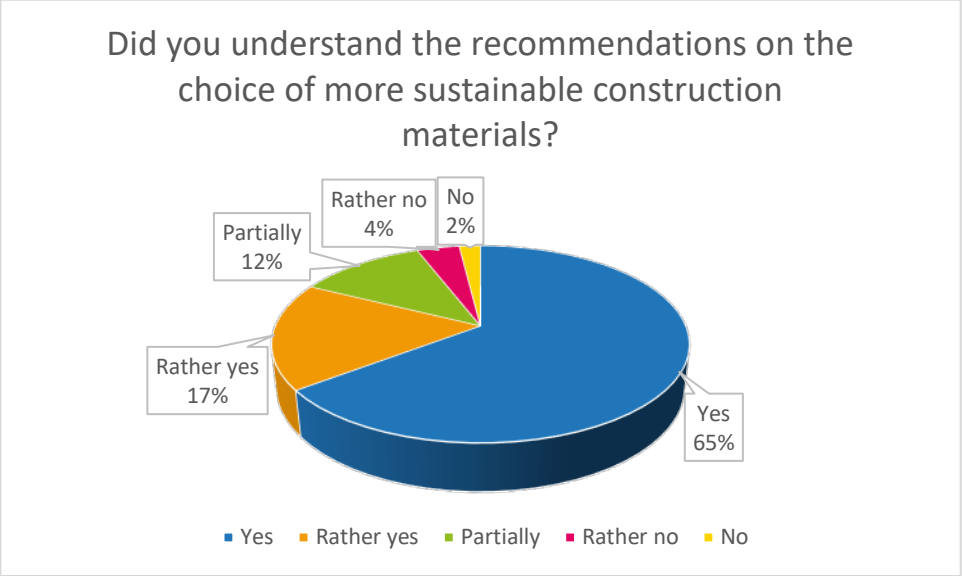

Figure 8. Responses to question 8: Did you understand the recommendations on the choice of more sustainable construction materials?

Figure 8 shows that 65% of respondents fully understood the recommendations regarding more sustainable construction materials ("Yes"), while 17% indicated general understanding ("Rather yes"). Partial comprehension was reported by 12% ("Partially"), 4% selected "Rather no", and 2% indicated no understanding ("No").

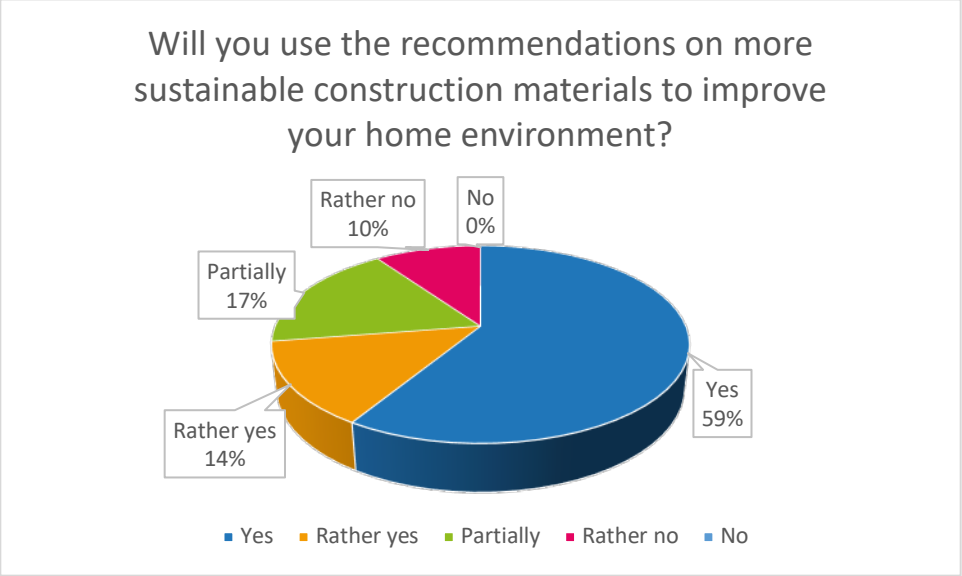

Figure 9. Responses to question 9: Will you use the recommendations on more sustainable construction materials to improve your home environment?

Figure 9 shows that 59% of respondents intend to use the recommendations on more sustainable construction materials to improve their home environment ("Yes"). An additional 14% indicated general intent ("Rather yes"), while 17% reported partial willingness ("Partially"). A smaller portion (10%) selected "Rather no", and no respondents chose "No".

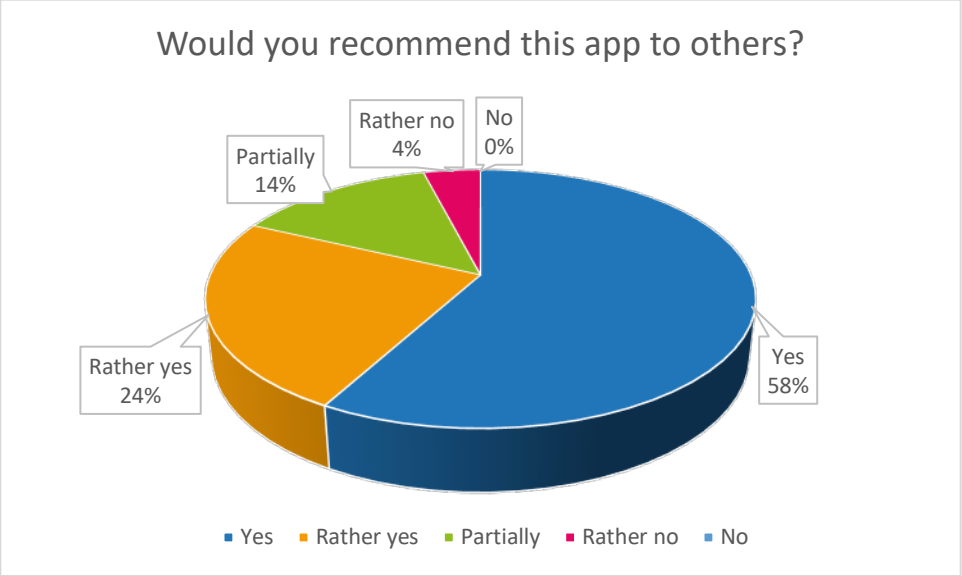

Figure 10. Responses to question 10: Would you recommend this app to others?

Figure 10 shows that 58% of respondents would recommend the app to others ("Yes"), while 24% expressed general willingness ("Rather yes"). Partial endorsement was indicated by 14% ("Partially"), and 4% selected "Rather no". No respondents chose "No", suggesting overall positive reception.

Open questions

Question 11: What measures could you imagine to take after going through your household with Check(ED) in order to reduce your exposure to endocrine disruptors from construction materials?

Participants provided a range of responses to the question regarding potential measures to reduce exposure to EDs from construction materials after using the Check(ED) tool. Some participants acknowledged the limitations of making immediate changes due to financial or logistical constraints, particularly when it comes to construction materials, which often require planned renovations. Nevertheless, others expressed a commitment to future improvements: *"If I do renovations, I will take these suggestions about less harmful materials into account."* Many emphasized the importance of more conscious consumer behavior, such as *"Shop more responsibly"*, *"Choose higher-quality and more natural materials"*, and *"I will choose natural materials and eco-labeled ones whenever possible."* Several participants highlighted the need to reduce plastic use in everyday items. Practical steps included reducing the use of coated pans and plastic containers, replacing melamine tableware, and increasing cleaning efforts like dusting and vacuuming to minimize chemical residue. Overall, the feedback reflects a growing awareness and a proactive, albeit measured, approach to reducing exposure to harmful substances in the home environment.

Question 12: Is there anything you would suggest improving to make the app better?

Participants provided constructive suggestions for improving the Check(ED) App, focusing on usability, language support, and functionality. Several users highlighted the need for better data handling and continuity, suggesting that *"It should be possible to save answers in between"* and *"The existing information doesn't get saved."* Others emphasized the importance of output accessibility, requesting features such as *"Make the results and recommendations available as a printable version"* and *"Save the suggestions as a PDF."* A common request was for broader language accessibility, with users stating, *"Improve the translation into Lithuanian."* Concerns were also raised about the app's complexity and clarity, with one user noting *"The entire check is very time-consuming. It would make sense if a check could be paused and continued later."* Additionally, feedback included questions about the relevance of certain inputs - *"Why ask age and weight? For research?"* Overall, the feedback reflects a desire for a more user-friendly, multilingual, and flexible tool that accommodates diverse user needs and contexts.

2.2.2. Summary findings on Check(ED) App testing

Feedback on usability

The survey results indicate a generally high level of user comprehension and satisfaction with the Check(ED) App.

- For most respondents the questions asked by the app were mostly understood.
- A majority of respondents reported that they fully understood the symbols and texts used in the app, and most found the provided information—including hints and recommendations—clear.

- The majority also found the questions easy to answer and felt they had sufficient information to complete the check.
- Most users indicated they fully understood the results, and many stated that they gained new insights from them.
- In relation to sustainable construction materials, a large portion of respondents understood the recommendations and expressed an intention to apply them in their home environment.

Additionally, most participants said they would recommend the app to others, reflecting a generally positive reception.

Feedback on reducing exposure to endocrine disruptors

Participants provided a range of responses to the question regarding potential measures to reduce exposure to endocrine disruptors from construction materials after using the Check(ED) tool.

- Some participants acknowledged the limitations of making immediate changes due to financial or logistical constraints, particularly when it comes to construction materials, which often require planned renovations.
- Others expressed a commitment to improve their habits and behaviour. Many emphasized the importance of more conscious consumer behaviour, such as shopping more responsibly, choosing higher-quality and ecolabeled materials, and reducing plastic use in everyday items.
- Practical improvement steps included reducing the use of coated pans and plastic containers, replacing melamine tableware, and increasing cleaning efforts like dusting and vacuuming to minimize chemical residue.

Overall, the feedback reflects a growing awareness and a proactive, albeit measured, approach to reducing exposure to harmful substances in the home environment.

Suggestions for improvements

Participants provided constructive suggestions for improving the Check(ED) App, focusing on usability, language support, and functionality.

- There is a need for better data handling and continuity, such as the ability to save answers and retain existing information.
- Importance of output accessibility, requesting features like printable or downloadable results.
- Language accessibility was also a common theme, with requests for improved translations.
- Some users found the app complex or time-consuming and suggested simplifying certain sections.
- There were also questions about the relevance of specific inputs, such as age and weight.

- There were also suggestions to improve design layout for easier comprehension.

Overall, the feedback reflects a desire for a more user-friendly, multilingual, and flexible tool that accommodates diverse user needs and contexts.

2.3. Fact sheets

The fact sheets are intended to be used by professionals.

In total, there are 12 fact sheets and 11 of them were tested (except fact sheet No 10), see Table 3. The working group divided the responsibilities, in order to test all fact sheets at least once. Testing took place in Latvia, Lithuania and Germany.

Each country engaged a distinct group of testers: in Latvia, testing was conducted at Vidzeme University of Applied Sciences by young professionals (students), while in Lithuania and Germany, the fact sheets were evaluated by practicing architects.

The answers were collected from 19 responders, where 2 of them were professional architects (from Lithuania and Germany) and 17 responders were students of the Vidzeme University of Applied Sciences (young professionals from New Construction School).

Table 3. List of fact sheets

No.	Fact sheet
1	Key aspects of toxicity, circularity, climate neutrality in buildings
2	Chemicals-health connections – how to interpret Safety Data Sheet
3	Building process from the design to construction
4	“Hot spots” in buildings
5	Thermal insulation materials
6	Ecolabels
7	Ecocertification of buildings
8	Product databases and platforms
9	Databases and platforms with management functions (logbooks, projects, product assessments, networking)
10	Databases and other information sources using data(sets) that require comparison and interpretation by the reader
11	NonHazCity Building Material Catalogue for tox-free construction
12	Finishing materials

The fact sheet testing involved asking testers structured questions. The questions and summaries of the answers are presented below.

2.3.1. Results of the Fact sheet testing

1. KEY ASPECTS OF TOXICITY, CIRCULARITY, CLIMATE NEUTRALITY IN BUILDINGS	
Is tree pillar approach clear and understandable?	• Key aspects are clear. • Information is useful, there is a lack of systematized material and this is valuable. • Some information is integrated in daily practice, but some is new.
Does the fact sheet give clear information on the importance of tox-free building?	
Is the information given in the fact sheet useful in your professional field?	

2. CHEMICALS-HEALTH CONNECTIONS – HOW TO INTERPRET SAFETY DATA SHEET	
Is it clear the Safety Data Sheet's (SDS) need and the information it includes?	• Overall, testers have a good understanding of the content of the SDS. Many people working in the industry admit that they are mostly in a document pile (on a site) and nobody uses them. • Many students were previously unfamiliar with different types of chemicals and their effects, so the fact sheet certainly helped them to remember the critical groups. • The information is clearly presented, and the fact sheet can help those who work less with SDSs on a daily basis. • Such information is very useful. Already at the planning stage, when selecting building materials and construction products. When communicating with a client, materials are often selected based on price, and other qualities are pushed to the side. Having such information sheets opens up another level of discussion regarding the choice of building products. • It is clear that the negative impact can take effect both during construction and after moving into the premises.
Is it clear the information about "not nice" construction chemicals?	
Is the information given in the fact sheet useful in your professional field?	

3. BUILDING PROCESS FROM THE DESIGN TO CONSTRUCTION	
Is it clear what should be considered at each stage of design and construction?	• The main thought is clear, the construction process information is too little ("dry").
Are the recommendations useful for design and construction processes?	

4. HOT SPOTS IN BUILDINGS	
Is it clear what are the hot spots in a building?	• Yes, of course. These are certain points in the building that have an increased risk of toxicity, heat loss, environmental sustainability risks and which need to be planned especially carefully. • Yes, useful. When planning, I would always like to check whether these points have been taken into account. • Short, main essence is there, understandable. • It is also valuable because having such a list makes communication with the client easier and provides compact material that can be used to justify various construction and design decisions. • If I had to build with the thought about hazardousness of materials, the content of this fact sheet would help me to understand the basics of this topic.
Is the Checklist useful to identify the hot spots in the building?	
Is the information given in the fact sheet useful in your professional field?	

5. THERMAL INSULATION MATERIALS	
Are the advantages and disadvantages of choosing synthetic, mineral-based or natural organic based materials clear? Is the fact sheet useful to decide which material type to use best? Is the information given in the fact sheet useful in your professional field?	• Information is clear. • It is clear that I would definitely not use synthetic materials. But I do not know exactly whether to choose mineral or natural products, because in principle natural products are often also affected by chemicals. Especially the question of cellulose, where there are many impurities. • The durability of materials would also be an interesting question. • Yes, useful. Currently, synthetic insulation materials are very often chosen in Lithuania. This sheet shows and confirms that this is not a good solution.

6. ECOLABELS	
Do you recognise different ecolabels and do you understand their meaning? Is the information given in the fact sheet useful in your professional field?	• Some of the enquired people knew about the ecolabel schemes, although the most part knew very little or nothing about them. After reading the fact sheet many indicated that they understand the necessity of ecolabels and will pay more attention to them in the future. • All the inquired people have indicated that the information given in the fact sheet is useful. Nowadays there is more and more request for sustainable building, so it is important to be informed about the ecolabels. • Very valuable, they make it much easier to get around and read information about construction products

7. ECOCERTIFICATION OF BUILDINGS	
Is it clear the necessity of ecocertification and the different ecocertification schemes?	• Almost all enquired people have responded that they understand the necessity of eco-certification of buildings. Eco-certifications are necessary to follow certain criteria for be more sustainable. • Partially clear. • The question is when is it mandatory to certify buildings? Or is it done on the initiative of the builder due to certain interests? • Almost all inquired people have responded that the main focus areas are clearly displayed. • The information given in the fact sheet is useful in professional field, because it indicates on what to pay attention. • I knew that it is necessary to have a building certified (handed over) when handing over a building after construction. I did not know that there are different certificates. Interesting aspect.
Are the main categories of evaluation and criteria clearly shown?	
Is the information given in the fact sheet useful in your professional field?	

8. PRODUCT DATABASES AND PLATFORMS	
Is it clear how to use each database?	• Students understand best after a demonstration. It was suggested that short tutorial videos would be useful. • Very good to have the links to check directly to the databases.
Is the information given in the fact sheet useful in your professional field?	• Students have different professional roles, so there are those who find it useful (those who are involved in the choice of materials) those who do not.

9.DATABASES AND PLATFORMS WITH MANAGEMENT FUNCTIONS	
Is it clear what services the platforms offer?	• Information presented is clear.
Is the information given in the fact sheet useful in your professional field?	• Partly. As we are not having projects in the whole BSR region, it is not that important to have all at one glance (e.g. Finland). The databases for the German market are really useful. • Some overlap with the fact sheets 9 and 10 was observed.

11. THE BUILDING MATERIAL CATALOGUE FOR TOX-FREE CONSTRUCTION	
Is it clear what the "Building material catalogue for tox-free construction" contains?	• Generally, students state that from the fact sheet the content of the Catalogue it is clear, however, having the opportunity to look at it would be more reassuring.
Would you like to read the "Building material catalogue for tox-free construction" in more detail after reading this fact sheet?	• Most students said that having such a catalogue would help them to develop their coursework (to look for safer alternatives) and to complete their practical assignments more successfully.
Is the information given in the fact sheet useful in your professional field?	• Students have different professional roles, so there are those who find it useful to be involved in the choice of materials and those who do not. • It is undoubtedly valuable, as having such a database allows for more targeted planning.

12. FINISHING MATERIALS	
Are the advantages and disadvantages clear for every finishing material described?	• Clear.
Does the description of the advantages and disadvantages will help in choosing the building materials?	• Of course, it is very useful. The proposed, previously unheard-of alternatives are also interesting.

2.3.2. Summary findings on fact sheet testing

1. Key Aspects of Toxicity, Circularity, Climate Neutrality in Buildings

This fact sheet was generally well received by participants. The “tree pillar” approach was reported as clear and understandable. Testers acknowledged the usefulness of the provided information, noting that while some elements are already integrated into everyday professional practice, several concepts introduced were new and valuable. The material successfully highlighted the relevance of toxic-free building principles within contemporary construction contexts.

2. Chemicals–Health Connections: How to Interpret Safety Data Sheets

Participants, including students and industry professionals, expressed a strong appreciation for this sheet. It clarified the purpose and content of Safety Data Sheets (SDSs), often underused in construction environments. Students improved their understanding of hazardous chemical groups, while professionals acknowledged the importance of these documents in informed product selection. The sheet was seen as effective in promoting safer construction practices and fostering more nuanced client communication regarding material choices.

3. Building Process from the Design to Construction

The central message of this fact sheet was understood, although several testers suggested it lacked detailed guidance. While the basic structure of the building process was outlined, further elaboration on each phase was desired. Nonetheless, the sheet provided a foundational perspective useful for both planning and execution of construction projects.

4. “Hot Spots” in Buildings

Respondents demonstrated a clear understanding of what constitutes a “hot spot” in a building—areas with elevated risks related to toxicity, heat loss, and environmental impact. The included checklist was considered beneficial for identifying such zones, aiding in the planning phase and enhancing dialogue with clients. This sheet was viewed as practical and relevant across various professional fields.

5. Thermal Insulation Materials

The advantages and disadvantages of synthetic, mineral-based, and natural insulation materials were effectively communicated. Participants favored natural and mineral-based options over synthetic materials due to chemical concerns. Uncertainty remained regarding the durability and chemical content of certain natural products, particularly cellulose-based ones. Overall, the sheet was instrumental in guiding material selection and promoting critical evaluation of insulation products.

6. Ecolabels

This fact sheet succeeded in raising awareness about ecolabel schemes. While initial familiarity varied, the content led many professionals to recognize the importance of ecolabels in sustainable construction. Testers indicated that the information would influence

future product selection decisions and enhance their ability to navigate sustainability certifications.

7. Ecocertification of Buildings

The necessity and value of ecocertification were clearly conveyed. Testers appreciated the explanation of various certification schemes and evaluation criteria. Some confusion remained regarding the circumstances under which certification is mandatory versus voluntary. Despite this, the sheet provided useful insights that clarified the role of certification in sustainable building practices.

8. Product Databases and Platforms

The sheet effectively introduced key databases, with testers noting the utility of embedded hyperlinks. Students, in particular, responded positively to the prospect of short tutorial videos to aid understanding. The relevance of this sheet varied across professional roles, depending on their involvement in material selection. Nevertheless, it was considered a helpful resource for navigating construction product information.

9. Databases and Platforms with Management Functions

This sheet was found to be clear in terms of explaining available services such as project assessments and logbooks. It was deemed particularly useful for professionals working in specific regional contexts, like Germany. However, its broader applicability across the whole of the Baltic Sea Region (BSR) was seen as less critical for some users, as markets are different. It was noted that the content overlaps with fact sheets 8 and 10.

10. Databases and Other Information Sources Using Data Interpretation (Not Tested)

This fact sheet was not formally tested. It focuses on sources requiring comparative data analysis and interpretation, and it shares thematic similarities with fact sheets 8 and 9.

11. NonHazCity Building Material Catalogue for Tox-Free Construction

Testers reported that the content and structure of the catalogue were adequately conveyed. Many expressed interest in exploring the catalogue further, viewing it as a valuable tool for academic assignments and professional planning. The sheet highlighted the catalogue's potential to support more targeted and informed material choices.

12. Finishing Materials

The sheet provided a clear comparison of the advantages and disadvantages of various finishing materials. It offered fresh insights and introduced alternative options that had previously been unfamiliar to some participants. Testers confirmed that the information would positively influence their decision-making when selecting finishing materials.

3. Synergies and conclusions

3.1. Synergies and inter-relations with outputs

DIY guide and Check(ED) App are good, complementary products. It has been noted that "*DIY guide provides general and detailed information, the Check(ED) App is personalized and action-based.*" They can be used together or separately. During testing it becomes clear that testing them together by a single tester can be a bit difficult for volunteers. However, some suggested that "*Both Check(ED) App and DIY guide work nicely together. It would make sense to use the Check(ED) App first in order to get an understanding of the problem and the personal exposure to EDs and use the DIY guide later in order to plan the renovation and back up the information that the Check(ED) App gives.*" The Check(ED) App is very good for raising awareness of the topic, especially the health impact, while the DIY guide is targeted towards DIY renovations with specific advice.

As the fact sheets were made for professional use, there is not much synergy with the Check(ED) App and the DIY guide. However, they are also a good product to raise awareness for many professionals, especially on ecolabels, eco-certification of buildings, aspects of hazardousness of construction materials and other topics.

3.2. Contribution to the aspects of Climate, Circularity and Chemicals

Reduction of Hazardous Substances:

Participants reported increased awareness and practical actions to reduce exposure to harmful chemicals. These included the use of natural or eco-labelled paints, avoidance of PVC flooring in favor of linoleum, and more critical evaluation of adhesives and sealants. For instance, one participant noted that "*I will have a better indoor air quality because I use VOC-free paints. At the moment my floor is covered with PVC. I will change it to linoleum. So, I will have much less Phthalates in my living environment.*" Several users noted improved indoor air quality and reduced dust levels as a result of these choices. The Check(ED) App and DIY Guide were instrumental in highlighting the health risks associated with endocrine-disrupting chemicals and promoting safer alternatives.

Climate Neutrality:

The guide raised awareness about the carbon footprint of construction materials. As indicated by participants "*The climate issue was not my main concern. But through reading the guide I am now more aware of the climate impact of construction material.*" Some users consciously avoided unnecessary replacements (e.g., windows) and selected materials with lower life-cycle emissions, such as linoleum over PVC. These decisions reflect a shift toward more climate-conscious renovation practices.

Circularity:

Participants demonstrated an understanding of circular construction principles, including the recyclability of materials and the importance of minimizing waste, indicating that "*From the*

beginning, my goal has been to avoid buying new products unless necessary. For example, I haven't replaced windows." Actions included reusing existing materials, selecting recyclable options like lime-based paints and linoleum, and reducing the purchase of new products. The guide effectively communicated possibilities and restrictions on recyclability and reuse.

Overall, the pilot activities confirmed that targeted tools and guidance can empower both professionals and private individuals to make informed decisions on more sustainable renovation choices and health aspects of construction materials.