R-ECO

1. User Research

1.1.   User research done by each team member

User Research (Andreia)

1.   Who are our users?
We consider our users the ones that would already want to take a minimum effort in order to recycle and are part of the following categories:
-People from Czech Republic or foreign citizens that are living here.
-People who are interested in recycling, but our not sure how to do it correctly.
-People who are attracted by the facilities given by the application (gaining points).
-People from rural parts of the country that don't have the same "settings" as the ones from the urban side.

From the users mentioned above, we can draw a few conclusions:

1.   The application should be very simple, accessible and convenient – recycling can be a very tough process which can require some time and interest from the user. We have to pay attention on how we enhance that interest by making sure that it does not become too hard or even frustrating.

2.   Keeping in mind that we also include citizens from parts of the country where the recycling system is not well developed, we have to provide solutions for those areas as well.

- How is recycling in Czech Republic – how popular & well-supported is it by the government? We want to know if the user has the right resources or is in some ways limited.
-It is popular to recycle in Czech Republic, but it still has a relatively low rate for the municipal waste recycling (33.3% - statistics from 2019).
https://www.statista.com/statistics/1219551/municipal-waste-recycling-eu-by-country/
-It is relatively easy to recycle in Prague, there are various places where you can throw diverse materials.
https://praguemorning.cz/how-to-recycle-in-prague-bring-your-recycling-routine-to-the-next-level/
-The government provides various networks around the country, but there are more in the developed parts of the country. Nevertheless, they still have some problems with their recycling strategy.
https://english.radio.cz/recycling-key-solving-czech-waste-problem-8144917
-There are many associations which are encouraging the citizens to recycle and ongoing plans to improve the recycling.

- What are the main problems encountered by the user when trying to recycle?
-It varies around the country (depends on community to community); the recycling programs are not made consistent by the government and they encounter even inconsistency by region. It depends, in a significant amount, on which part of the country

you live. Some may have the desire to be part of the change and be responsible, but they have problems accessing the resources.

-It is time consuming: preparing and cleaning the recyclables, having to travel to a recycling center. Most of the people (even if they are driven by the desire of change) won't find it easy to go through a process that requires too much time, they are in a continuous hurry and don't pay attention to these kinds of routines.
https://www.huffpost.com/entry/psychology-of-why-people-dont-recycle_n_57697a7be4b087b70be605b3

-It can be confusing: the users are not sure what is recyclable and what it isn't and how to read the label to identify different materials (Universal Recycling Symbol). Therefore, they would need to search for this information and even after that, they should find the availability in their region for disposing of that specific material.

-A large majority of people want to support recycling and have it as their priority, but just a few people actually do it. The discrepancy comes not only from inconvenience or confusion, but also from lack of knowledge regarding what can be recycled. This could ruin the overall process, not receiving the desired results.
https://www.forbes.com/sites/blakemorgan/2021/04/21/why-is-it-so-hard-to-recycle/

-Users would also want to avoid buying plastic, but the alternatives are rarely there, or they need to make a further step in order to discover which companies or markets encourage the use of eco-friendly materials.

We identified the following key aspects to analyze the collected data:

Goals and Motivations:
The users have good intentions and want to respect the process in a correct way in order to add their contribution to the society. The incentive can come from the sense of responsibility or from gaining different discounts throughout the way.

Knowledge:
They have little or more knowledge on how the process needs to be done. They are surrounded by this kind of information in schools, articles, news where a general idea or the importance of recycling is presented, but not necessarily the steps.

Behaviors:
The usual behavior for the users is renouncing on recycling when they don't know for sure what to select or where to go. This is also influenced by the unsteady infrastructure provided by the government.

User Research (Francisco)

Situation
Many people don't know how to recycle in a correct way, that is why an application that informs users about the best way to recycle, providing relevant information about the material they want to recycle is vital in today's society.

There are large groups of people that due to ignorance or laziness to look for recycling areas, don't recycle well, so an integrated map of a mobile application with help on areas where you can recycle materials can be very beneficial to society.

When starting a business related to recycling, it may be difficult to find customers or users, but thanks to the *R-ECO* application, they are promoted as places where people around them can recycle within those businesses.

Goals/motivations
Many people are curious to learn how to recycle in an optimal way (these users may not know how or where to recycle), which is why an application that informs about recycling, but also indicates recycling areas can be especially interesting.
If you also add the possibility of obtaining incredible discounts in different shops, you have an application that has a great appeal to our users.

Knowledge
Recycling is one of the booming topics in today's society, but the knowledge about it is different depending on the age of the users.
The knowledge of recycling according to age can be divided as follows:

> **- Children (13-18 years old):** This group knows what recycling is because they will have seen it at school and at home so most of the elements that appear in the application will be common to them.
> **- Adults (18-60 years):** This group generally knows about recycling but may not know how or where to recycle.
> **- Adults (over 60 years old):** This audience don't usually recycle in a proper way due to the ignorance they may feel about separating the materials or the distance they have to travel to recycle each of the materials.

Behaviors
The world produces approximately 300 million tons of plastic waste every year and currently only 14% is collected for recycling. Of all the plastic waste that has been produced in our history, only 9% has been recycled according to the UN (https://www.unep.org/news-and-stories/story/plastic-recycling-underperforming-sector-ripe-remake), therefore it is necessary to raise the percentage of recycled waste by raising awareness among the population.
Last year in the Czech Republic 2.5 tons of waste were produced per capita, which is 4.5% less than the previous year (according to https://english.radio.cz/czechs-embracing-recycling-culture-says-environmental-analyst-8254787), therefore, an application with the characteristics of *R-ECO* could be particularly interesting, because given the statistics, it is very likely that many people don't recycle plastic waste.
Why encourage recycling through a mobile application?
According to the website https://espanol.radio.cz/el-uso-de-las-redes-sociales-entre-los-checos-ve-una-ligera-caida-8128532, the application usage rate of Czechs is 77% and the average time spent per day on mobile apps is 143 minutes.
Why an application in the Czech Republic?
The Czech Republic is one of the most committed countries in terms of recycling (according to https://espanol.radio.cz/los-checos-entre-los-mas-responsables-en-cuanto-al-reciclaje-de-plastico-8185774)
Separate waste collection is on the rise in the Czech Republic. More than 70% of the population regularly separates their garbage, which means that every Czech sent 45 kilos of paper, plastic and glass for recycling last year.

It is very likely that many people don't recycle because of laziness, because they don't find the motivation or because they don't know how to do it, therefore, the *R-ECO* application not only seeks to create a cleaner world but also to inform society.

User Research (Clement)

Situation
Czech Republic is currently trying to diminish the part of the waste that is destroyed and to increase recycling. The tech industry is booming in Czech Republic and in Prague. A lot of recycling companies exist in Czech Republic (*Eco Sun*, *Lars cz*, and others...).
Recycling figures doubled in less than 20 years, but still, recycling is not done everywhere. In some households people still don't do it or do it the wrong way.
https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/recycling-of-municipal-waste
Most of the waste is still incinerated. It comes partly from the fact that some products are impossible to recycle (some types of plastics).

Recycling is mostly complicated because there are a lot of subtypes of products that can be recycled differently, the most concrete example being plastic.
https://www.generalkinematics.com/blog/different-types-plastics-recycled/
https://abetterfootprint.com/what-types-of-plastic-cannot-be-recycled/
The categories are difficult to understand, because they are based on the types of molecules used to create the plastic. And depending on your sources, the number of types can vary a little. Even worse, some plastic types cannot even be recycled, making it even more confusing.

Why is the situation so complicated? Why is there not a simple classification on a national scale? It's because recycling depends on the recycling system of the community and is more thought of as a local scale than a national one.
https://bettermeetsreality.com/what-plastics-can-cannot-be-recycled-how-to-find-out/
https://www.forbes.com/sites/blakemorgan/2021/04/21/why-is-it-so-hard-to-recycle/

Goals/motivations
For recycling companies, an increase of recycling would mean providing them with more raw material. For people, the main motivation is moral. They don't get paid for it nor do they earn anything for doing it (at least it's what they think).
https://www.linkedin.com/pulse/5-reasons-why-people-dont-recycle-should-sean-cullen
The reductions in some partner companies could also act as an incentive, having immediate feedback on your actions.
For people living in Czech Republic the situation is the same, as everywhere, the recycling process depends on where you live. Prague is a place where recycling is easy, with 16 available recycling centers, and 4 different types of bins for daily waste. But the situation is not the same everywhere in Czech Republic.

Knowledge
People don't know everything about recycling. For most of them, they don't know what happens to their waste once thrown into the bin.
https://www.huffingtonpost.co.uk/entry/why-is-recycling-so-complicated-guide-to-getting-started_uk_5e4a7e79c5b64ba297525f81

1.2. User research done from the Google Form

We have done a google form with questions about the perception that people have related to recycling. We shared it with different people to gain an overall idea of the actual situation.

1. How much importance do you think recycling has?
32 responses
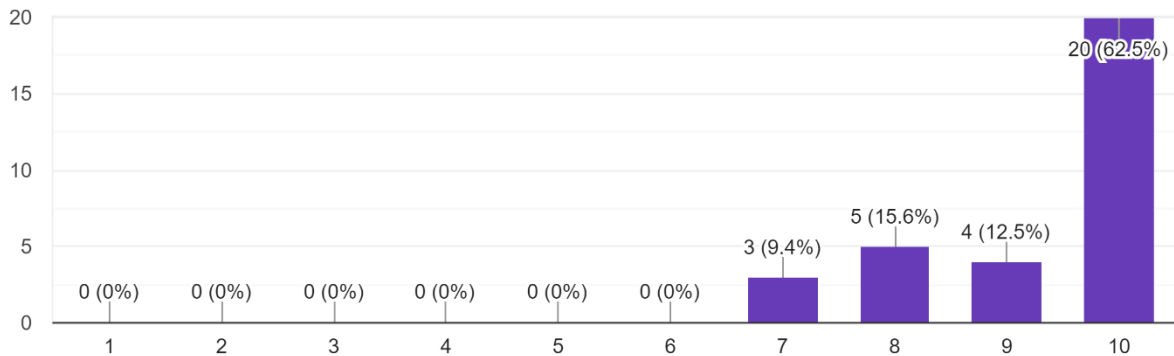
20 out of 32 people think that recycling is a vital part of our society, giving a score of 10 on a scale where 1 is not very important and 10 is very important.
We can also see that all 32 people think that recycling is of great importance, as the minimum score in the test was 7.

2. How difficult do you find recycling?
32 responses
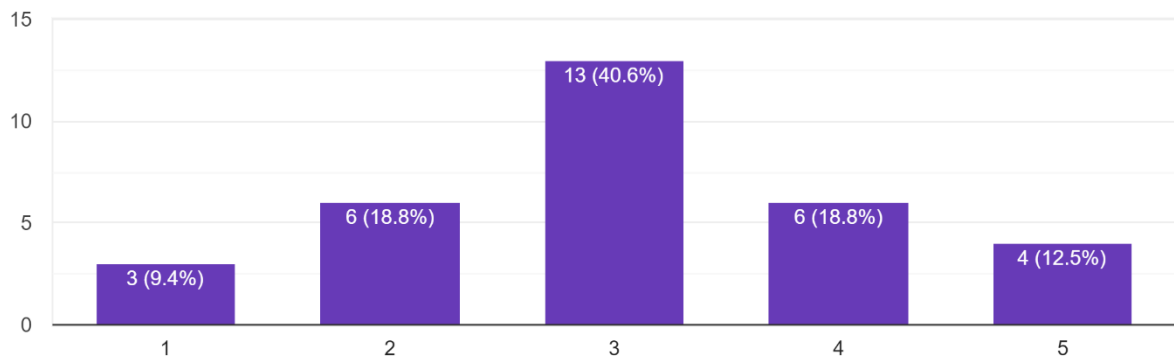
This graph gives us a lot of information because, as it can be seen, 13 out of 32 people have an average knowledge about recycling. There are people who believe that recycling is difficult, therefore an application that helps them to learn more about recycling can be very useful.
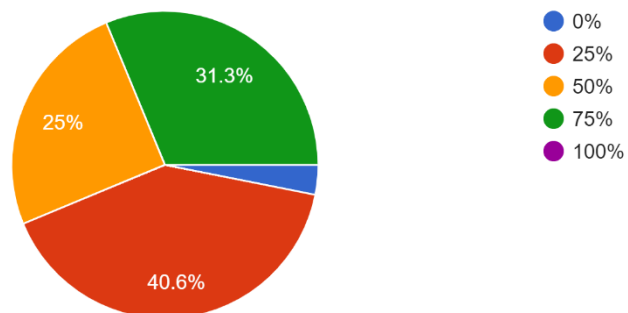
3. How often do you throw your garbage? (per month)
32 responses

- less than twice
- 2-5
- 5-7
- more than 7
- I don't know

28.1%
21.9%
43.8%
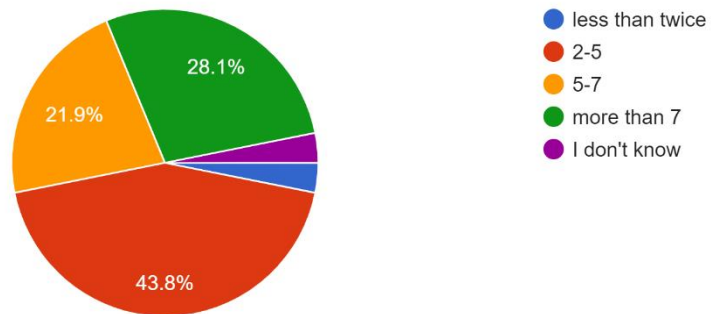
As we can see, half of the interviewed people have quite large municipal waste (green and orange), while the other have has less.

### 4.What Proportion of your waste do you recycle ?
32 responses

- 0%
- 25%
- 50%
- 75%
- 100%

31.3%
25%
40.6%

The percentage of recycled waste is never 100% due to the difficulties in recycling certain products, however we can see that 21 of the respondents recycle between 50% and 75%, while the rest recycle 25% and even 0%.

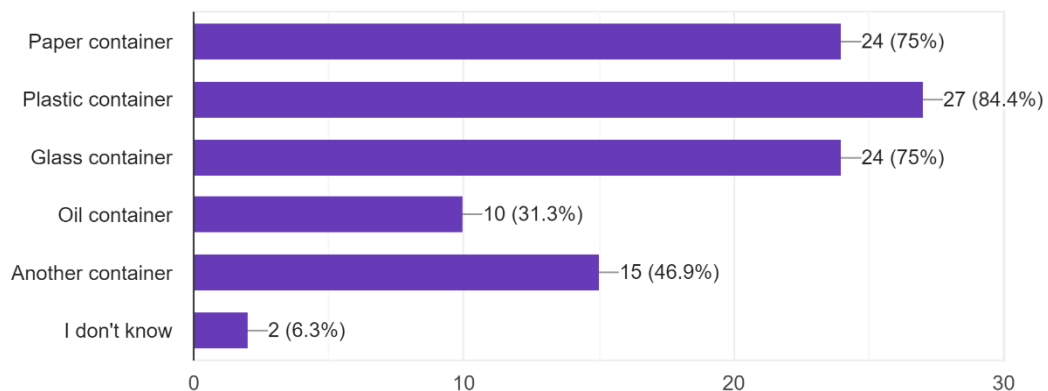## 5.Is recycling usual in your neighbourhood?
32 responses

- ● Yes
- ● No
- ● Not sure

31.3%
15.6%
53.1%
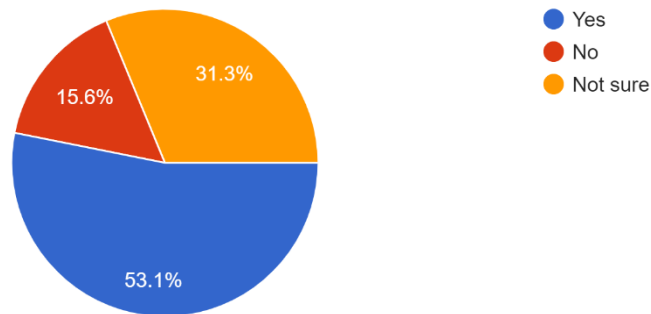
Half of the people surveyed live in a neighborhood that recycles, and unfortunately there are 5 responses which reveal that those neighborhoods don't tend to recycle.

6. How many different waste container do you have at home (including compost, electronic waste bin...)
32 responses

Category	Value
Paper container	24 (75%)
Plastic container	27 (84.4%)
Glass container	24 (75%)
Oil container	10 (31.3%)
Another container	15 (46.9%)
I don't know	2 (6.3%)

Most people separate materials before recycling, however, we can realize that there are certain products that cost a little more to recycle and therefore are not given a container, such as oil, for example.

7. How many types of waste can you think of ?

32 responses

Legend:
- 1-3
- 4-6
- More than 6
- I don't know

Percentages shown: 28.1%, 12.5%, 59.4%
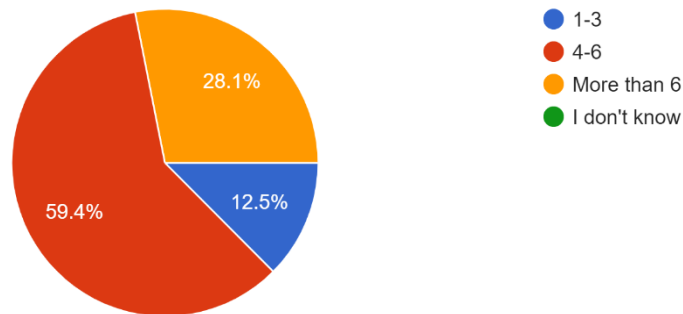
In this graph you can see the knowledge of the interviewees about the materials that can be recycled, normally they will have thought about recycling paper, cardboard, plastic and glass. However there are many more materials that can be recycled.

8. Do you avoid buying plastic or do you find package alternatives?

32 responses

No

Sometimes

Yes

Not really

I try to find alternative packages when I can

No I don't.

I avoid buying it, although I still try to go with long-lasting alternatives so that I don't waste paper or other materials either.

yes, both; if i don't find alternatives, in 2 out of 3 cases, i just give up on that product;

Neither do I avoid buying plastic nor try to find alternatives.

Neither do I avoid buying plastic nor try to find alternatives.

to be honest, i don't care as much as i should

No.

Both

I try to buying no plastic stuff.

Yes, I do. I bring my own bags when going shopping and try to place the sticker directly on the vegs so I don't use several bags for individual pieces of food. I buy cosmetic products with 100% recycled plastic packaging.

As it can be seen, most of the responses show that the interviewees are still buying plastic, although there are also users who are looking for alternatives to plastic.

9. Do you often throw something and then ask yourself if you threw it in the right bin ?

32 responses
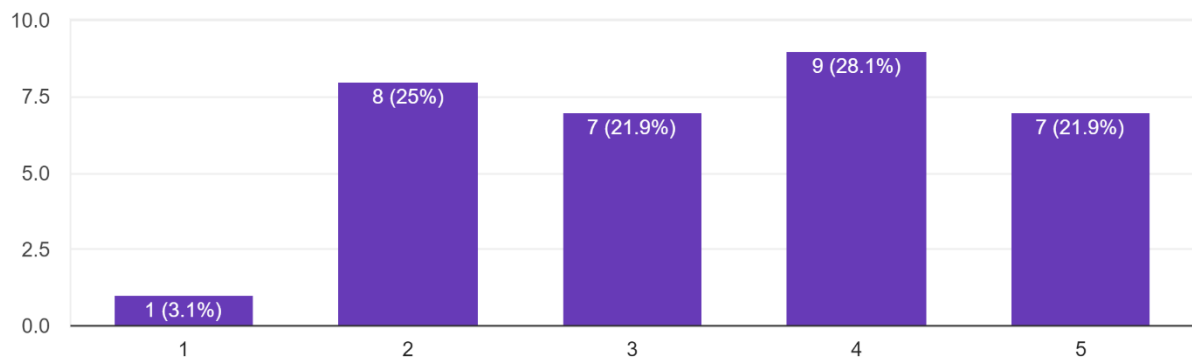
15 of the 32 (numbers 2 and 3) respondents are not quite sure if they have recycled correctly by throwing their waste in the right bin and 16 people (numbers 4 and 5) are not sure about it in most of the cases.

10. Did you ever struggle in identifying the materials you want to recycle?

32 responses

- Yes, all the time
- Sometimes
- Never

65.6%

9.4%

25%
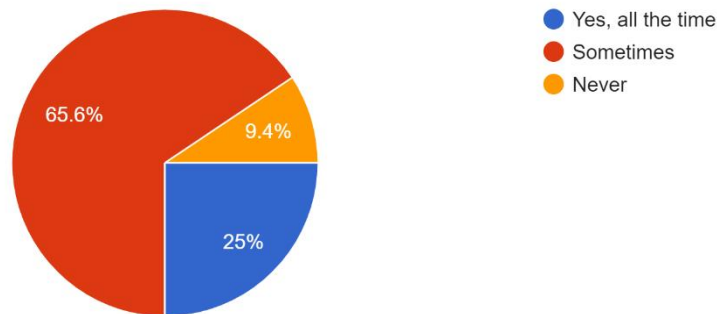
There are 21 respondents who sometimes have problems in identifying the materials they want to recycle and 8 who are struggling all the time, which reveals a great lack of knowledge about recycling. This can be solved by informing them about the correct way to identify the materials they want to recycle.

## 11. Do you know some recycling companies present in your neighbourhood ? If yes, which ones?

19 responses

No

No.

UNLU

I can't remeber names

rosal

No but I know there are tho

I can't remeber names;

Supercom, Brantner

Ecoembes

Noves

Recycling is a very well-known topic all over the world, and that is why, little by little, new companies are emerging to support it, as is the case of *UNLU, Rosal, Supercom, Bratner* or *Ecoembes*. On the other hand, 14 out of 19 people have answered that they don't know recycling companies in their neighborhood.

12. For some type of waste, do you have to walk/drive to throw them away, and if yes, how long does it take ?

24 responses
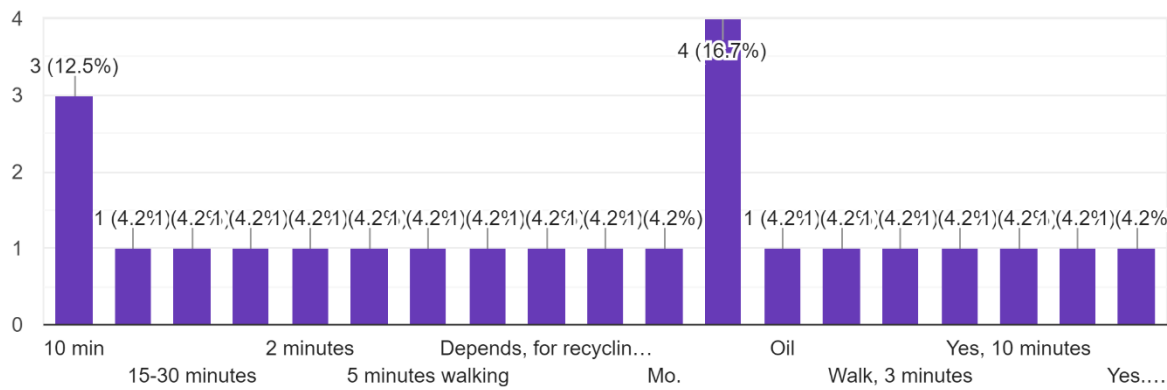
Most people don't take long to get to a recycling point, but there are some who take 10, 20 or even 30 minutes to go and throw their rubbish away for more pretentious kinds of recyclables.

13. Would you like to know more about recycling ? Do you want to recycle more efficiently ?

32 responses

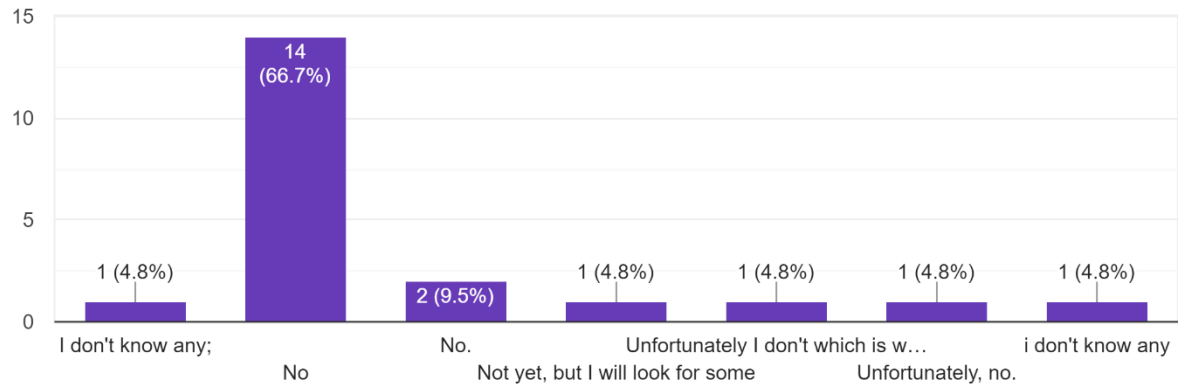Yes, I'm very interested in recycling
Not too much
No, I hate recycling

87.5%
12.5%
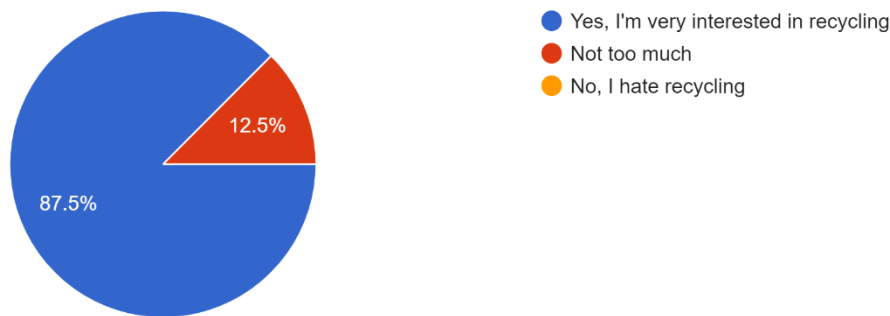
28 of the respondents admit that they are very interested in recycling and want to learn how to recycle better. Also, there is not a single person who doesn't want to recycle.

14. Do you know some apps that help you to recycle?, if yes, Which ones?
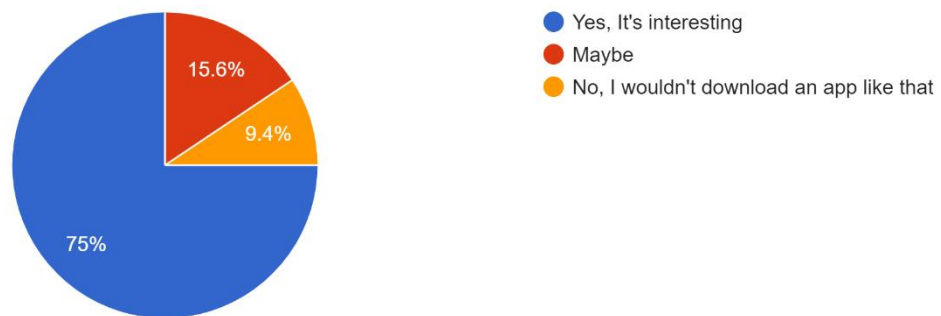
21 responses

As it can be seen in the graph, our future users are not aware of any recycling-related applications and are eager to try them out.

15. Would you like an app that tells you which is the nearest zone to recycle?
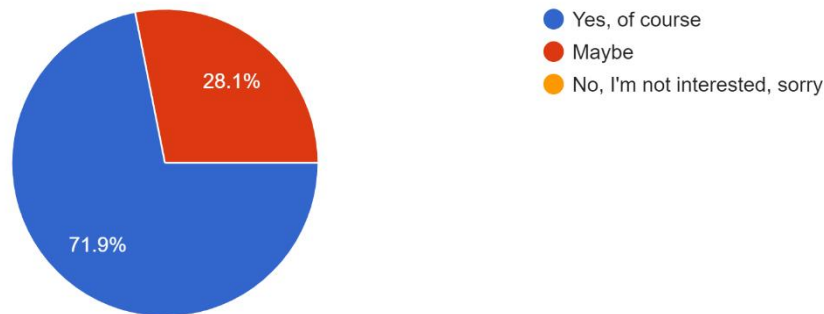
32 responses

23 respondents are, or could be, interested in using an application such as *R-ECO* to find out where the nearest recycling area is.

16. Would you try some app with which you can earn amazing discounts?

32 responses

- Yes, of course
- Maybe
- No, I'm not interested, sorry

28.1%

71.9%

Finally, all 32 of the respondents could try our application, of which 23 are very interested in trying it.

1.3.   Summary of the knowledge gained

Our user research was made not only for identifying the difficulties of the users, but also to gain knowledge about the support of their country, to make a connection between their needs and what is provided. Therefore, we noticed that the government of Czech Republic wants drastic changes in order to reduce the municipal waste and cares strongly about this topic and a vast majority (70%) are willing to separate their waste. For people living in Prague, things can be assembled much easier due to the well-made networks for recycling, however there might be a lack of resources in other parts of the country that we will have to deal with. Also, we found out that there are many recycling companies around Czech Republic and various associations which encourage people to reduce waste or recycle. So, our application will run in a society where people care indeed for the environment and can be effortlessly influenced in this way.

Having set the status quo, we can now exemplify the main struggles of our users and what they will require from our project. We consider our users the ones who would want to make a minimum effort to recycle or ones who have a vague idea about it, driven more by curiosity and need a stronger incentive for being part of the change.

One of the most common problems, not only in Czech Republic, but also around the world is that the recycling processes vary around the country and are inconsistent, therefore some users will find it too hard to find the right places or to go somewhere further away from their homes. Another identified issue would be that sometimes it is time consuming to prepare, clean and gather the recyclables or even having to travel to a specific center. We also discover that confusion can represent a major discouragement because some people don't know what materials or what categories from those materials can be recycled and would have to take one more search to understand the symbols from the label. Nevertheless, inconvenience and confusion are not the only factors that influence the user, but also lack of knowledge; being such a meticulous process, the recyclables can be unintentionally contaminated. Laziness could be another essential aspect but, as we mentioned, one's who don't wish to make changes in their routine are not going to download the application in the first place. Consequently, we refer to

those who will want to drop their waste in a specific place, but don't have the time to search for it. In this way, we can provide them the exact and summarized information in one place.

1.4. User requirements

- Reduction point that can be used in different partner company's shops.
- An account system where your points can be stored.
- A map that tells you where you can throw your garbage. The map needs to be able to use your current location and then direct you to the nearest garbage container.
- A list of all the different types of waste and how to process each of these types to properly recycle them.
- Short, precise information on how to prepare the recyclables, which are the right bins, where can you find them.
- Information about the points that you can gather through our application.

2. Key problems to be solved

2.1. Identified key problems

- *Inconvenience, lack of resources*:

  Depending on where you live, the recycling process can change and the types of waste that can be recycled are not the same. Therefore, we have to find the best solutions and alternatives for the present situation because we have no influence on the infrastructure. The application relies also on what is already provided by the government and the companies, it will be difficult to please all our users if they don't have the resources nearby, especially if they live in remote areas or areas difficult to access (mountains for example). There is no HCI connected to this problem, it does not depend on how we conceive the application. Some specific waste cannot be collected by the municipality; one needs to go directly to the recycling center. In this case, people living in smaller towns or villages will use their car. So, the application needs to be able to give indications to someone driving or to be connected to other technologies such as Google Maps.

- *Time consuming: preparing and cleaning the recyclables & going to a recycling center. How will we make this process faster?*

  If we want to ensure that the preparation and result is made in a proper way, we can't skip steps, hence we still have to keep all the necessary information related to recycling. One of our scopes is to help the user separate his waste correctly so we need to discover how to deliver this message in a way in which one will not be discouraged or overwhelmed.
  HCI: How do we categorize the information?

- *Recycling is confusing for users: they have to know what is recyclable and what isn't.*

  We will need to search for the right information and find:
  -what is recyclable in Czech Republic and attach the correspondent labels to those materials;
  -from each material what can be recycled and emphasize the most common mistakes that people make and that could ruin the overall system (e.g.: recycling napkins).
  HCI: How do we provide the right information in a short and undemanding manner?

- *Unmotivated:*
  People don't have the motivation all the time to search for companies or categorize everything in place as they should have. Here we can apply our points and discounts to motivate them to gather as many as they can, hence try to go to recycling companies when needed.
  HCI: How do we make the connection with our application and the recycling companies around Czech Republic?

- *The elders aren't familiarized with applications.*

  One group of users we would like to attract is the elderly, many of whom have never had contact with mobile applications and getting them to master the application and feel comfortable with it can be a difficult task.
  HCI: To improve the experience for this type of users, we will design interfaces that are very simple and that go straight to the information the user is looking for. In addition, we consider that typography shouldn't be too small because many of the elderly don't have good vision and the colors must inspire tranquility to the user.

- *Color blind people*

  We are aware that there are groups of users who are sensitive to colors, for example, the design of the application for a person without color blindness is not the same as for a person with color blindness.
  HCI: To try to accommodate these visually impaired groups we had thought of adding a button that would make the design of the application a comfortable environment for such visually impaired users.

2.2. Emerging HCI

- Depending on where you live the process for recycling the waste can change, and the types of bin/garbage container may change too. In some towns, there is nothing to differentiate the different types of recyclable waste, and everything goes in one "recycle bin", whereas in other cities, you can separate glass, paper and plastic. So, the application will need to take into account where you live, and where you currently are.

- The app is also targeting elderly, and so to have them use the app, we need them to understand easily what to do. They are less accustomed to using such applications and they lack some common reflexes younger people instinctively have. The part that could be the most complicated for them to use is the interactive map, especially when using the map to guide themselves. Having the possibility to have the way displayed as a series of directions (for example: turn right, turn left, then after 300 meters turn right on a specific street) would make it easier to understand.

- The map will be used by people driving, so to be used by drivers, the map needs to have some voice system. What's more, the research radius for people driving should be bigger as they are travelling faster. It is also important that the user can specify if he is walking/driving/cycling, as the path he will be able to take will change according to that.

- There are certain countries where only certain materials are recycled and therefore, to categorize or prioritize the information related to which materials should be listed first or which should not be listed would be a complex task of researching the recycling practices of Czech Republic.

- For many users there is some information in the application that may be irrelevant, so apart from carrying out research on which parts of the application are of most interest to users, we must carry out some testing phases with the prototype of the application to find out if the user really feels comfortable with the interaction with the application, or on the contrary, some adjustments need to be made.

- For ensuring our discounts, we have to see first what is already offered by the recycling companies. Therefore, we will have the following types of companies:
-The ones which already offer money for some recycled materials. These ones may want to collaborate with us and integrate their prizes into our application.
-The ones that don't offer anything for the brought products but will be willing to help us make sure that the user recycled the product and actually went to that company.
-The ones who will not be interested at all. We could still put this on the map (because it wouldn't be fair to ignore places which could help the user), but specify that they won't bring points.
For this we will need a well-made system in which we can communicate with each company and receive the needed data. Our system should connect with theirs in some ways or just to collect data for how many products they brought and what kind of materials. We suppose that they already gather this kind of information, so the only necessary thing will be just the connection with their services.