Co-funded by the
Erasmus+ Programme
of the European Union

CLAY Closing the Loop Along with the Youth

IO2 /A1

Development of Circular Behavior Index

FINAL REPORT

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Summary

This output is a continuous stage of the IO1. In this context, the literature of circular economy will be screened first. Then, circular activities and circular and linear consumption attitudes of the partner countries, which are common among the youth, will be examined. In this context, by screening circular economy literatures an index will be developed in order to measure both attitudes and behaviors of young people on circular economy. With the help of this index, it will be understood how the youth are prone to participate in circular activities and moreover, attitudes and behaviors of closing the loop approach will be tried to be understood. The index prepared under this output had been applied and data had been collected.

Task 2 - Assessment of the Items by Experts

The item pool had been asked to experts from each partner country to create a more comprehensive and complete index. The experts evaluated the items.

During the index development process, 4 partners from 4 countries presented the prepared item pool for experts' opinions. An evaluation form consisting of two parts was prepared for the ***content validity*** test. Each partner consulted 5 experts and ***the content validity*** of the item pool prepared according to the opinions of these experts was tested. The total number of experts is 22. 15 experts from Turkey, Austria, and the Czech Republic (5 per each) and 7 experts from Italy have reported opinions.

In the first part of the evaluation form, experts were asked to evaluate the items one by one with options such as "The item is not necessary", "The item is necessary but major revision required", "The item is necessary but minor revision required" and "The item is necessary". In the second part of the evaluation form, the suggestions of the experts regarding the items were asked in an open-ended manner.

The response of the experts according to the four options given was used to calculate the Content Validity Ratio (1). Those in acceptable value ranges have been reviewed according to the suggestions (2) of the experts. Thus, the item pool was reviewed in two stages and the index was made ready for the pilot study.

Task 3. Development of Proposed Index

The answers from the experts was discussed. Items which are not necessarily due to the experts were removed from the index. The remaining items and other indicators are harmonized and combined together. The index is ready for the pilot study. At last a pilot study will be held with 40 young in each country (Round1).

The Content Validity of the Circular Economy Index Item Pool

Table 1. CVR (Content Validity Ratio)

IT1	0,636364	IT16	0,909091	IT31	0,727273	IT46	0,636364
IT2	0,727273	IT17	1	IT32	0,636364	IT47	0,727273
IT3	0,909091	IT18	0,909091	IT33	0,454545	IT48	0,818182
IT4	0,636364	IT19	1	IT34	0,909091		
IT5	0,727273	IT20	1	IT35	0,909091		
IT6	1	IT21	1	IT36	0,818182		
IT7	0,909091	IT22	1	IT37	0,909091		
IT8	0,909091	IT23	1	IT38	0,545455		
IT9	0,909091	IT24	1	IT39	0,818182		
IT10	0,909091	IT25	0,909091	IT40	0,909091		
IT11	0,909091	IT26	0,909091	IT41	0,909091		

IT12	0,818182	IT27	0,909091	IT42	0,909091		
IT13	0,909091	IT28	1	IT43	0,909091		
IT14	0,818182	IT29	0,636364	IT44	1		
IT15	1	IT30	1	IT45	0,909091		

The calculation of the CVR: According to Lawshe (1975), *any item, performance on which is perceived to be "essential" by more than half of the experts, has some degree of content validity. The more panelists (beyond 50%) who perceive the item as "essential," the greater the extent or degree of its content validity. With these assumptions in mind, the following formula for the content validity ratio (CVR) was devised:*

$$CVR = \frac{E - \left(\frac{N}{2}\right)}{\frac{N}{2}}$$

E: Number of experts indicating "essential"

N: Total number of experts (22)

Note: The options "," The item is necessary but major revision required "," The item is necessary but minor revision required "and" The item is necessary "are accepted as essential while calculating.

Table 2. CVR reference value ranges

Number of experts	*Min Value*
5	.99
6	.99
7	.99
8	.75
9	.78
10	.62
11	.59
12	.56
13	.54
14	.51
15	.49
20	.42
25	.37

According to Table 1. and Table 2., all items are within the acceptable value range. According to Lawshe (1975), the acceptable value range for 22 expert opinions ranges from .37 to .42. CVR value of the items in the Circular Economy Index Item Pool ranges from .45 to 1. As a result, all 48 items suggested after this evaluation were started to be reviewed in line with expert suggestions.

Expert Suggestions for items:

ITEM 1 - I have a concern for circular economy.

Suggestions:

“Question is redundant to the ones below; Will young people understand what is meant? a bit too general? CE only a sub-aspect of activities for sustainability (e.g. environmental protection, social issues, climate change); 1“strongly disagree” to 5 “totally agree”

Proposed corrections: it is not necessary because it assumes the respondent's knowledge about circular economy (something not taken for granted). The degree of knowledge about circular economy is included in question 1.2.

● According to me, the items marked as unnecessary are excessively technical, and dedicated to "insiders". A young person does not grasp the technical language used by the circular economist or the designer

● not relevant

● - I think that the order of the questions is fundamental: the level of knowledge of the topic has to be gradually inserted from the beginning. How can I care about something that I have probably never heard of?”

The item after review according to suggestions;

I have interest about circular economy*.

* A circular economy is an economic system of closed loops in which raw materials, components and products lose their value as little as possible, renewable energy sources are used and systems thinking is at the core.

ITEM 2 - I have an appropriate information about circular economy.

Suggestions:

“Maybe rephrase: "I know what circular economy is about."

The item after review according to suggestions;

I know what circular economy is about.

ITEM 3 - I am interested in circular economy practices in the world.

Suggestions:

“We suggest reviewing the questions indicated as follows: I am interested in environmental issues at a global level

● Minor revisions to do: When you talk about practices, what do you mean? Applications (App)? Please, explain better

● to be changed in: "I am interested in environmental issues at a global level"

● I am interested in environmental issues at a global level.

Young people may not be able to evaluate whether the information is appropriate, but this question could help to evaluate the extent of itself - to which extent young people have appropriate information based on the further answers.

Suggestion: I have enough information (depends on what you really need)

Suggestion: I know what a "circular economy" means.

can be merged with next question "…in my country and in the world."

“Unclear question; did you mean a fear of not implementing it?

Unclear question; did you mean concern or interest?

Suggestion: I am interested in circular economy practices”

The item after review according to suggestions;

I am interested in circular economy practices at a global level.

ITEM 4 - I am interested in circular economy practices in my country.

Suggestions:

“We suggest reviewing the questions indicated as follows: I am interested in environmental issues in my country.

● to be changed in "I am interested in environmental issues in my country"

● I am interested in environmental issues in my country”

The item after review according to suggestions;

I am interested in circular economy practices at my country level.

ITEM 5 - I am aware of the global environmental problems like climate change, global warming etc.

Suggestions:

“This question is not necessary in case you accept the suggestions proposed for questions 1.3. and 1.4

● to be changed in "It becomes necessary if the previous changes are not accepted"

● This becomes a necessary question if the previous changes are not accepted.

Should be moved to the begin of the questionnaire (for generic towards specific aspects)”

The item after review according to suggestions;

I am aware of the global environmental problems like climate change, global warming etc.

ITEM 6 - I know the meaning of the circular economy labels.

Suggestions:

● “I know the meaning of environmental certifications of a product

● When you talk about labels, what do you mean? Which lables?

● to be changed in "I know the meaning of environmental certifications of a product"

● I know the meaning of environmental certifications of a product.

●"circular economy labels" - what does this mean?; Which labels?; Which labels are referred to?; name examples? Are there so many CE labels (besides C2C) add eco-labels?; Yes or no”

The item after review according to suggestions;

I know the meaning of the circular economy labels (ecolabel).

ITEM 7 - The design of products and services is an important feature of circular economy.

Suggestions:

● “Product and service design is an important feature for circular economy.

● to be changed in "Products and services design is an important feature for circular economy"

● When it comes to services design, the concept could remain harsh and distant if not properly explained.”

The item after review according to suggestions;

The products and services design is an important feature for circular economy.

ITEM 8 - Digital technology plays an important role for circular economy.

Suggestions:

No suggestion.

The item after review according to suggestions;

Digital technology plays an important role for circular economy.

ITEM 9 - Sustaining already produced products is key for circular economy.

Suggestions:

● “Supporting the use of goods produced with recycled materials is a central aspect for circular economy.

● What does it mean to "sustain already produced products"? What's the meaning of sustain?

● to be changed in "Supporting the use of goods produced with recycled materials is a central aspect for circular economy.”

The item after review according to suggestions;

Supporting the use of goods produced with recycled materials is a central aspect for circular economy.

ITEM 10 - Business models need to be re-thought for circular economy.

Suggestions:

● “It is necessary to rethink business models for circular economy (design-production-raw materials supply, etc.).

● to be changed in "It is necessary to rethink business models for circular economy (design-production-raw materials supply, etc.)"

● Within circular economy it is necessary to rethink business models (design-production-supply of raw materials, etc.)”

The item after review according to suggestions;

Business models* need to be re-thought for circular economy.

*Circular business models represent fundamentally different ways of producing and consuming goods and services. They have the potential to drive the transition towards a more resource efficient and circular economy and, in doing so, significantly reduce the environmental pressure resulting from economic activity.

ITEM 11 - Waste needs to be used as a resource in circular economy.

Suggestions:

No suggestion.

The item after review according to suggestions;

Waste needs to be used as a resource in circular economy.

ITEM 12 - A circular economy needs to be based on regenerative resources.

Suggestions:

No suggestion.

The item after review according to suggestions;

A circular economy needs to be based on regenerative resources.

ITEM 13 - Collaboration and cooperation are main features of a circular economy.

Suggestions:

● “Collaboration and cooperation (between PA, business world and citizens) are the main characteristics of circular economy

● to be changed in "Collaboration and cooperation (between PA, business world and citizens) are the main characteristics of circular economy"

● Collaboration and cooperation (between PA, business world and citizens) are the main characteristics of circular economy

The item after review according to suggestions;

The collaboration and cooperation are main features of a circular economy.

ITEM 14 - I know the true recycling process will reduce the waste of natural resources.

Suggestions:

● “Unclear meaning, "true recycling process"?;

●Wording? What is a "true" recycling process?; recycling;

●what is a true recycling process?”

The item after review according to suggestions;

I know the appropriate recycling process will reduce the waste of natural resources.

ITEM 15 - I know “zero waste" is the supplementary unit of the circular economy.

Suggestions:

●"Zero waste" is the target and the added value in circular economy.

● Zero waste as a supplementary unit. Supplementary to what? A young person may not understand.

● to be changed in "Within circular economy "zero waste" is the target and added value"

● Within circular economy "zero waste" is the target and the added value.

● I know the difference between zero waste and circular economy.

● Not clear: what do you mean by “supplementary unit”?

● "supplementary unit" or "key element”? Wording? What does that question mean? supplementary; isn't zero waste more a goal of CE than a supplementary unit?”

The item after review according to suggestions;

Within circular economy "zero waste" is the target and the added value.

ITEM 16 - I know the importance of selective waste collection at the household level for the circular economy.

Suggestions:

● “Separate collection at home is mentioned (now it is established) together with collaboration, cooperation, fashion, Internet (it is difficult to grasp the link among many different things and their connection with everyday life and our choices for a circular economy). I believe they must be placed in an increasing order of complexity.

●"selective waste collection" should be rephrased, e.g. "know, that separating waste… is important"; Be more specific in the question”

The item after review according to suggestions;

I know the importance of separating waste at the household level for the circular economy.

ITEM 17 - I am aware of the benefits of reusing on circular economy practices.

Suggestions:

● “I am aware that reuse is among the good practices (applications) of circular economy.

● to be changed in "I am aware that reuse is part of the good practices (applications) of the circular economy"

● I am aware that reuse is among the good practices (applications) of circular economy

● "reusing and other circular economy practices”? why only reusing and not rethinking or refusing as they would come first in the hierarchy of R-strategies?”

The item after review according to suggestions;

I am aware that reuse is among the good practices (applications) of circular economy.

ITEM 18 - I am aware of successful implementations of circular economy in my country.

Suggestions:

● I am aware that my country is working for the development of circular economy

● to be changed in "I am aware that my country is working for the development of circular economy"

● I am aware that my country is working for the development of circular economy

● The section circular aspects linked to successful implementations is a bit confusing."

The item after review according to suggestions;

I am aware that my country is working for the development of circular economy.

ITEM 19 - I am aware of circular aspects of electronics production (e-waste).

Suggestions:

● I am aware that electronic waste can be recovered to generate new materials

● Circular aspects: the definition is a bit vague...

● to be changed in "I am aware that electronic waste can be recovered to generate new materials."

● I am aware that electronic waste can be recovered to generate new materials.

● what are circular aspects of xy? Examples may help for all of the "I am aware of" questions and also for all of them the scale could be adapted because now they would be rated on "importance" as I understood the explanations of the 3 levels."

The item after review according to suggestions;

I am aware that electronic waste (e-waste) can be recovered to generate new materials.

ITEM 20 - I am aware of circular aspects of plastics and packaging.

Suggestions:

● I am aware that plastics and packaging can be recovered and reused

● to be changed in "I am aware that plastics and packaging can be recovered and reused"

● I am aware that plastics and packaging can be recovered and reused."

The item after review according to suggestions;

I am aware that plastics and packaging can be recovered and reused (to generate new materials).

ITEM 21 - I am aware of circular aspects of food and agriculture.

Suggestions:

● I am aware that in the agricultural and food sector waste can be reduced and circularity increased.

● to be changed in "I am aware that in the agriculture and food sector, waste can be reduced and circularity increased"

● I am aware that in the agricultural and food sector waste can be reduced and circularity increased”

The item after review according to suggestions;

I am aware that in the agricultural and food sector waste can be reduced and circularity increased.

ITEM 22 - I am aware of circular aspects of fashion and clothes.

Suggestions:

● I am aware that in the fashion and clothing sector waste can be reduced and circularity increased

● to be changed in "I am aware that in the fashion and clothing sector waste can be reduced and circularity increased"

● I am aware that in the fashion and clothing sector waste can be reduced and circularity increased.”

The item after review according to suggestions;

I am aware that in the fashion and clothing sector waste can be reduced and circularity increased.

ITEM 23 - I am aware of circular aspects of the internet.

Suggestions:

● I am aware of the extent that Internet can contribute to the development and management of circular economy

● to be changed in "I am aware of the extent of Internet to contribute to the development and management of circular economy"

● I am aware of the extent of Internet in contributing to the development and management of circular economy.”

The item after review according to suggestions;

I am aware of the extent of Internet in contributing to the development and management of circular economy.

ITEM 24 - I am aware of the benefits of effective natural resource usage for circular economy.

Suggestions:

● “unclear meaning, "benefits of effective natural resource usage"; what does effective natural resource usage mean or cover?

● I am aware of the benefits that derive from the efficient use of natural resources for circular economy.

● to be changed in "I am aware of the benefits for circular economy deriving from the efficient use of natural resources"

● I am aware of the benefits deriving from the efficient use of natural resources for circular economy.”

The item after review according to suggestions;

I am aware of the benefits deriving from the efficient use of natural resources for circular economy.

ITEM 25 - When purchasing a product, I decide based on its durability.

Suggestions:

● “what kind of product? Could be different for cars, smartphones, groceries, fashion etc.

● This question is redundant.

● What products exactly? Add examples.”

The item after review according to suggestions;

When purchasing computer equipment (PCs, laptops, etc.), I decide based on its durability.

When purchasing clothes, I decide based on its durability.

ITEM 26 - When purchasing a product, I decide based on its repairability.

Suggestions:

● “I suggest you review the questions indicated as follows: When I buy a product, I decide according to its reparability

● to be changed in "When I buy a product, I decide according to its reparability"

● When I buy a product, I decide according to its

● what kind of product? Could be different for cars, smartphones, groceries, fashion etc.

● What products exactly?”

The item after review according to suggestions;

When purchasing computer equipment (PCs, laptops, etc.), I decide based on its reparability.

When purchasing computer smartphone, I decide based on its reparability.

ITEM 27 - I live properly with sustainability issues.

Suggestions:

● I live properly to sustainability issues: what does it mean? Rephrase this sentence in a more understandable way.

● I suggest you review the questions indicated as follows: I try to follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating).
● to be changed in "I try to follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating)"

● I try to live a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating)

● I think that living sustainability issues appropriately seems excessive or still very vague. I would ask if I live thinking about it, at least...

● The respondent has to know the sustainability principles to answer this…

● Not clear what you mean.

● I don't understand the question, did you mean: I live in accordance with sustainability requirements….?

● rephrase, very unclear meaning; what means "to live properly with sustainability issues"? Be more clear; Generic for sustainability, not only circular economy. Maybe ask at the beginning! Wording? I don't really understand what is meant with sustainability issues

The item after review according to suggestions;

I follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating).

ITEM 28 - I make my decisions in my life according to circular economy practices (such as recycling, repair, second hand trade, refurbished goods etc.) .

Suggestions:

● I suggest you review the questions indicated as follows: I orient my consumption habits according to the principles of circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.).

● to be changed in "I orient my consumption habits according to the principles of circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.)"

● I orient my consumption habits according to the principles of circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.)”

The item after review according to suggestions;

I orient my consumption habits according to the principles of circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.)

ITEM 29 - I am unwilled to demonstrate more circular economy purchasing choices.

Suggestions:

● I am not willing to make purchasing decisions based more on the circular economy: what does this mean?

● I would separate the more concrete questions from the broader ones (separate everyday behaviors from "I am willing" which is more an idea)

● Not clear: willing or unwilling?

● The respondent has to know the sustainability principles to answer this…

● rephrase, "more circular purchasing choices"; Be more clear; Direction of question contrary to the one used in this questionnaire; "I am unwilled" - never heard that, maybe ask native speaker

The item after review according to suggestions;

I do not apply circular economy practices while purchasing.

ITEM 30 - I am willing to lease products instead of buying them.

Suggestions:

● I suggest you review the questions indicated as follows: I agree with the principles of circular economy and therefore I am willing to rent products instead of buying them.

● to be changed in "I agree with the principles of the circular economy and therefore I am willing to rent products instead of buying them"

● I agree with the principles of circular economy and therefore I am willing to rent products instead of buying them.

● rephrase "lease or rent"”

The item after review according to suggestions;

If I have chance, I rent the products instead of buying them.

ITEM 31 - I contribute to the reduction of the global environmental problems like climate change, global warming etc.

Suggestions:

● the same thing applies to contribute to climate change issues. I would ask if they know them or if they Generic for sustainability, not only circular economy. Maybe ask at the beginning!

● Could be more precise… I guess most people would like to contribute to a reduction of climate change? know concrete and daily ways to give their contribution"

The item after review according to suggestions;

I contribute to the reduction of the global environmental problems like climate change, global warming etc.

ITEM 32 - I follow the topics on waste management and recycling on social media in order to apply them in my daily life.

Suggestions:

● I follow the issues on waste management and recycling on social media to apply them in my everyday life. Unfold the sentence in two parts: "I follow the themes" and "I apply them in my everyday life".

● I suggest you review the questions indicated as follows: I am interested in, and follow on social media, the issues about waste management and recycling to apply them in my daily life.

● to be changed in "I am interested in, and follow on social media, waste management and recycling issues to apply them in my daily life"

● I am interested in, and follow on social media, issues of waste management and recycling to apply them in my daily life.

● It seems that recycling issues are the key to circular economy? Maybe "narrative" of this questions could be changed a bit?"

The item after review according to suggestions;

I am interested in, and follow on social media, the issues about waste management and recycling to apply them in my daily life.

ITEM 33 - The longer lasting products take my attention during my shopping.

Suggestions:

● What is mean with "take my attention"?

● When shopping, I prefer second longer-lasting products…."

The item after review according to suggestions;

I buy long-lasting products.

ITEM 34 - The second-hand products take my attention during my shopping.

Suggestions:

● I suggest you review the questions indicated as follows: When I buy a product, I also consider second-hand ones.

● to be changed in "When I buy a product, I also consider second-hand ones"

● When I buy a product, I also consider second-hand ones

● When shopping, I prefer second hand products….”

● rephrase "I check out second hand markets (e.g. eBay), when shopping for "new" products"

The item after review according to suggestions;

I buy second hand products.

ITEM 35 - I repair my goods when they have broken rather than buying the new ones.

Suggestions:

● “maybe add: repair them or let them repair?”

The item after review according to suggestions;

I repair (I have it repaired) my goods when they have broken rather than buying the new ones.

ITEM 36 - I buy the newest technological and electronic goods though the one I own is still in a good condition.

Suggestions:

● “rephrase "I buy new goods (e.g. electronic devices) even if the one I already own still is in good condition."; Direction of question contrary to the one used in this questionnaire; although start though”

The item after review according to suggestions;

I buy the newest goods (e.g. electronic devices) even if the one I already own still is in good condition.

ITEM 37 - I am keen to repair and recycle.

Suggestions:

- I am keen on repairing

The item after review according to suggestions;

I am keen on repairing and recycling.

ITEM 38 - I recycle everything that can be recycled.

Suggestions:

- I suggest to review the questions indicated as follows: I gather information and recycle all the material that can be reused
- to be changed in "I check out and recycle all material that can be reused"
- I find and recycle all the material that can be reused."

The item after review according to suggestions;

I check out and recycle all material that can be recycled.

ITEM 39 - I prefer public transport vehicle rather than private car.

Suggestions:

- I prefer using public transport than a private car. Reformulate: Consider zero-emission private transport (e.g. bicycles).
- rephrase "I use public transport." - private cars are not that relevant for the target group; not related to circular economy; boundary to "sustainable" or eco/climate friendly behavior not fully clear. A few aspects are mixed in, majority focused on CE; public transport / or vehicle … ; strange transition from recycling to mobility behavior?
- Use: public transportation"

The item after review according to suggestions;

I use public transportation rather than private car.

ITEM 40 - I bike for the short driving (0-10 km) distances.

Suggestions:

- "not related to circular economy; boundary to "sustainable" or eco/climate friendly behavior not fully clear. A few aspects are mixed in, majority focused on CE
- I ride a bicycle for short distances (0-10km)"

The item after review according to suggestions;

I bike for the short driving (0-10 km) distances.

ITEM 41 - I bike for the long driving (10-20 km) distances.

Suggestions:

No suggestions.

The item after review according to suggestions;

I bike for the long driving (10-20 km) distances.

ITEM 42 - Used batteries and light bulbs are important for the environment therefore I bring them to the collection centers.

Suggestions:

● “rephrase "batteries" and "dangerous" instead of important; Check spelling; how can they be "important for the environment”

The item after review according to suggestions;

I collect used batteries and light bulbs for the recycling.

ITEM 43 - I travel via sharing cars.

Suggestions:

● I suggest to review the questions indicated as follows: I travel with car sharing / bike sharing (bikes, scooters).

● to be changed in "I travel with car sharing / bike sharing (bikes, scooters)

● I travel with car sharing / bike sharing (bikes, scooters)

● again, might not be relevant for the target group; Double check sentence with English native; structure: below other mobility questions

● I prefer sharing cars when travelling.”

The item after review according to suggestions;

I travel with car sharing / bike sharing (bikes, scooters).

ITEM 44 - I bring used jeans and clothes to cloth collection boxes.

Suggestions:

● "Why are jeans and clothes separated; why are you asking for collection boxes and not for other options of r-strategies? E.g clothes swapping?"

The item after review according to suggestions;

I bring used jeans and clothes to cloth collection boxes.

I bring used jeans and clothes for swapping.

ITEM 45 - I do search for lowering energy use methods.

Suggestions:

● I suggest to review the questions indicated as follows: I find out about possible methods to reduce energy consumption (water, electricity, gas).

● to be changed in "I find out about possible methods to reduce my energy consumption (water, electricity, gas)"

● I find out about possible methods to reduce my energy consumption (water, electricity, gas)

● rephrase (also the two questions below): "I am trying to lower my energy consumption."; since these items are on participation, it should be more active statements - not "searching for" but actually doing something; not related to circular economy; Is searching for it enough or maybe ask for "applying"; Double check sentence with English native"

The item after review according to suggestions;

I find out about possible methods to reduce my energy consumption (water, electricity, gas).

ITEM 46 - I do search for lowering material use methods.

Suggestions:

● Not really related to circular economy; Is searching for it enough or maybe ask for "applying";

● Double check sentence with English native"

The item after review according to suggestions;

I find out about possible methods to reduce my material using.

ITEM 47 - I do search for lowering the level of waste methods.

Suggestions:

● I find out about possible ways to reduce the level of waste. What do you mean by "level" of waste?

● Is searching for it enough or maybe ask for "applying";

● Double check sentence with English native"

The item after review according to suggestions;

I find out about possible methods to reduce my waste.

ITEM 48 - I rent or borrow IT equipment (PC, laptop, etc.), Mobile phone equipment, Hobby related products (bicycle, sky, etc.), and Clothes rather than buying.

Suggestions:

● I rent and borrow computer equipment (PCs, laptops, etc.), mobile phone accessories, hobby-related products (bicycles, skis, etc.), and clothes instead of buying them. Too many elements. You can make a single category (used objects) or you can split the question into as many questions as the objects categories.

● I think it is focused and concrete, but maybe I would put it in the first place. First of all, I ask how I behave in my everyday life (3), then I try to connect it to the specific issues (2), then I understand that this is part of the circular economy (1)... However, this is my personal approach, but I obviously could be wrong.

● Should be separated into the respective aspects, too comprehensive"

The items after review according to suggestions;

I rent and borrow computer equipment (PCs, laptops, etc.) instead of buying them

I rent and borrow mobile phone accessories instead of buying them

I rent and borrow hobby equipment (bicycles, skis, etc.) instead of buying them

I rent and borrow clothes instead of buying them.

Circular Economy Index" Item Pool After Experts Assessments

Expert Opinions: Critical review on proposed items which measure youth circular behavior. Classifying items for their necessity on measurement.

Circular Economy Index" Item Pool After Experts Assessments

A. Perception Scale

IT1. I have an interest in circular economy*. * A circular economy is an economic system of closed loops in which raw materials, components, and products lose their value as little as possible, renewable energy sources are used and systems thinking is at the core.
IT2. I know what circular economy is about.
IT3. I am interested in circular economy practices at a global level.
IT4. I am interested in circular economy practices at my country level.
IT5. I am aware of global environmental problems like climate change, global warming, etc.
IT6. I know the meaning of the circular economy labels (ecolabel).
IT7. The products and services design is an important feature of a circular economy.
IT8. Digital technology plays an important role in the circular economy.
IT9. Supporting the use of goods produced with recycled materials is a central aspect of the circular economy.
IT10. Business models* need to be re-thought for the circular economy. *Circular business models represent fundamentally different ways of producing and consuming goods and services. They have the potential to drive the transition towards a more resource-efficient and circular economy and, in doing so, significantly reduce the environmental pressure resulting from economic activity.
IT11. Waste needs to be used as a resource in a circular economy.
IT12. A circular economy needs to be based on regenerative resources.
IT13. Collaboration and cooperation are the main features of a circular economy.
IT14. I know the appropriate recycling process will reduce the waste of natural resources.
IT15. Within a circular economy, "zero waste" is the target and the added value.
IT16. I know the importance of separating waste at the household level for the circular economy.
IT17. I am aware that reuse is among the good practices (applications) of the circular economy.
IT18. I am aware that my country is working for the development of a circular economy.
IT19. I am aware that electronic waste (e-waste) can be recovered to generate new materials.
IT20. I am aware that plastics and packaging can be recovered and reused (to generate new materials).
IT21. I am aware that in the agricultural and food sector waste can be reduced and circularity increased.
IT22. I am aware that in the fashion and clothing sector waste can be reduced and circularity increased.
IT23. I am aware of the extent to which the Internet is contributing to the development and management of the circular economy.
IT24. I am aware of the benefits deriving from the efficient use of natural resources for a circular economy.

B. Behavior Scale

IT25. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its durability.
IT26. When purchasing clothes, I decide based on its durability.
IT27. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its reparability.
IT28. When purchasing a computer smartphone, I decide based on its reparability.
IT29. I follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating).
IT30. I orient my consumption habits according to the principles of the circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.).
IT31. I do not apply circular economy practices while purchasing. (reverse item)
II32. If I have a chance, I rent the products instead of buying them.
IT33. I contribute to the reduction of global environmental problems like climate change, global warming, etc.
IT34. I am interested in and follow on social media, the issues about waste management and recycling to apply them in my daily life.
IT35. I buy long-lasting products.
IT36. I buy second-hand products.
IT37. I repair (I have it repaired) my goods when they have broken rather than buying the new ones.
IT38. I buy the newest goods (e.g. electronic devices) even if the one I already own still is in good condition.
IT39. I am keen on repairing and recycling.
IT40. I check out and recycle all material that can be recycled.
IT41. I use public transportation rather than a private car.
IT42. I bike for the short driving (0-10 km) distances.
IT43. I bike for the long driving (10-20 km) distances.
IT44. I collect used batteries and light bulbs for recycling.
IT45. I travel by car-sharing / bike sharing (bikes, scooters).
IT46. I bring used jeans and clothes to cloth collection boxes.
IT47. I bring used jeans and clothes for swapping.
IT48. I find out about possible methods to reduce my energy consumption (water, electricity, gas).
IT49. I find out about possible methods to reduce my material using.
IT50. I find out about possible methods to reduce my material using.
IT51. I rent and borrow computer equipment (PCs, laptops, etc.) instead of buying them
IT52. I rent and borrow mobile phone accessories instead of buying them
IT53. I rent and borrow hobby equipment (bicycles, skis, etc.) instead of buying them
IT54. I rent and borrow clothes instead of buying them.

Task 4. Measuring the Validity and Reliability of Index

The purpose of this output is to develop a valid and reliable index that measures the circular economy perception and behaviors of young people.

Method

Sample

The study group of the research consists of youth living in partner countries and volunteering in the research. The data were collected in 2021. The construct validity of the index was tested with Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

The collected data was divided into two by random method and EFA with the data from the first sample group, and CFA with the data from the second sample group. In the study, it was planned to reach at least five times more the sample size of the sample size for both EFA and CFA.

In this framework, usable data was collected from 780 youth for EFA and DFA.

Development of the Data Collection Tool

In the development of CLAY Index, the literature has been scanned in detail and the outputs of IO2 have been used and items have been written accordingly. At the end of this study, an 54-item question pool was created. The scale with five likert-type response options is answered in (1) totally disagree, (5) totally agree.

The items in the question pool were presented to the opinion of 22 experts who are competent in the field for scope validity and rearranged in line with the suggestions received. Later, index was presented to the opinion of 187 youth in terms of features such as understandability and easy response. Taking into consideration these opinions, the index, which has been revised as 54 items, is ready for the data collection phase.

Data Analysis

In determining the validity of CLAY Index, firstly exploratory factor analysis (EFA) was applied, and then confirmatory factor analysis (CFA) was applied to determine whether the structure in question was valid.

In determining the normality of the distribution, skewness and kurtosis coefficients were examined. It was seen that these values are between +1 and -1. In determining the extreme values, Z and Mahalanobis calculated the distances. According to Z values greater than + 3 and less than -3 and .01 significance level, Mahalanobis values above .01 were determined as extreme values and removed from the data set.

Findings

In this section, the findings related to the CLAY Index validity and reliability study are included. During the development of the Index, exploratory and confirmatory factor analysis and then reliability analyzes were applied over the data collected from the participants.

Findings Related to Exploratory Factor Analysis (EFA) – Perception

Kaiser Meyer Olkin (KMO) value and Bartlett Sphericity Test examined the data to determine whether the data were suitable for factor analysis. KMO value is .91 and Bartlett Sphericity Test [x2 = 3202.65; p = .00 and df =276] was found significant.

These values show that the data are suitable for factoring. Exploratory Factor Analysis (EFA) was applied to ensure the structural validity of the measuring tool. Basic components analysis was applied while performing EFA. The scree plot based on the eigenvalues of the factors and the contribution of each factor to the total variance were examined and the scale was decided to be three-factor and the data were analyzed through the three-factor structure.

The criterion was based on the fact that factor loadings are greater than .40 and the difference between the factor loads of items that give high load to more than one factor is at least .10.

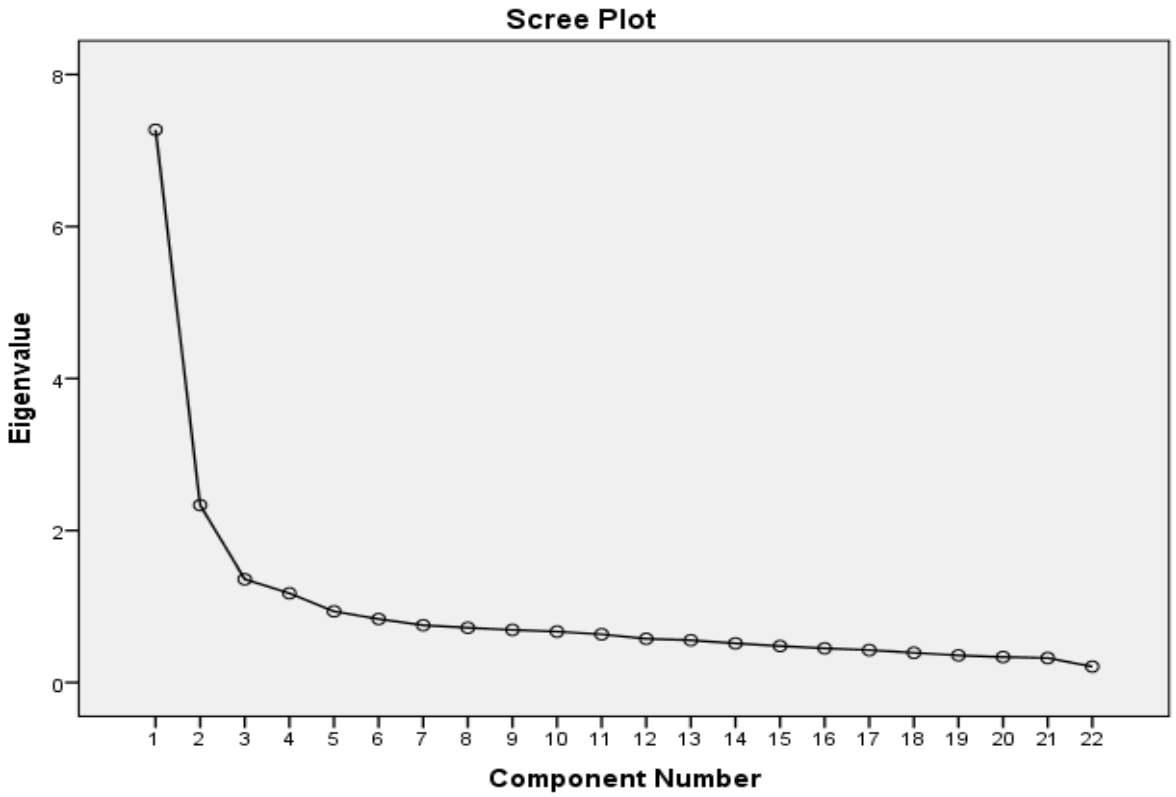
Table 3. Exploratory Factor Analysis Results of Perception

Items	F1	F2	F3
IT1	0,702		
IT2	0,632		
IT3	0,807		
IT4	0,769		
IT6	0,545		
IT18	0,545		
IT7		0,508	
IT8		0,522	
IT10		0,532	
IT11		0,575	
IT12		0,612	
IT13		0,625	
IT14			0,691
IT15			0,525
IT16			0,671
IT17			0,639
IT19			0,537
IT20			0,731
IT21			0,62
IT22			0,669
IT23			0,532
IT24			0,534
Explained Variances	**%15.5**	**%13.9**	**%20.4 (Total= %49.8)**

According to the Table 3, the perception of the scale was decided to be three-factor and the data were analyzed through the three-factor structure. The Factor 1 is related with the interest of the

Circular Economy, the Factor 2 is related with the knowledge of Circular Economy and the Factor 3 is related with the knowledge of Reuse/Reproduce/Regenerate.

Figure 1. Scree Plot of Perception



Findings Related to Exploratory Factor Analysis (EFA) – Behavior

Kaiser Meyer Olkin (KMO) value and Bartlett Sphericity Test examined the data to determine whether the data were suitable for factor analysis. KMO value is .88 and Bartlett Sphericity Test [x2 = 4422.46; p = .00 and df =435] was found significant.

These values show that the data are suitable for factoring. Exploratory Factor Analysis (EFA) was applied to ensure the structural validity of the measuring tool. Basic components analysis was applied while performing EFA. The scree plot based on the eigenvalues of the factors and the contribution of each factor to the total variance were examined and the scale was decided to be five-factor and the data were analyzed through the five-factor structure.

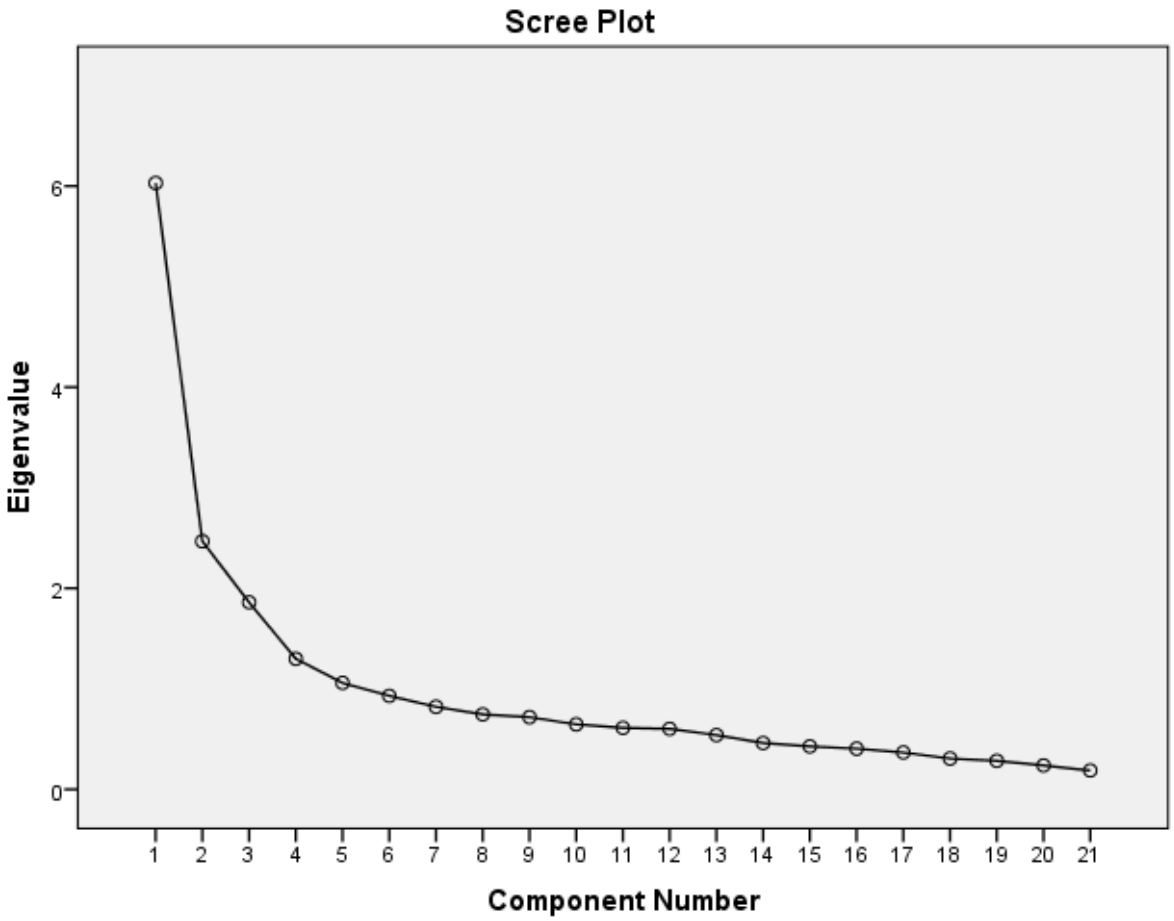
The criterion was based on the fact that factor loadings are greater than .40 and the difference between the factor loads of items that give high load to more than one factor is at least .10.

Table 4 - Exploratory Factor Analysis Results of Behavior

Items	F1	F2	F3	F4	F5
IT 25	0,655				
IT 26	0,685				
IT 27	0,833				
IT28	0,832				
IT29		0,566			
IT33		0,805			
IT34		0,608			
IT36			0,421		
IT39			0,472		
IT40			0,636		
IT44			0,617		
IT46			0,773		
IT49			0,679		
IT50			0,818		
IT41				0,662	
IT42				0,775	
IT43				0,639	
IT47					0,74
IT51					0,77
IT52					0,845
IT54					0,722
Explained Variances	**%12.7**	**%9.0**	**%16.9**	**%8.6**	**%13.1 (Total= %60**

According to the Table 4, the behavior of the scale was decided to be five-factor and the data were analyzed through the five-factor structure. The Factor 1 is related with the tendency to use long lasting; the Factor 2 is related with circular lifestyle behaviors; the Factor 3 is related with circular transportation behavior; the Factor 4 is related with the behavior of Reuse/Reproduce/Regenerate and the Factor 5 is related with second hand usage.

Figure 2. Scree Plot of Behavior



Findings on the Reliability of CLAY Index

Cronbach's Alfa internal consistency coefficient was examined for the reliability of CLAY Index. Results regarding the reliability of CLAY are presented in Table 5 and Table 6. These tables shows the CLAY Reliability Results both for perception and behavior.

Table 5. CLAY Reliability Results for Perception

Dimensions	Item No	Cronbach's Alfa
The Interest of Circular Economy	IT1 IT2 IT3 IT4 IT6 IT18	.80
The Knowledge of Circular Economy	IT7 IT8 IT10 IT11 IT12 IT13	.68
The Knowledge of Reuse/Reproduce/Regenerate	IT14 IT15 IT16 IT17 IT19 IT20 IT21 IT22 IT23 IT24	.84
		Total: .88

Table 6. CLAY Reliability Results for Behavior

Dimensions	Item No	Cronbach's Alfa
Tendency to Use Long-lasting	IT25 IT26 IT27 IT28	.74
Circular Lifestyle Behaviors	IT29 IT33 IT34	.65
Circular Transportation Behaviors	IT41 IT42 IT43	.64
The Behavior of Reuse/Reproduce/Regenerate	IT36 IT39 IT40 IT44 IT46 IT49 IT50	.72
Second Hand Usage	IT47 IT51 IT52 IT54	.67
		Total: .81

Findings Related to Confirmatory Factor Analysis (CFA) – Perception

When the findings obtained from the CFA were evaluated, the χ2 / sd was found 1.55.

CFA was applied to test the structure that emerged as a result of EFA. Model fit values are presented below:

Factor 1 – The Interest of Circular Economy

IT1. I have an interest in circular economy

IT2. I know what circular economy is about.

IT3. I am interested in circular economy practices at a global level.

IT4. I am interested in circular economy practices at my country level.

IT6. I know the meaning of the circular economy labels (ecolabel).

IT18. I am aware that my country is working for the development of a circular economy.

Factor 2 – The Knowledge of Circular Economy

IT7. The products and services design is an important feature of a circular economy.

IT8. Digital technology plays an important role in the circular economy.

IT10. Business models* need to be re-thought for the circular economy.

IT11. Waste needs to be used as a resource in a circular economy.

IT12. A circular economy needs to be based on regenerative resources.

IT13. Collaboration and cooperation are the main features of a circular economy.

Factor 3 – The Knowledge of Reuse/Reproduce/Regenerate

IT14. I know the appropriate recycling process will reduce the waste of natural resources.

IT15. Within a circular economy, "zero waste" is the target and the added value.

IT16. I know the importance of separating waste at the household level for the circular economy.

IT17. I am aware that reuse is among the good practices (applications) of the circular economy.

IT19. I am aware that electronic waste (e-waste) can be recovered to generate new materials.

IT20. I am aware that plastics and packaging can be recovered and reused (to generate new materials).

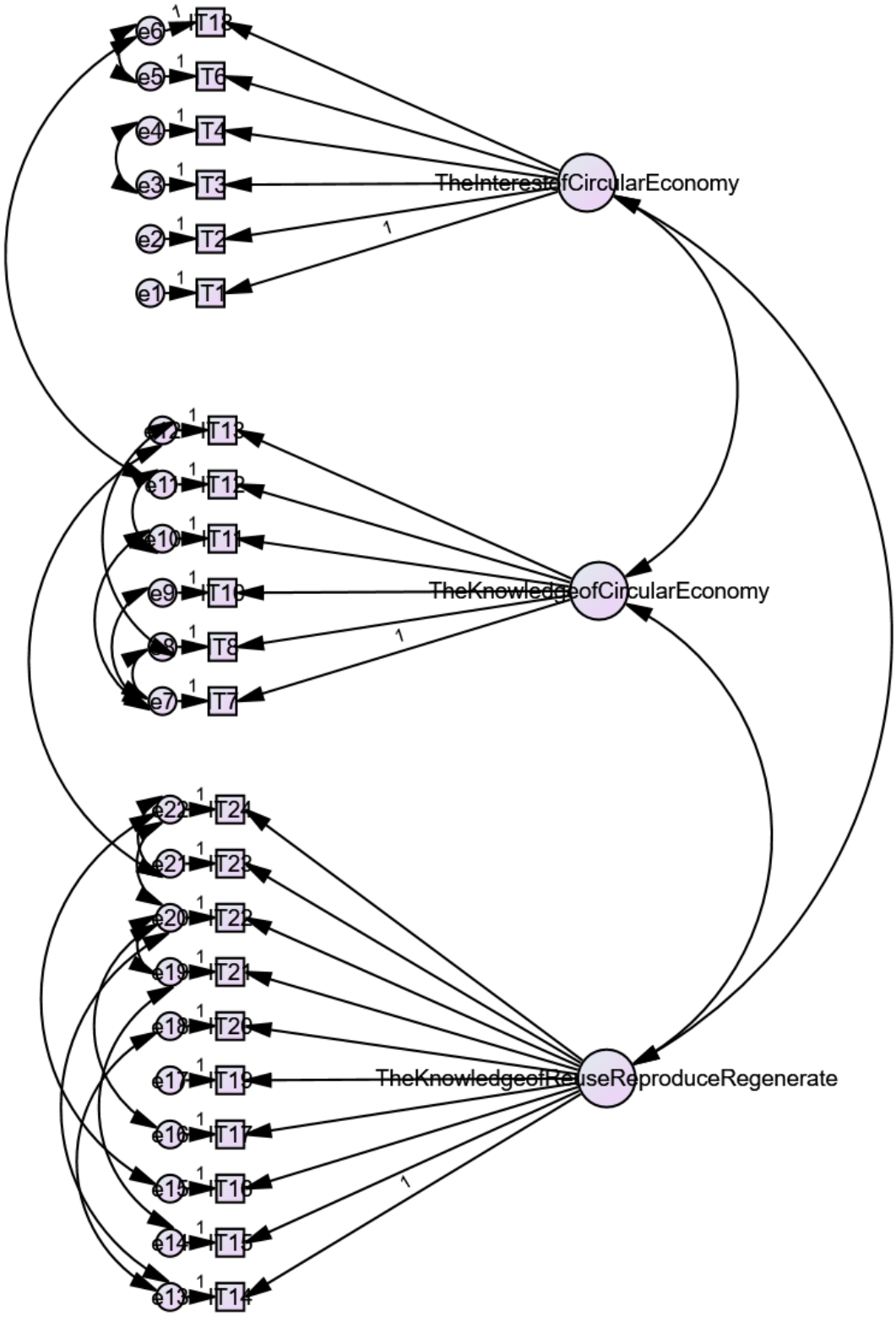
IT21. I am aware that in the agricultural and food sector waste can be reduced and circularity increased.

IT22. I am aware that in the fashion and clothing sector waste can be reduced and circularity increased.

IT23. I am aware of the extent to which the Internet is contributing to the development and management of the circular economy.

IT24. I am aware of the benefits deriving from the efficient use of natural resources for a circular economy.

Figure 3 - Confirmatory Factor Analysis (CFA) Model of Perception



Findings Related to Confirmatory Factor Analysis (CFA) – Behavior

When the findings obtained from the CFA were evaluated, the χ2 / sd was found 1.59. CFA was applied to test the structure that emerged as a result of EFA. Model fit values are presented below:

Factor1- Tendency to Use Long Lasting

IT25. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its durability.

IT26. When purchasing clothes, I decide based on its durability.

IT27. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its reparability.

IT28. When purchasing a computer smartphone, I decide based on its reparability.

Factor 2- Circular Lifestyle Behaviors

IT29. I follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating).

IT33. I contribute to the reduction of global environmental problems like climate change, global warming, etc.

IT34. I am interested in and follow on social media, the issues about waste management and recycling to apply them in my daily life.

Factor 3- Circular Transportation Behavior

IT41. I use public transportation rather than a private car.

IT42. I bike for the short driving (0-10 km) distances.

IT43. I bike for the long driving (10-20 km) distances.

Factor4- The Behavior of Reuse/Reproduce/Regenerate

IT36. I buy second-hand products.

IT39. I am keen on repairing and recycling.

IT40. I check out and recycle all material that can be recycled.

IT44. I collect used batteries and light bulbs for recycling.

IT46. I bring used jeans and clothes to cloth collection boxes.

IT49. I find out about possible methods to reduce my material using.

IT50. I find out about possible methods to reduce my material using.

Factor 5- Second Hand Usage

IT47. I bring used jeans and clothes for swapping.

IT51. I rent and borrow computer equipment (PCs, laptops, etc.) instead of buying them

IT52. I rent and borrow mobile phone accessories instead of buying them

IT54. I rent and borrow clothes instead of buying them.

Figure 4 - Confirmatory Factor Analysis (CFA) Model of Behavior

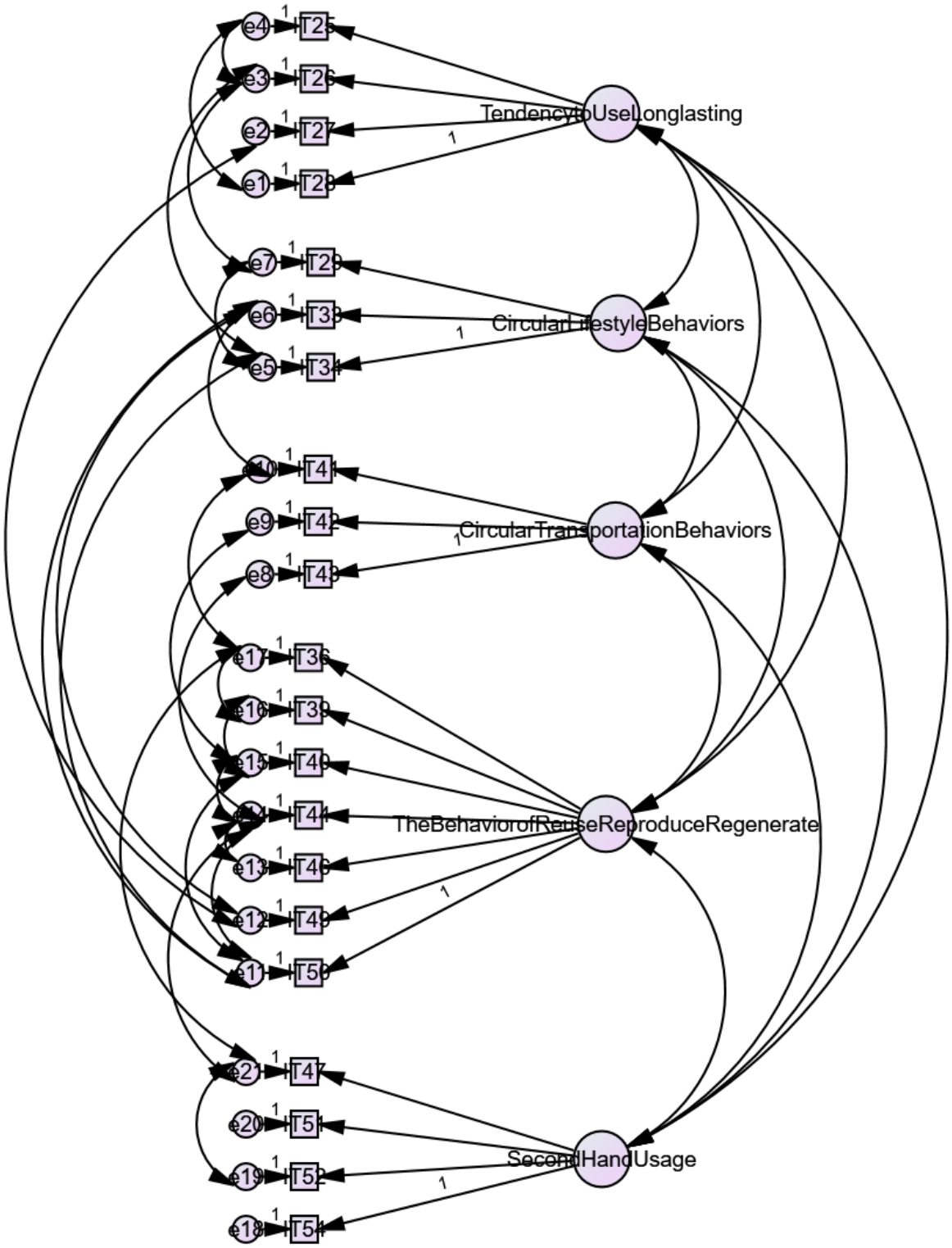


Table 7. Fit Indices Results of CLAY Index

Fit Indices Results	Good Fit	Acceptable Fit	Perception	Behavior
X2/sd	≤3	≤3-4	1.569	1.576
NFI	≥0.95	0.94-0.90	.875	.880
TLI	≥0.95	0.94-0.90	.939	.934
IFI	≥0.95	0.94-0.90	.951	.952
CFI	≥0.97	≥0.95	.950	.951
RMSEA	≤0.05	0.06-0.08	.043	.044
GFI	≥0.90	0.89-0.85	.920	.927
AGFI	≥0.90	0.89-0.85	.893	.893
RMR	≤0.05	0.06-0.08	.055	.08

Extracted Items in the Pool

The following items were extracted from the item pool, since they were not working during data analysis period.

IT5. I am aware of global environmental problems like climate change, global warming, etc.

IT9. Supporting the use of goods produced with recycled materials is a central aspect of the circular economy.

IT30. I orient my consumption habits according to the principles of the circular economy (such as recycling, repairing, second-hand trade, refurbished goods, etc.).

IT31. I do not apply circular economy practices while purchasing. (reverse item)

IT32. If I have a chance, I rent the products instead of buying them.

IT35. I buy long-lasting products.

IT37. I repair (I have it repaired) my goods when they have broken rather than buying the new ones.

IT38. I buy the newest goods (e.g. electronic devices) even if the one I already own still is in good condition.

IT45. I travel by car-sharing / bike sharing (bikes, scooters).

IT48. I find out about possible methods to reduce my energy consumption (water, electricity, gas).

IT53. I rent and borrow hobby equipment (bicycles, skis, etc.) instead of buying them.

Calculation Method of CLAY Index

CLAY Index Score Formula

$$CS = \frac{(PCS - 43) \times 172}{100}$$

CS: CLAY Index Score (between 0 to 100)

PCS: Total Score of the Scales (Perception Scale Score + Behavior Scale Score) (between 43 to 215)

CLAY Index Score Formula is used to obtain a standardized score in the 0-100 range. CLAY Index is formed by the combination of two indicators. These indicators are perception and behavior scales. CLAY Index is the standardized expression of the total score obtained from these two scales in the range of 0 - 100. There are 22 and 21 items in the scales scored between 1-5 Likert type, respectively. On the Likert scale, 1 option in the PCS corresponds to 1 point, and 5 option to 5 points. In scale scoring, a participant who marks 5 options for each item gets 215 points in total, while a participant who marks 1 option for each item gets 43 points in total. While calculating CS, the CS score of a participant who gets 43 points from the scales corresponds to 0 , and the CS score of a participant who gets 215 points from the scales corresponds to 100.

Final Version of CLAY Index

The final version of the CLAY Index consist of 43 items. These items measure two main and eight sub-dimensions of circular economy perception and behaviors of youth. Table 8 and Table 9 shows the final version of CLAY.

Table 8. Final Version of CLAY Perception Scale

IT1. I have an interest in circular economy.
IT2. I know what circular economy is about.
IT3. I am interested in circular economy practices at a global level.
IT4. I am interested in circular economy practices at my country level.
IT5. I know the meaning of the circular economy labels (ecolabel).
IT6. The products and services design is an important feature of a circular economy.
IT7. Digital technology plays an important role in the circular economy.
IT8. Business models need to be re-thought for the circular economy.
IT9. Waste needs to be used as a resource in a circular economy.
IT10. A circular economy needs to be based on regenerative resources.
IT11. Collaboration and cooperation are the main features of a circular economy.
IT12. I know the appropriate recycling process will reduce the waste of natural resources.
IT13. Within a circular economy, "zero waste" is the target and the added value.
IT14. I know the importance of separating waste at the household level for the circular economy.
IT15. I am aware that reuse is among the good practices (applications) of the circular economy.
IT16. I am aware that my country is working for the development of a circular economy.
IT17. I am aware that electronic waste (e-waste) can be recovered to generate new materials.
IT18. I am aware that plastics and packaging can be recovered and reused (to generate new materials).
IT19. I am aware that in the agricultural and food sector waste can be reduced and circularity increased.
IT20. I am aware that in the fashion and clothing sector waste can be reduced and circularity increased.
IT21. I am aware of the extent to which the Internet is contributing to the development and management of the circular economy.
IT22. I am aware of the benefits deriving from the efficient use of natural resources for a circular economy.

Table 9. Final Version of CLAY Behavior Scale

IT23. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its durability.
IT24. When purchasing clothes, I decide based on its durability.
IT25. When purchasing computer equipment (PCs, laptops, etc.), I decide based on its reparability.
IT26. When purchasing a computer smartphone, I decide based on its reparability.
IT27. I follow a lifestyle that is as sustainable as possible (e.g. I don't waste water, I don't waste food, I don't use too much heating).
IT28. I contribute to the reduction of global environmental problems like climate change, global warming, etc.
IT29. I am interested in and follow on social media, the issues about waste management and recycling to apply them in my daily life.
IT30. I buy second-hand products.
IT31. I am keen on repairing and recycling.
IT32. I check out and recycle all material that can be recycled.
IT33. I use public transportation rather than a private car.
IT34. I bike for the short driving (0-10 km) distances.
IT35. I bike for the long driving (10-20 km) distances.
IT36. I collect used batteries and light bulbs for recycling.
IT37. I bring used jeans and clothes to cloth collection boxes.
IT38. I bring used jeans and clothes for swapping.
IT39. I find out about possible methods to reduce my material using.
IT40. I find out about possible methods to reduce my material using.
IT41. I rent and borrow computer equipment (PCs, laptops, etc.) instead of buying them
IT42. I rent and borrow mobile phone accessories instead of buying them
IT34. I rent and borrow clothes instead of buying them.

The Relation Between Items and Training Modules

After finalizing two initial steps which are Round 1 and Round 2, SBTC Team has analyzed the findings in accordance with the above analysis the relation between CLAY Index scale (IO2) and training modules (IO3) is presented below:

Table 10. The Relation Between Items and Training Modules

Training Modules	Perception Dimension of CLAY Index	Behavior Dimension of CLAY Index
Module 1: Lineer vs Circular Economy	Factor 1 – The Interest of Circular Economy Factor 2 – The Knowledge of Circular Economy Factor 3 - The Knowledge of Reuse/Reproduce/Regenerate	Factor 2 – Circular Lifestyle Behaviors
Module 2: Exploring Circular Economy	Factor 1 – The Interest of Circular Economy Factor 2 – The Knowledge of Circular Economy Factor 3 - The Knowledge of Reuse/Reproduce/Regenerate	Factor 1 – Tendency to Use Long lasting Factor 2 – Circular Lifestyle Behaviors Factor 3 – Circular Transportation Behaviors Factor 4 - The Behavior of Reuse/Reproduce/Regenerate Factor 5 – Second Hand Usage
Module 3: Designing Circular Solutions	Factor 3 - The Knowledge of Reuse/Reproduce/Regenerate	Factor 1 – Tendency to Use Long lasting Factor 2 – Circular Lifestyle Behaviors Factor 3 – Circular Transportation Behaviors Factor 4 - The Behavior of Reuse/Reproduce/Regenerate Factor 5 – Second Hand Usage
Module 4: Strategies for Circular Economy	Factor 1 – The Interest of Circular Economy Factor 2 – The Knowledge of Circular Economy Factor 3 - The Knowledge of Reuse/Reproduce/Regenerate	Factor 2 – Circular Lifestyle Behaviors Factor 3 – Circular Transportation Behaviors Factor 4 - The Behavior of Reuse/Reproduce/Regenerate
Module 5: EU Policy Framework, Financing Products, Instruments and Services	This modul is related with generic legislations about CE, so there is no specific measurement in the index.	