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The impact of CIRCO

Study on the impact of CIRCO and its expected contribution to (future) CO2 reduction

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Photo: CIRCO

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Main Conclusions

Black arrows: strong connection
Grey arrows: less strong connection
Green arrows: leverage effect
Continuous arrows: effect already noticeable
Dashed arrows: effect is expected

CIRCO contributes to CO_2 reduction through its workshop participants being trained to develop circular services and products. How much (future) CO_2 reduction is actually achieved depends on the sector and the success of the participants; however, the potential impact is considerable.

The way in which CIRCO contributes to CO_2 reduction is that participants in their workshops (further) develop circular services and products that lead to lower CO_2 emissions.

There are strong connections between CIRCO's activities and outputs

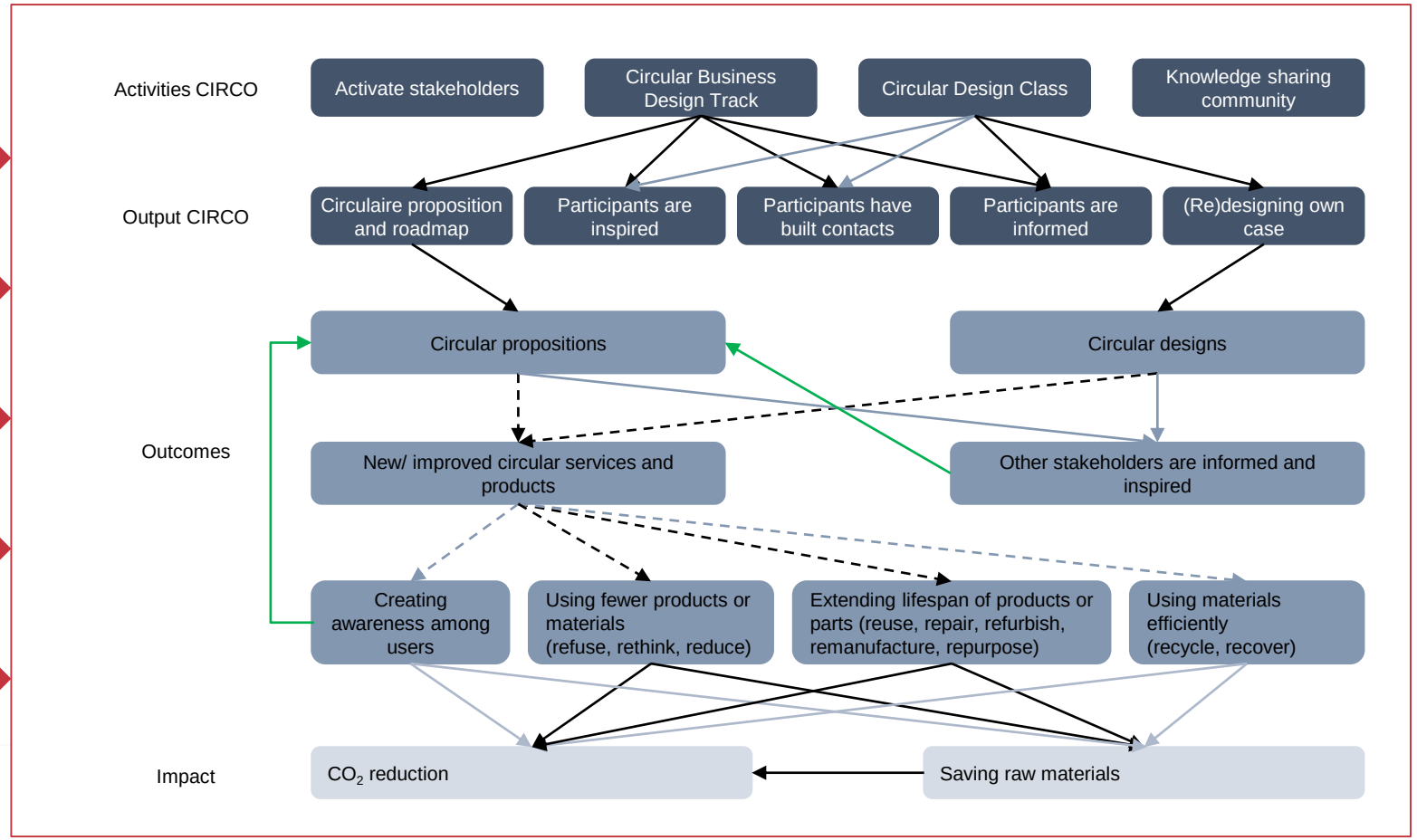
Two thirds of the respondents took further steps after participating

Many circular services and products are in development, but few are already available on the market

Most products/ services will reduce the amount of materials used or extend the lifespan of those materials

Using less products/ materials and extending their lifespan can reduce CO_2 considerably

The extent to which CIRCO contributes to CO_2 reduction is difficult to determine precisely due to the long, complex impact pathways and dependence on follow-up actions by participants.



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Reason for this study

CIRCO trains designers and companies

Over the past 5 years, CIRCO has trained designers and companies in the manufacturing and creative industry. CIRCO facilitates them in the development of circular propositions.

CIRCO activates and equips

CIRCO stands for "creating business through circular design". Their goal is to create a movement towards a circular economy by activating and equipping designers and companies to get started with circular entrepreneurship.

From 400 to 4,000 companies

The number of participants/ companies has grown strongly over the years: from 30 a year to 300 a year (target for 2019). Plans for the future include an (exponential) scale-up, so that 4,000 companies will have participated by the end of 2023. By facilitating this growth, CIRCO aims to launch a movement ("making waves").

How does CIRCO contribute to future CO_2 reduction?

CIRCO wants to get a clearer picture of its impact and has asked Technopolis to investigate. CIRCO requested Technopolis to specifically look at its impact on CO_2 reduction (this includes other greenhouse gases that can be expressed as CO_2 equivalents). Economic impact, for example, is of lesser importance to this study.

This unpacks as two sub-questions:

- In what way does CIRCO contribute to future CO_2 reduction?
- To what extent can CIRCO contribute to future CO_2 reduction?

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Methods

The impact study was conducted through desk research, a survey and interviews

Desk research
The desk study includes:
- Reports on the relationship between circular economy and CO_2 reduction.
- Documents related to the strategy and objectives of CIRCO
- Cases CIRCO had analysed by Partners for Innovation
- Questionnaires filled out by the participants after the workshops

Survey
We invited all participants of CIRCO workshops to fill out the survey and sent several reminders.
- Out of the 641 organisations that attended a CIRCO workshop (sometimes several people per organisation), 96 organisations participated in the survey, which is 15%.
- Because former workshop participants decide themselves whether or not to participate in the survey, there is a "self-selection bias". Participants who have a strong connection with circularity were probably more likely to complete the survey. To mitigate the self-selection bias, we contacted a random selection of participants by telephone to ask them to complete the survey, of which fourteen participants complied.

Interviews
Two types of interviews were conducted:
- Research started with a couple of exploratory interviews with CIRCO stakeholders, on which the survey questions were based.
- At the end of the study, seven in-depth interviews were conducted with participants of CIRCO workshops, in order to ask more in-depth questions about the answers they provided in the survey.

Impact pathways

We use impact pathways to show how different activities of CIRCO lead to different results (outputs) and how they subsequently result in outcomes and impacts. The next page contains an overview and step-by-step explanation of the impact pathways.

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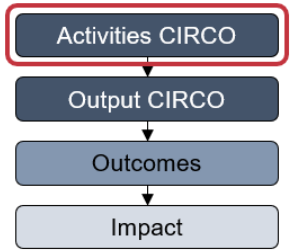

CIRCO's activities

Circular Business Design Track: more than 800 participants

The Circular Business Design Track is a three-day workshop for businesses. The goal of the track is for the participating companies to each develop a concrete circular proposition. They follow three steps: initiate, ideate, implement. The Tracks are often organised for specific sectors (e.g. plastic, maritime, construction) and/ or for a specific region.

Circular Design Class: more than 300 participants

These classes are primarily aimed at designers who attend a one-day workshop. They bring their own case to the class and redesign it in a circular way. The idea behind the class is to let the participants think at system level, analysing the entire chain.

Community and networking

In addition to the workshops, CIRCO provides a community to share inspiration and knowledge and offers a network of professionals to realise upscaling. They activate stakeholders (e.g. by organising mini-workshops) and share knowledge and inspiration (e.g. in network events). However, this study only focused on the Track and the Class.

Products that last

Participants of the Track and Class learn about circular business models and design strategies derived from the book "Products that Last" (TU Delft).

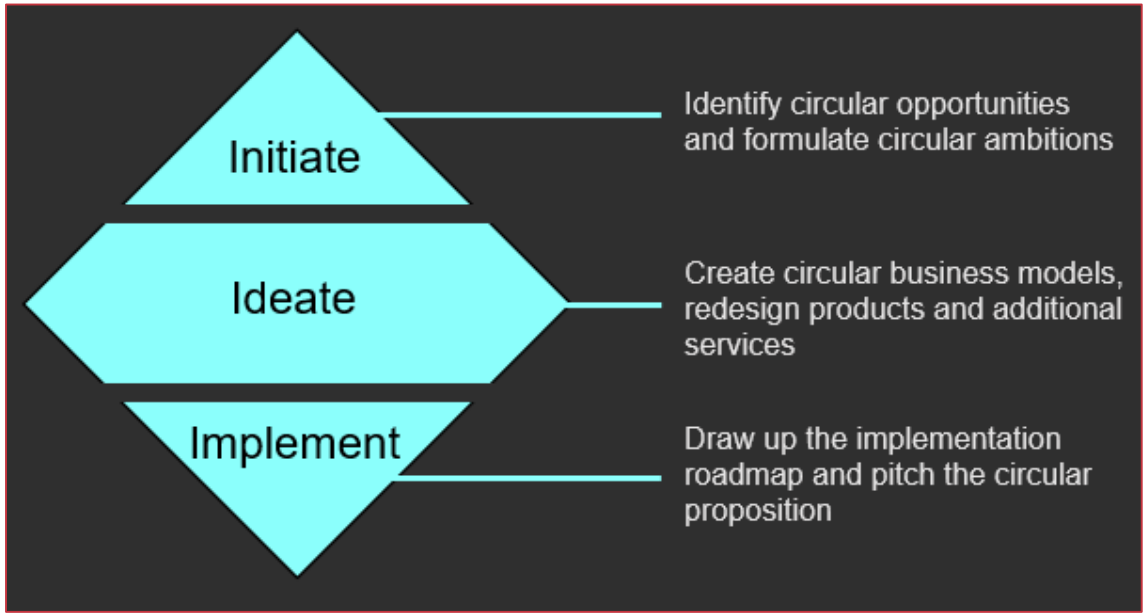

Image based on CIRCO manual 2018.

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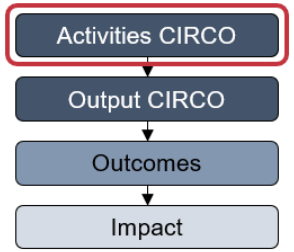
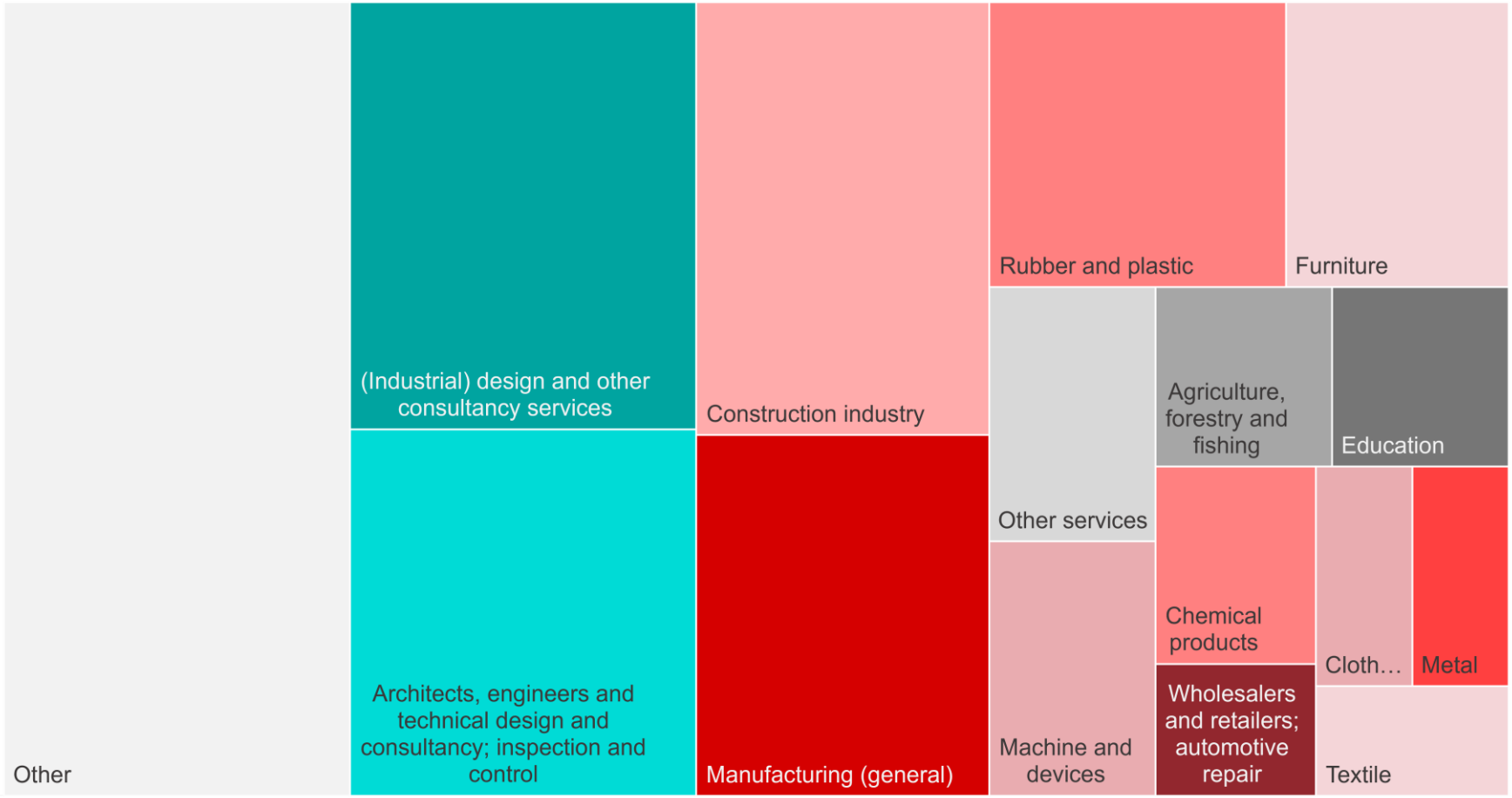


Activities – numbers of participants per sector

Many companies (in particular in the manufacturing industry), design agencies and architectural firms participate

The figure on the right shows the sectors in which survey respondents work. Manufacturing companies are shown in red shades and design agencies and architectural firms in green shades.

The category 'other' includes health care, other goods, food, recycling companies and researchers.



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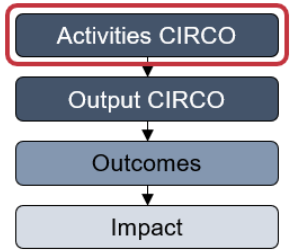

CIRCO's activities - conclusions

CIRCO organises two types of workshops: the Circular Business Design Track and the Circular Design Class. In addition, CIRCO activates stakeholders and offers a knowledge sharing community. The greatest impact is expected through the participants of the workshops.

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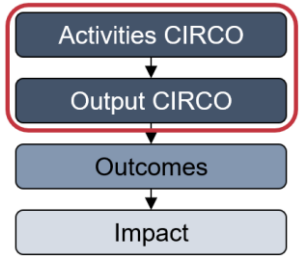


From activities to output – Circular Design Class

Average Class rating: 8.1

The workshops are rated 8.1 on average, as evidenced from the survey that CIRCO conducts among participants after the Class. The facilitators and the level of interaction were rated highest.

(Re)designing own case

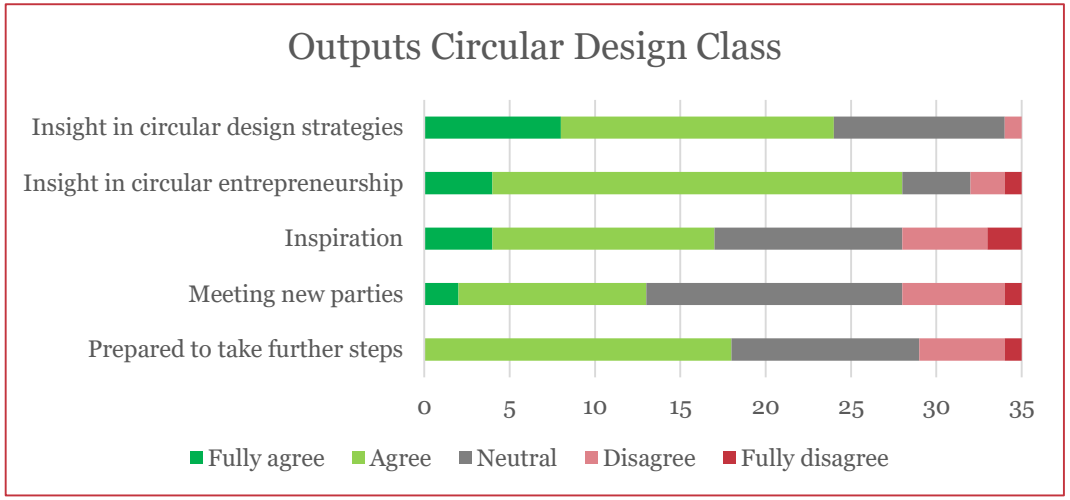
At the end of the Design Class, the participants of the workshop have (re)designed the case they introduced at the start. These designs are a tangible output of the CIRCO program.

Practical application and other practical information are appreciated the most

Participants mentioned that concrete practical application and practical information about circular business models and design strategies add the most value (based on the answers to an open question in the survey). Obtaining new contacts was also mentioned, albeit to a lesser extent.

Participants mainly gain new insights about circular design strategies and circular entrepreneurship

This is shown in the graph below. A significant part of the participants was inspired and met new collaboration partners. A number of participants feel prepared to take further steps.



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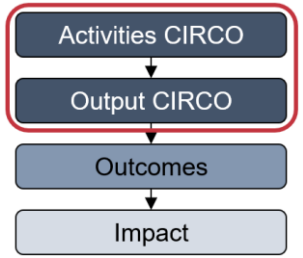


From activities to output – Circular Business Design Track

Average Track rating: 7.9

The workshops are rated 7.9 on average, as evidenced from the survey that CIRCO conducts among participants after the Track.

Circular proposition and roadmap

The most direct output of the Track is that at the end of the workshops participants have developed a circular proposition and a roadmap to implement the proposition.

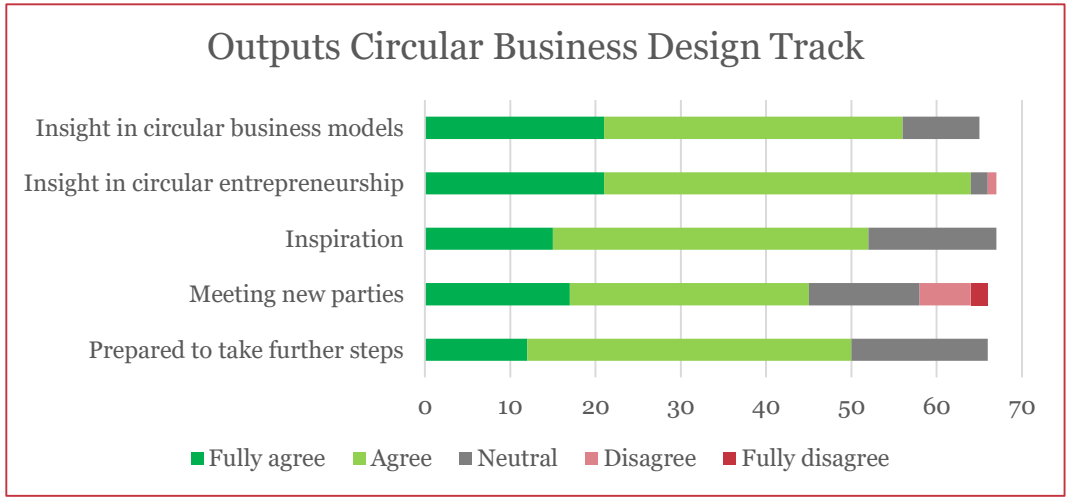
CIRCO's three major added values

The greatest added value of CIRCO mentioned by participants of the Track (as answers to open questions) can be divided into three categories:

- Awareness and familiarisation
  - This includes an increased understanding of circularity and value chain thinking
- Practical tools and applications
  - A better understanding of circular business models, possibilities and opportunities
- Networking and interaction
  - Bringing the value chain together, learning from others and building new contacts

Insight, inspiration and meeting new parties

Participants of the Track said that they have gained insight into circular business models and circular entrepreneurship. Many participants felt inspired and met interesting new parties. Finally, many participants feel prepared to take steps to build circular propositions. The percentage of participants that feels prepared after the Track is a lot higher than those who feel the same way after the Class (75% compared to 50%), which can be explained by the fact that the Track is longer and more comprehensive (3 days compared to 1 day).



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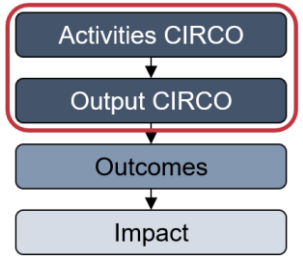

From activities to output – examples

Whereas some participants take part in the workshops to be introduced to circular design, others are already thinking about circularity in a more advanced way. They use the workshops mainly to refine their plans and the way they communicate their story to others or to obtain chain partners.

"During the course provided by CIRCO I first encountered the concept of circular economy. The theoretical part was quite revealing in itself and was explained in a very comprehensible way. The teacher was very good."

"We are now able to convince a client that demountable building solutions are beneficial in the long term. At CIRCO, we have also learned to look at the entire value chain even more."

"It is difficult to introduce circular thinking in a large company. Setting up such a business model takes a lot of time. "

"I would like to follow a CIRCO track again; not with an electrics manufacturer, but with a boiler installer. "

"Insight into more sustainable methods than material reduction and recyclability."

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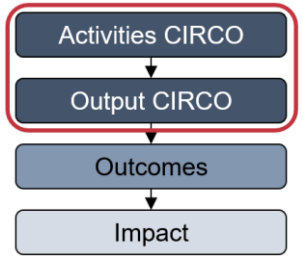
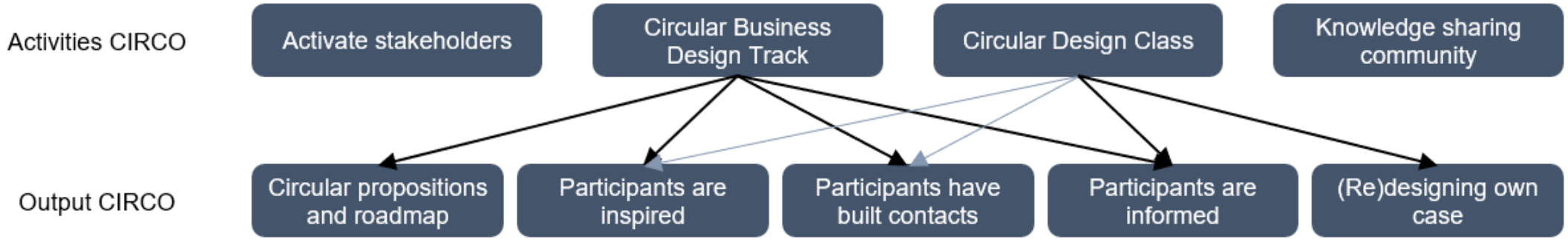


From activities to output - conclusions

Direct outputs of the Business Design Track are a circular proposition and roadmap made by participants. Participants also said to have been inspired and informed by the workshop and mentioned they built new contacts.

Participants have (re)designed their own case during the Circular Design Class.

After participating in the Class they feel well-informed and many of them have also gained inspiration or built new contacts.



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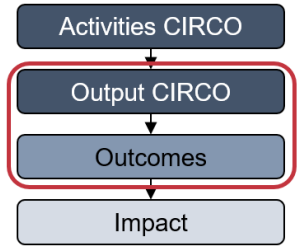


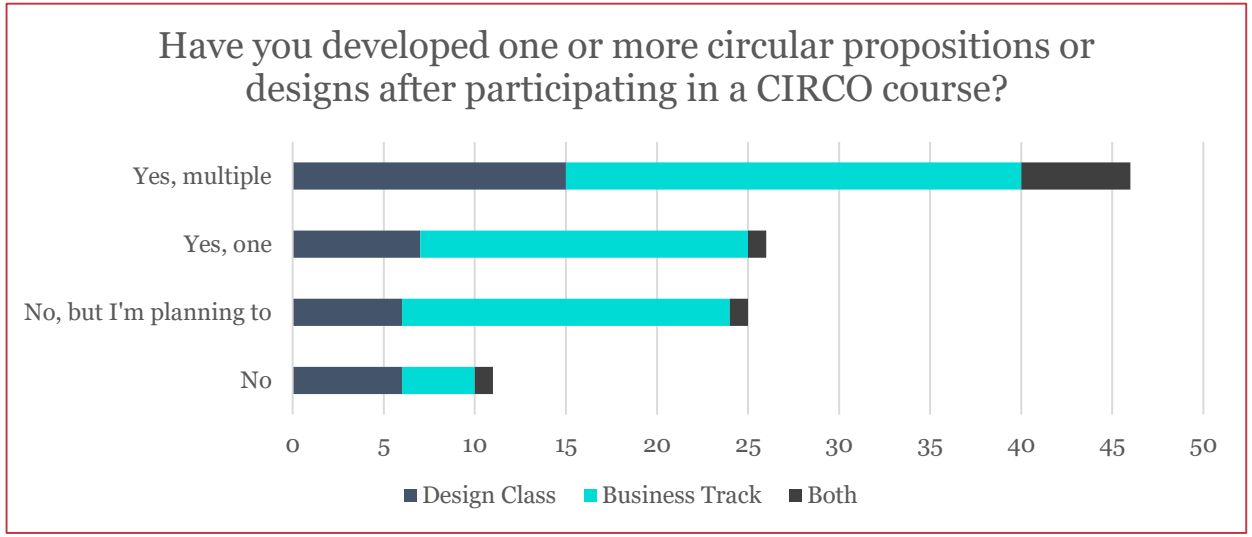
From output to outcome

Two thirds of the survey respondents started working on a circular proposition/ design

A large part of this group have even developed several circular propositions or designs. Most participants who have not done so are planning to.

There are relatively many respondents that participated in the Class who have developed several circular propositions/ designs (44% compared to 38% for the Track), which is expected because they have multiple clients. The percentage of respondents who have built one or more circular propositions/ designs is the same for the Class and the Track.

The most frequently given reasons among participants for not developing a circular proposition or design is that it is currently not a priority or that either clients or the market are not ready for it. In one case, the respondent felt that the practical tools to make things concrete for clients were missing.



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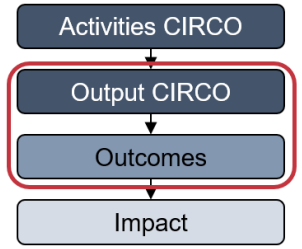
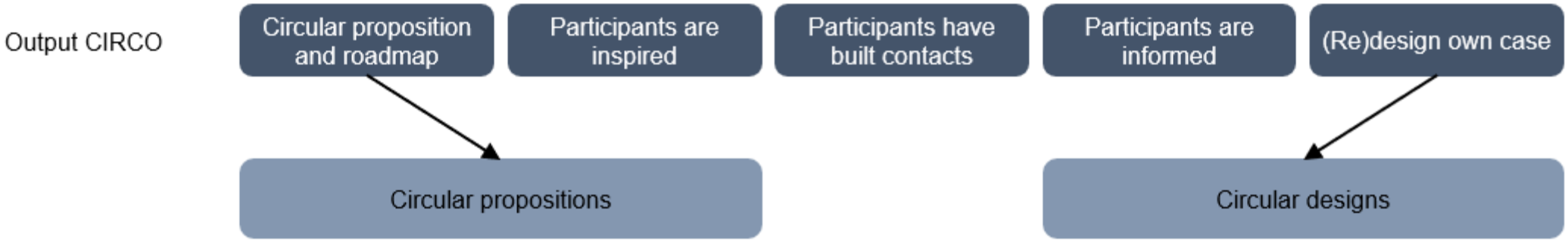


From output to outcome - conclusions

Two thirds of the survey respondents started using a circular proposition (participants of the Track) or a circular design (participants of the Class).



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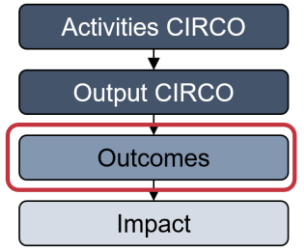

Outcomes - Circular Business Design Track

Follow-up steps are taken and progress is being made on many fronts

Running pilots and setting up collaborations has been achieved most often, followed by acquiring new skills/ knowledge and finding collaboration partners. This could mean that these are the first or the easiest steps that are often taken.

Many follow-up steps are needed before results can be achieved

Remarkably, the respondents seldom claimed that a step does not apply. This shows that the development of circular propositions requires many steps.

Arranging financing and adjusting the purchasing strategy are the biggest obstacles

There are many other obstacles, as well.

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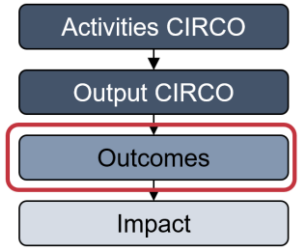


Outcomes – Implementing a circular proposition/ design

Some participants have already developed a circular proposition or design

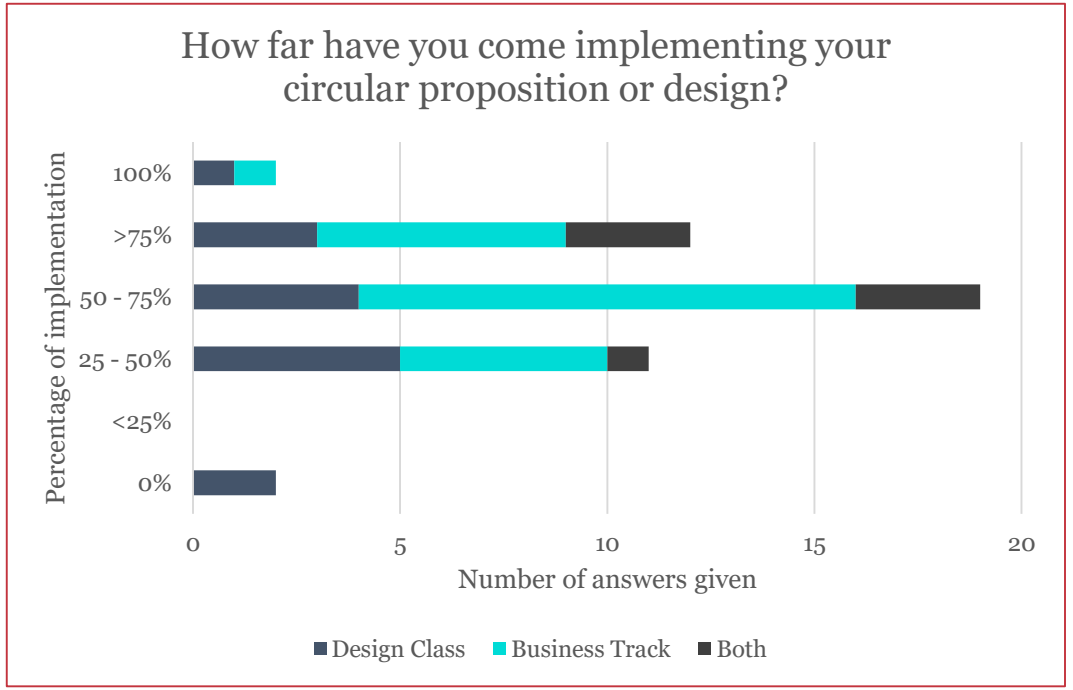
Two survey respondents said that they are in the implementation phase. Some examples of this can be found in the case studies as well.

Most participants feel that they are already halfway there

Many participants of both the Design Class and the Business Track indicate that they are already halfway on the road to implementation.

There is no clear relation between progress and year of participation

Participants who attended the workshops in the past are no closer to implementation than participants who have followed the workshops more recently. This is probably due to the fact that it differs greatly per participant how far they have come developing their circular proposition when they start a CIRCO course.



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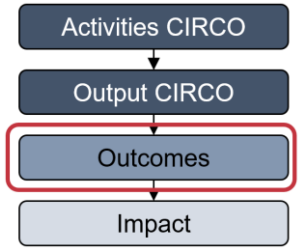
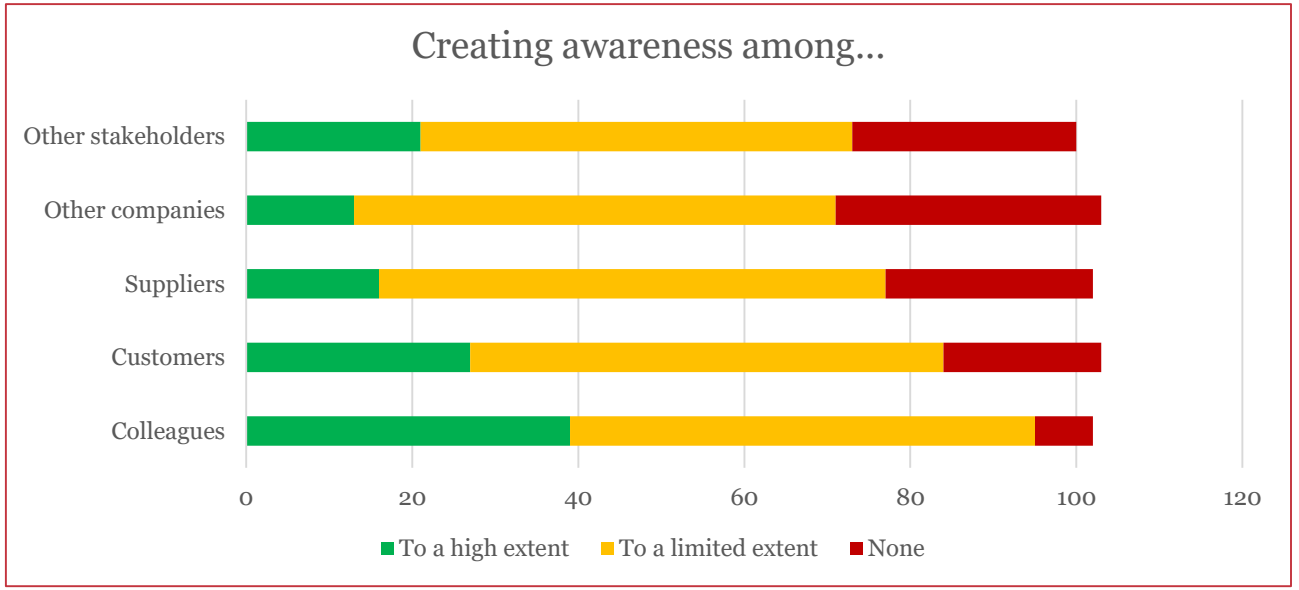


Outcomes – Creating awareness

Participants also create awareness among others, especially colleagues

Some participants believe they create significant awareness among other parties, colleagues and customers especially, but sometimes other stakeholders as well. Most participants do think that their impact is limited.

With regard to the above, differences between participants in the Track and the Class are small. Class participants answered that they contribute to awareness "to a significant degree" more often than Track participants, but they also said more often than Track participants that they contribute “not at all”.



“Circular design is still in its infancy. Many colleagues will have to see to believe that it can be a profitable way of working."

“Circularity has now become a much-discussed topic. This was not the case before.”

"We feel that we have been able to inform the government on the current agricultural policy and regulations that stand in the way of circularity."

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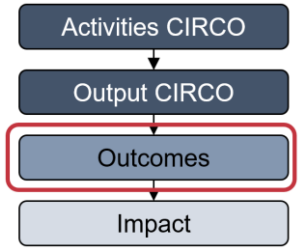


Outcomes – Expected contribution to saving raw materials and/ or CO_2

Categorisation of circularity strategies

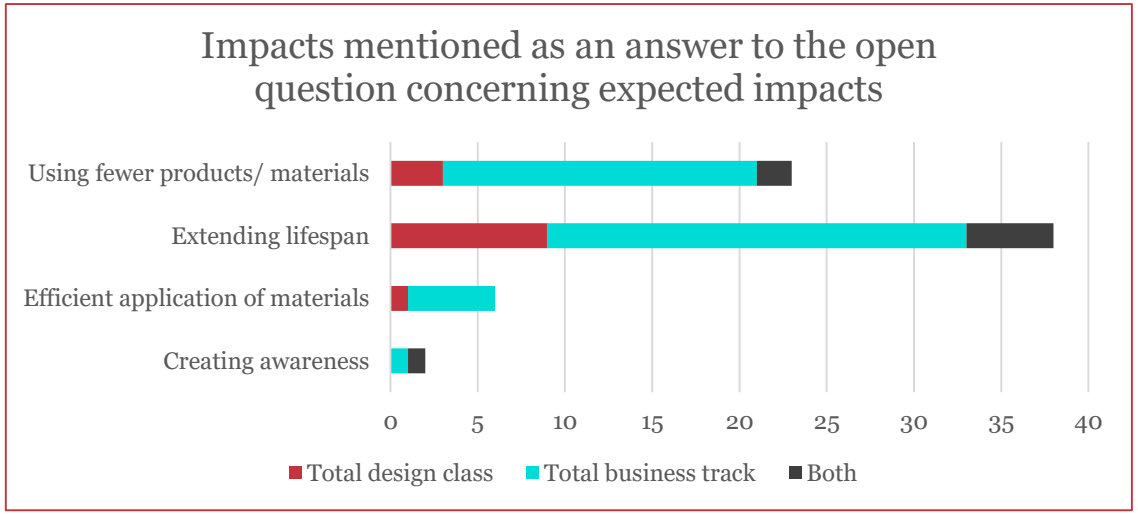
The expected contribution of participants to saving raw materials and/ or CO_2 emissions differs. To be able to analyse this contribution, we have categorised the answers. We divided the R-ladder into three, based on research by the PBL. The breakdown is shown in the figure below. A further explanation of the R-ladder can be found on page 24.

Using fewer materials and products	Extending lifespan of products and parts	Efficient application of materials
Refuse	Reuse	Recycle
Rethink	Repair	Recover
Reduce	Refurbish	
	Remanufacture	
	Repurpose	

Source: PBL 2018, "Circulaire economie: Wat we willen weten en kunnen meten". Edited by Technopolis.

Contribution is mainly a result of the reduction of materials and extension of their lifespan

Many respondents listed different ways in which they expect to contribute. A reduction of materials and extending their lifespan (through the reuse of materials/ products, or better quality) were most frequently mentioned. Recycling was mentioned a few times as well. Some also mentioned creating awareness and reducing transport and energy consumption. The answers to the open questions are categorised in the graph below.



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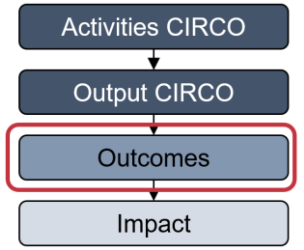

Outcomes – Examples

"As a result of my advice, I think that the companies I am coaching will certainly achieve a significant reduction, but it is an ongoing process, so I expect to see real improvement in 3 or 4 years."

“Long service life, repair and maintenance options, adaptable design and upgradability are the most important points I focus on and where I expect to be most successful. I also talk with clients about circular business models.”

“As a designer, you can make a major contribution. Especially by choosing new materials with as much future value as possible”.

"In particular, using less raw material (and creating less waste) by giving existing furniture a second life and by designing it in such a way that it can be easily adjusted later (longer service life)."

"Use high-quality, virgin materials, detachable design, arrange return processes, involve lifespan extension in projects."

“Especially by choosing new materials with as much future value as possible. To a lesser extent by reusing demolition waste, this is often too expensive in the current infrastructure.”

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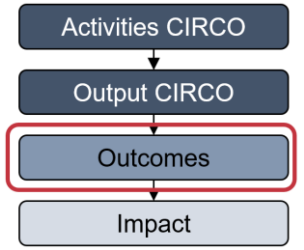


Outcome - conclusions

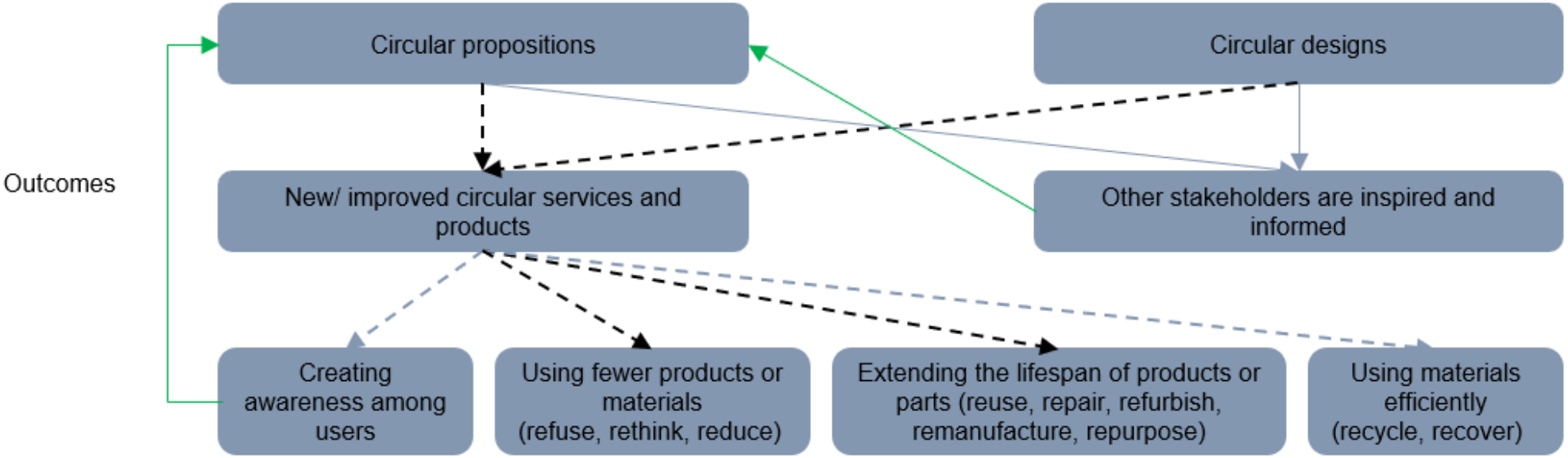
Many businesses and designers have started developing circular products and services. However, few circular services and products have actually been brought to market.

Participants regularly inspire and inform others.

It is expected that the circular services and products will contribute to making products smarter and extending their lifespan. Useful application of materials or creating awareness among users are mentioned as the most important impacts less often.

Inspiring stakeholders and creating awareness among users will cause a snowball effect.

This will then lead to new circular propositions.



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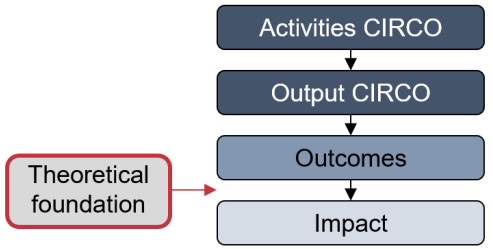
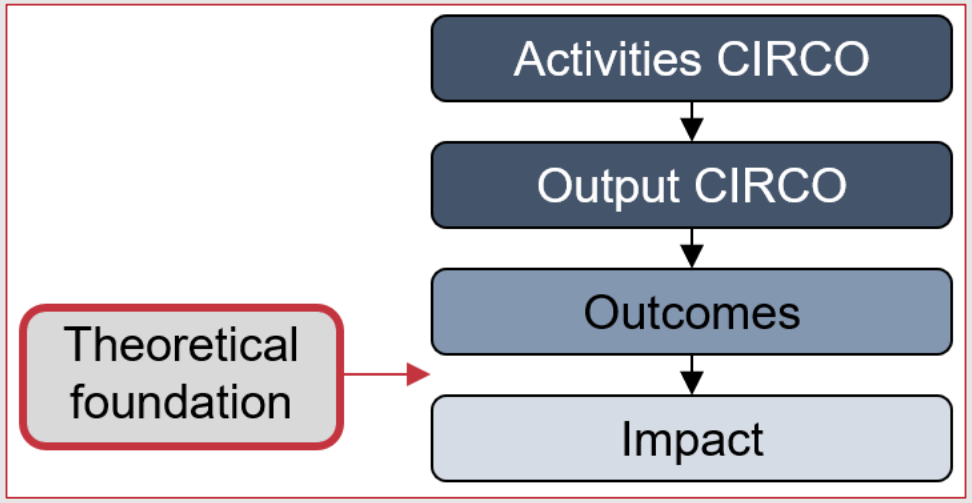


Connection between circular design and CO_2 reduction

The impact of lifetime extension and efficient use of materials on CO_2 reduction is difficult to measure. However, various studies inside and outside the Netherlands have been conducted on whether this link is present and how strong this link is.

In the following light gray sheets we provide the theoretical foundation of how the various outcomes lead to CO_2 impact.

We then establish the relation between the outcomes and the impact of CIRCO.



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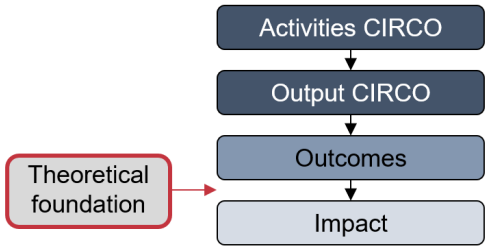
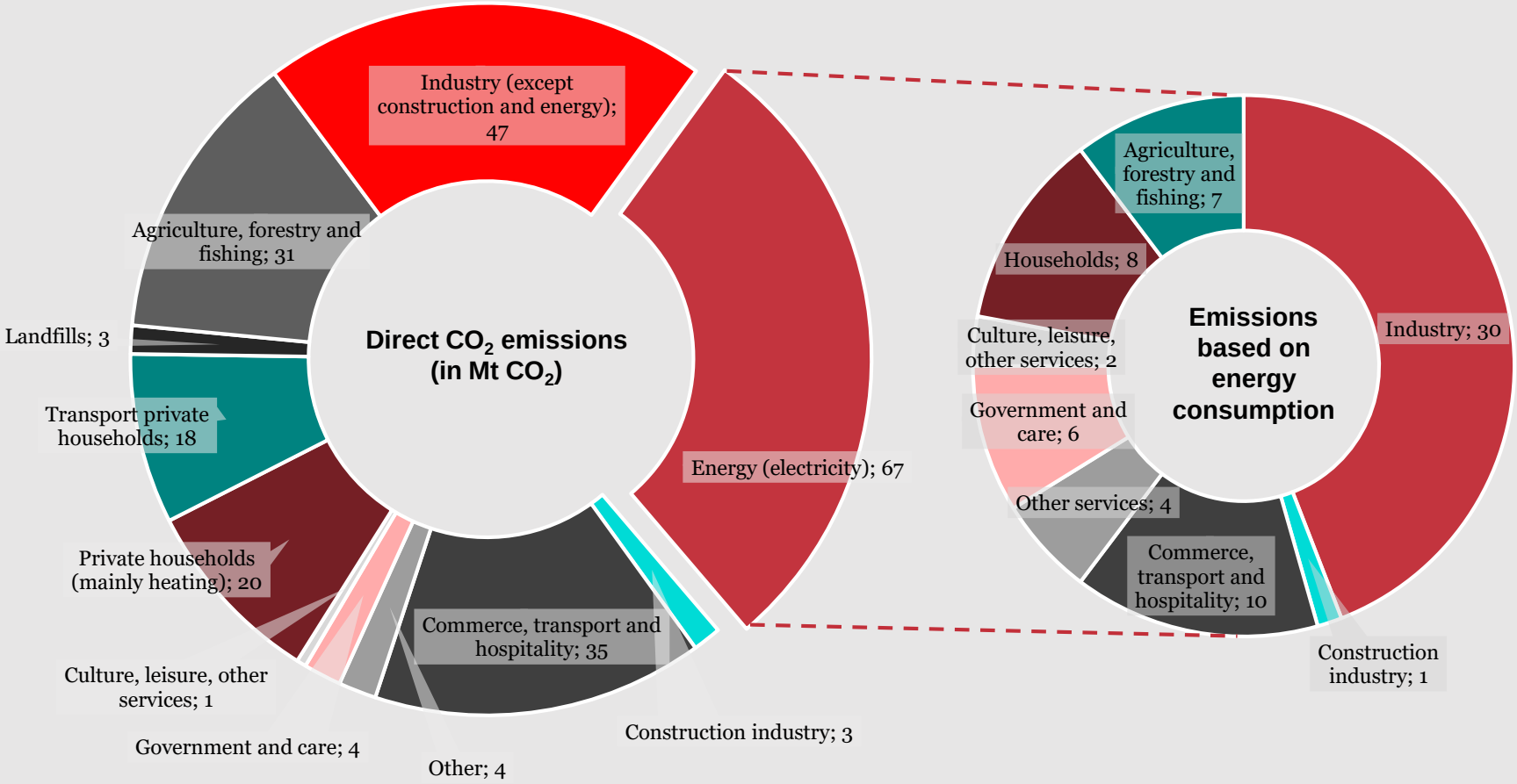


Economical activity causes CO_2 emissons

The manufacturing industry produces the most CO_2 emissions in the Netherlands

The environmental accounts annually published by CBS show that the manufacturing industry is responsible for a lot of emissions (47 of 233 Mt CO_2) from direct energy consumption such as coal for steel, petroleum for plastics and natural gas for fertilizer (left donut). The industry is also, with 30 of 67 Mt CO_2) the largest user of electricity and therefore also the largest cause of emissions from electricity (right donut).

Everything produced by the manufacturing industry ultimately ends up with a consumer. Therefore, consuming less means a decrease in emissions.



Data: CBS Statline 2018

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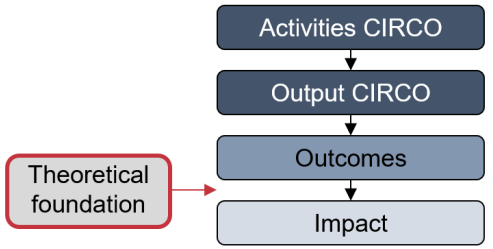
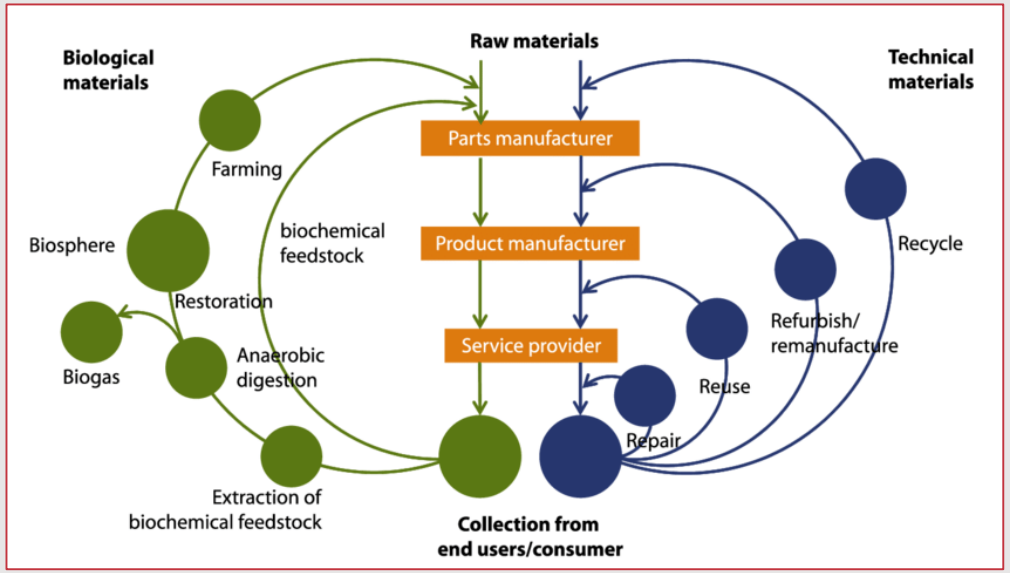


The circular economy prevents CO_2 emissions

If material consumption causes CO_2 emissions, a decrease of material consumption causes a reduction of CO_2 emissions.

Every time we fulfil a social need, we rely on the chain. The idea of the circular economy is to not always walk the linear path from extraction onwards, but to use loops that are as small as possible. The Ellen MacArthur Foundation calculated that the circular economy can prevent up to 45% of global emissions.

What the circular economy looks like for both biological materials (left) and non-biological (or technical, right) is shown in this well-known diagram designed by the Ellen MacArthur foundation.



Ellen MacArthur Foundation

By using smaller loops, we save the CO_2 emissions associated with the longer path.

For a selection of materials, the CO_2 saved by recycling instead of using *virgin* materials is listed below (Turner, 2015). The full study showed that recycling leads to high savings for 52 out of 55 commonly used consumer products.

Waste material	CO_2 besparing (KG CO2/ ton)
Paper	-459
Wooden products, furniture	-177
Car tyres	-636
Aluminium cans	-8.143
Glass	-314
Plasterboard	4
Drinks cartons	-242
Matrasses	-1.241
PET	-2.192

Journal of Resources, Conservation and Recycling (105 (2015) 186–197)

Even more CO_2 can be saved by using goods longer and more intensively instead of recycling them.

The smaller the loop, the greater the value retention of the activity. Recycling has the longest loop, which means that its value retention is smaller than the value retention of other activities.

For example, with glass, the trouble of collecting, crushing, fusing and subsequently producing and transporting it can be saved if bottles remain bottles. The same applies to electronics, cars and other complex products.

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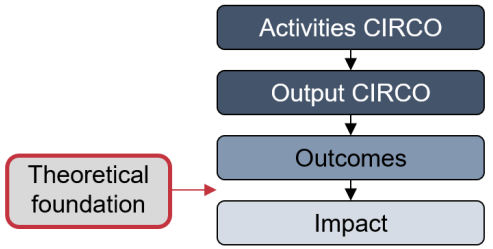
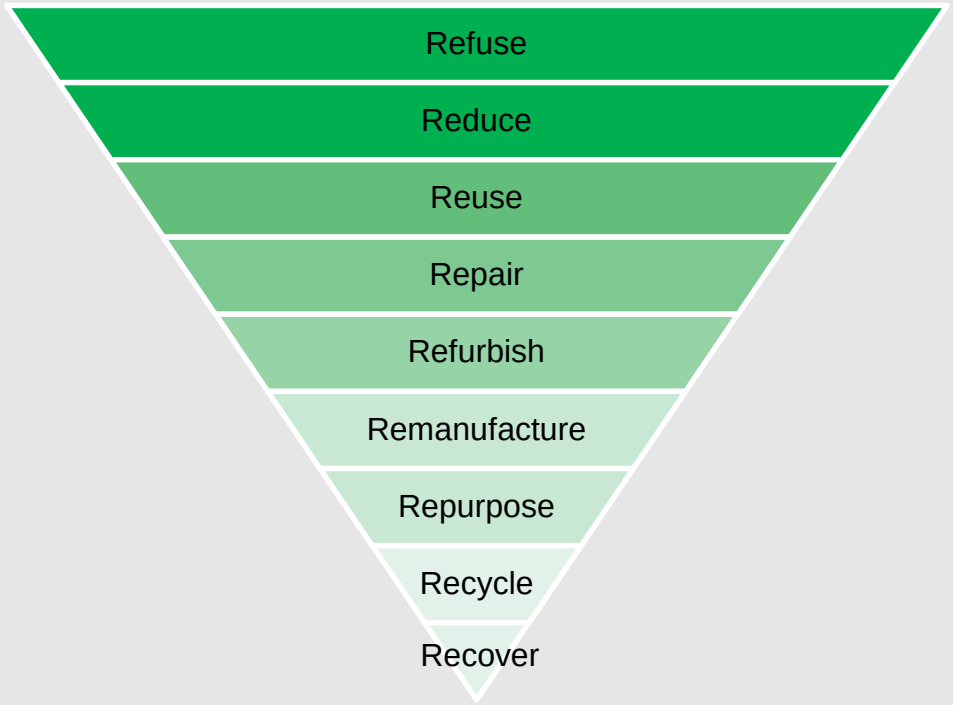


Strategies for a circular economy: the R-Ladder

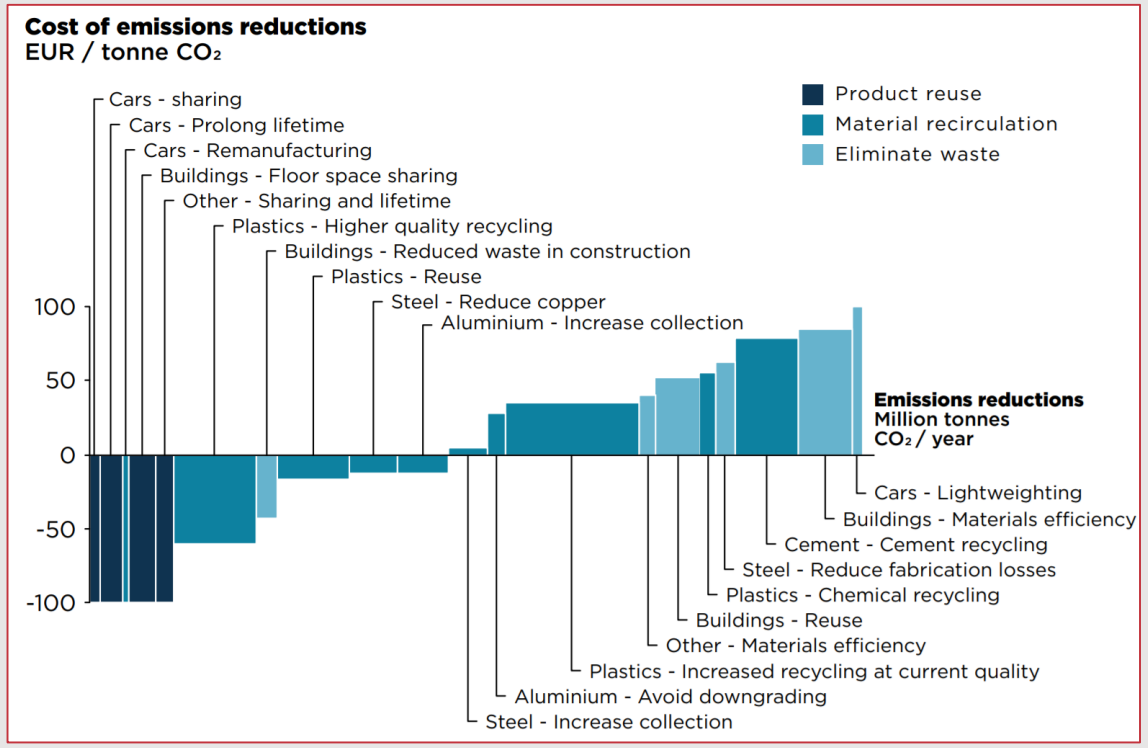
The higher up the R-ladder, the better the economic and ecological value is preserved

On the previous pages we saw that a circular economy reduces CO_2 emissions and that the effect is greater the earlier in the chain people intervene. A frequently used ranking of interventions for a circular economy is shown below: The so-called R-ladder. By using this model, the maximum (economic and ecological) value of a product is retained.



Many measures have economic benefits as well as ecological ones

For some specific measures, the worldwide potential has been calculated and plotted against the costs per tonne of CO_2 savings. All the measures shown save CO_2 and everything below the horizontal axis also brings in money. The wider the column, the greater the potential reduction.



Ellen MacArthur foundation, Completing the picture: how the circular economy tackles climate change

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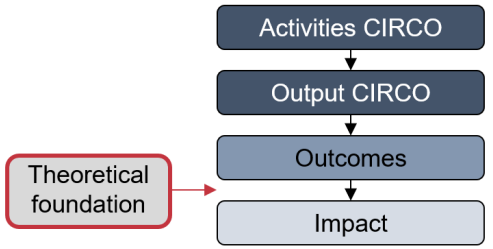

The potential of a circular economy in the Netherlands

The potential contribution of the circular economy to CO_2 reduction in the Netherlands is 7.7 Mt CO_2 in 2030

TNO has analysed the potential contribution of the circular economy to GHG (greenhouse gas) savings for the Netherlands. This amounts to 7.7 Mt CO_2 reduction in 2030 and 13.3 Mt in 2050.

This analysis is based on a equilibrium model and only includes the quantifiable plans from the “Rijksbrede Programma Circulaire Economie” and the accompanying transition agendas. This contribution is predominantly made by the Biomass and Food and Plastics sectors, because the agendas of these sectors contained the most quantifiable targets.

The study also includes an extrapolation from other studies (which have Europe or the world as its scope) to the Dutch situation. These figures are shown on the right. It is remarkable that completely different approaches and starting points produce similar results.

Differences include:

- Bottom-up versus top-down approach. Bottom-up is the sum of a large number of small effects, which is then extrapolated to an industry or sector. A top-down approach uses input/ output and supply/ use tables.
- The rebound effect, which also plays a role in the TNO study, reasons that any savings on one factor are usually offset by another, which may be more CO_2-intensive than the original.

Who	Year of study	Horizon	Extrapolation GHG-emission reduction NL (Mt) / year
Bio by Deloitte	2016	2030	22
Club van Rome	2015	2030	5
Ellen MacArthur Found.	2015	2030	25
Matter project	2001	2050	30
McKinsey & Company	2016	2040	20
OECD	2012	2030	12
TNO	2013	2025	17

TNO: Contribution of the Rijksbrede Programma voor de Circulaire Economie to the climate targets, 2019

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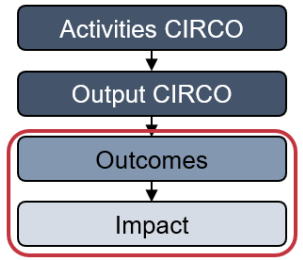


CIRCO's potential and impact

The circular economy can prevent up to 45% CO_2 emissions, savings higher on the R-ladder have the greatest impact

In the previous slides we showed that:

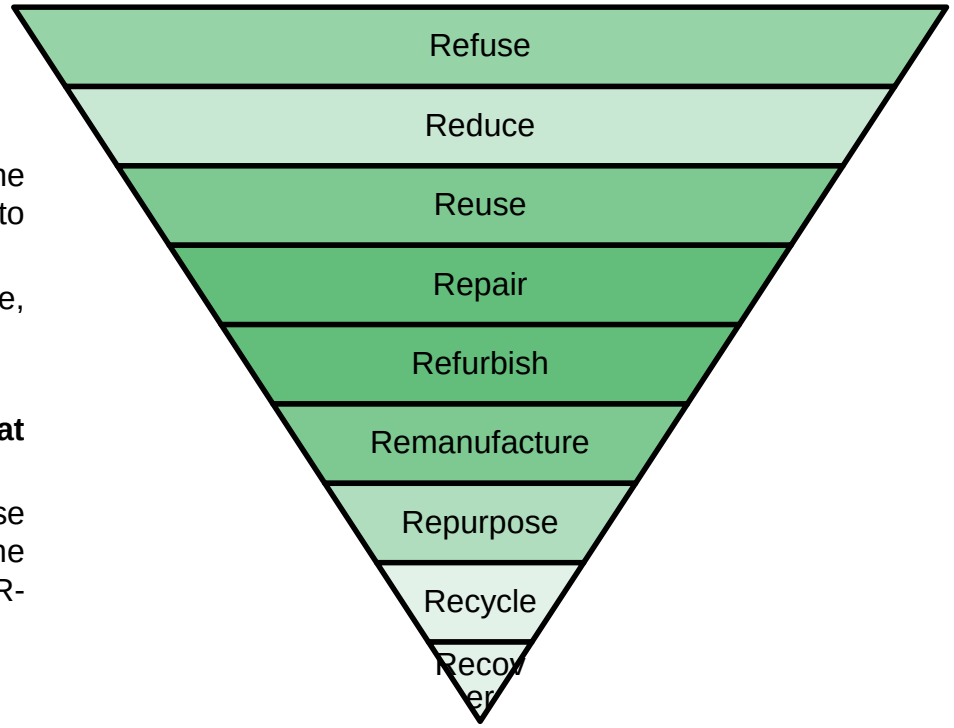
- large greenhouse gas emission savings can be achieved with the circular economy: the Ellen MacArthur Foundation has calculated that the circular economy can prevent up to 45% of global CO_2 emissions.
- savings increase as higher steps of the R-ladder are implemented: first share, then reuse, then repair, etc.

The main focus of the CIRCO workshops is the middle of the R-ladder, which means that CIRCO's contributes to CO_2 reduction is relatively high

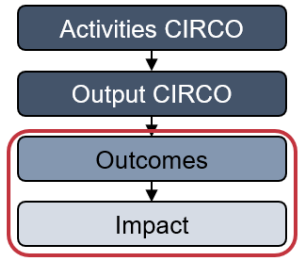
The CIRCO workshops focus in particular on reducing the use of (virgin) raw materials, reuse and (design for) product preservation (repair up to and including repurpose), shown in the figure on the right with darker colours. The main focus therefore lies in the middle of the R-ladder and way before recycling.

Some concrete results are available

To further substantiate these claims, some bottom-up results are available. Seven respondents provided an estimate of the (future) CO_2 and/ or raw material reduction. According to these (self-supplied) numbers from students, CIRCO's activities have already **saved 13,800 tons of CO_2**. This is based on five answers ranging from 54 to 12,000 tons of CO_2 savings. In addition, five participants (some overlap with the aforementioned seven) provided an estimate of the amount of material saved, which together amounts to 14,100 tons of material - mainly plastics, steel, aluminium, and wood.



The figure above was created by keeping a tally of the sections of the R-ladder that relate to the learned circular business models and design strategies. This is in line with how the participants expect to make an impact (see p. 18).

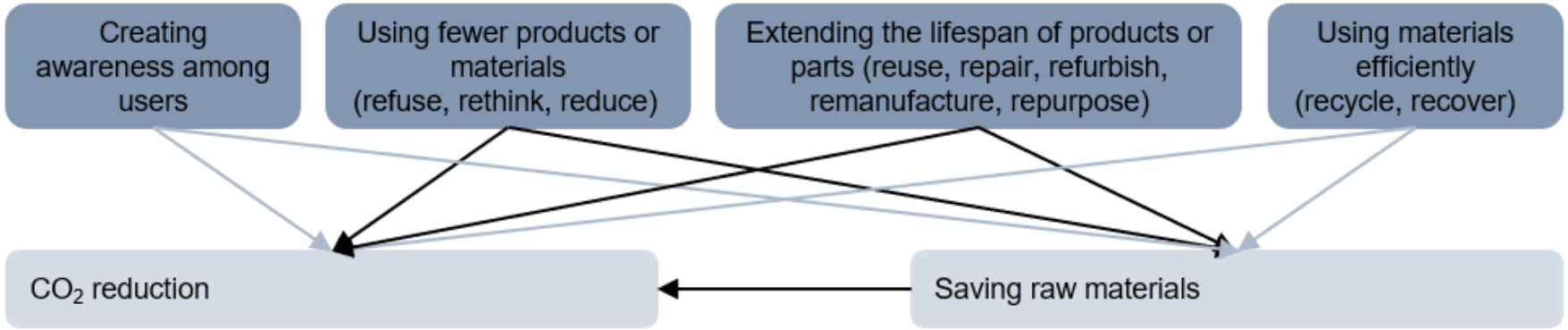


From outcomes to impact - conclusions

Reducing the use of raw materials has a demonstrable and large impact on CO_2 reduction

Activities higher up the R-ladder, such as using fewer products or materials and extending their lifespan, have the greatest impact. A smaller effect is attributed to efficient application of materials and increasing awareness among users.

The main focus of the CIRCO workshops is to use fewer materials and to extend their lifespan, from which follows that they clearly contribute to CO_2 reduction.



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Conclusions

CIRCO contributes to CO_2 reduction through its workshop participants being trained to develop circular services and products. How much (future) CO_2 reduction is actually achieved depends on the sector and the success of the participants; however, the potential impact is considerable.

The most significant way in which CIRCO contributes to CO_2 reduction is that participants in their workshops (further) develop circular services and products that lead to lower CO_2 emissions.

- Reducing raw materials has a demonstrable large impact on CO_2 reduction.
- In addition to using fewer products or materials (refuse, rethink, reduce), extending the lifespan (reuse, repair, refurbish, remanufacture, repurpose) can also lead to considerable CO_2 reduction. Efficient application of materials (recycle, recover) has a smaller effect on CO_2 reduction.
- Most circular products/ services of participants in the CIRCO workshops will result in the use of fewer materials or lifespan extension, which may reduce CO_2 emissions.
    - The extent of the CO_2 reduction is largely determined by the commercial success of the products/ services developed. CIRCO workshops also address circular business models, which increases the chance that participants will combine ecological and economic opportunities and come up with a successful business case.
- Participants of CIRCO are developing various circular services and products, but many have yet to be fully implemented.
- Two thirds of the participants take further steps after participating in the CIRCO workshops. Many follow-up steps are often needed before circular services and products are brought to life.

In addition, CIRCO has a leverage effect, because participants of CIRCO workshops inform and inspire others and raise awareness.

The extent to which CIRCO contributes to CO_2 reduction is difficult to determine precisely, because many assumptions and long, complex impact pathways are involved. The magnitude of the impact is also strongly determined by the extent to which participants put what they have learned into practice, on which CIRCO has no direct influence. However, the potential impact is considerable, as literature shows that the circular economy can prevent a large part of CO_2 emissions, particularly on the higher steps of the R-ladder.

Recommendations for CIRCO

- By focusing extra on recruiting participants from sectors that can have a large impact, more impact can be achieved with the same input.
- Using the network and mobilising capacity of partners (such as provinces and branch organisations) can enhance the leverage effect because parties involved in circular design (within a geographical or content-related area) strengthen each other and increase their critical mass.
- Network activities are important if you aim to create communities and want to encourage them to get started with what they have learned in the course. Mix new and old students for cross-pollination.
- In-house CIRCO workshops can be organised for larger companies. CIRCO can also set up a train-the-trainer programme, to facilitate even faster growth of CIRCO's impact.
- CIRCO could charge higher registration fees to, for example, repeat participants (differentiate rates). This makes CIRCO more self-sufficient. In order to remain accessible for new participants, a low registration fee is still recommended for them.