
CONTEXT FOR THE ACTIVITY

This activity provides a reference point to circular design by putting into context the overarching dimensions of design thinking and circular economy needed to create a new mind set for design. It is based on understanding four lenses of circular design:

Lens 1 – Think about compatible nutrients and their flows

Lens 2 – Shape creatively to meet needs

Lens 3 – Embed digital intelligence

Lens 4 – Design with context in mind

A ‘lab story’ from Cranfield University is used to prompt discussion on how we can re-think great inventions such as the toilet. The key context for this activity is Cranfield University’s Nano Membrane Toilet which will be able to treat human waste on-site without external energy or water. Great inventions have changed people’s lives, yet they are not accessible to all. For example, 2.4 billion people globally still lack proper sanitation facilities. So, there is a huge opportunity to create new mindsets for design to reinvent current structures and create regenerative systems that are accessible to all.

RESOURCES AVAILABLE

- 5:R1a Intro PPT slide
- 5:R1 PPT explaining the four lenses of circular design
- 5:R2 Lab Story video - interviews with research team members (20 mins running time). See Thumbnails page for the video download.
- 5:R3 Video story board card prompts - excerpts of the R2 video interviews
- 5:R4a and R4b A4 sheets for note taking and Card prompts with key questions about the four lenses of circular design
- 5:R5 Illustration of the Nano Membrane Toilet system configuration
- 5:R6 Full transcript of the video
- 5:R7 Diagrams of a sanitation system from Toilet Board Coalition

ORGANISATION

- Plenary and dialogue around PPT and the Lab Story video
- Small groups (4s) around Resource prompts R3 to R5
- Plenary debrief

TASK(S) AND RUNNING ORDER

- 1) Dialogue around the PowerPoint R1. Why is it important to provide a reference point to circular design through these four lenses?
- 2) Play the 'Lab story' video.
- 3) Use the video to discuss in small groups how each of the four lenses is considered in the design of the nano membrane toilet.
- 4) Feedback and debrief from each group to the plenary.
- 5) Plenary reflection: what other dimensions do we need to consider when creating new mindsets for design?

TIMINGS

Overall approximately 140 minutes. Task 1: 20 mins; Task 2: 20 mins; Task 3: 60 mins; Task 4: 20 mins; Task 5: 20 mins.

AIM OF THE ACTIVITY

To provide a reference point to circular design by understanding the dimensions of design thinking and circular economy to create a new mindset for design.

GUIDANCE FOR FACILITATORS INCLUDING DEBRIEFING NOTES

The Nano Membrane Toilet Lab Story video (R2) and story board cards (R3) act as a lead to prompt discussion in groups about a reference point to circular design. Although we propose four lenses for explain the overarching dimensions of design thinking and circular economy, these are not limiting and further reflection should prompt other dimensions to consider when creating new mind sets for design.

cycle of products/services/systems and the use of material and resources considering open and closed-loop systems; Lens 2: meeting people's needs according to their own context/system; Lens 3: technological advances taking place in specific economic landscapes; and Lens 4: systems thinking and context setting.

In the discussion, ask: why is it important to provide a reference point to circular design through these four lenses? What are the overarching elements of design thinking, systems thinking and circular economy that are important to create new mind sets for design?

TASK

1

PowerPoint R1 introduces the four lenses of circular design. These four lenses came about from an extensive literature review to provide a reference point for circular design. Use the PowerPoint slides to develop dialogue around the overarching dimensions of design thinking and circular economy. Design thinking is a method that designers use to meet people's needs and desires in a technologically feasible and strategically viable way (Brown, 2008). Circular economy in its short definition is a system that is restorative by intention and design (Ellen MacArthur Foundation, 2012). This definition puts design as a core element to achieve the transformation needed towards a circular economy. Between design thinking and circular economy there are overarching dimensions such as: Lens 1: life

TASK

2

3

Invite participants to watch the video R2 in small groups. The video R2 prompts discussion based on an invention following circular design principles. The video is a 'Lab Story' based on current research conducted by Cranfield University to re-invent the toilet. The video gives a snap shot of different researchers talking about their contribution to this nano membrane toilet invention.

GUIDANCE FOR FACILITATORS INCLUDING DEBRIEFING NOTES (continued)

Task 2 and 3 continued.

Discuss the video in small groups using the resources R3 to R5. Mainly use the story board abstracts/cards (R3) from the video to discuss how each of the four lenses is considered in the design of this toilet.

Note that R4 is presented in two formats: a) as A4 sheets presenting each lens and allowing participants to write notes when they are watching the video and b) as four cards presenting key questions around the four lenses of circular design to prompt discussion on the design of the toilet.

R5 presents the Nano Membrane Toilet system configuration. This resource helps participants to further understand the technical aspects of the toilet.

Allow each small group of participants to have a discussion around the video, the toilet system configuration, and the four lenses of circular design. Ask them to capture points of tension and/or agreement on the R4a A4 sheets and/or flip charts to present back to the plenary.

Note that R6 provides the full video transcript - as facilitator, this may be a useful resource for you during preparation of this activity (you can cut/paste with this document to create additional stimulus materials).

TASK

4 5

The follow up to the small group discussions around the video and the four lenses is to present to plenary a debrief of each group discussion. Then, at the end of this plenary ask participants to reflect on the question: what other dimensions do we need to consider when creating new mindsets for design? This discussion is important because these lenses are not set in stone and further reflection should prompt other ideas.

Facilitator clues: other dimensions could include the interrelationship of the business model with the design aspects of the toilet. The discussion could focus on value creation and distribution with materials using the 'power of loops' (Ellen MacArthur Foundation, 2012), and how the 'revenue streams' may be transformed to 'social capital'.

POSSIBLE EXTENSION ACTIVITY

R7 can be used to prompt further discussion beyond the Nano-membrane Toilet to identify the circular design dimensions when comparing with alternatives such as flush toilets connected to sewers, or toilets with container-based collection. R7 is a sanitation system diagram from the Toilet Board Coalition. This shows human waste (which the Toilet Board rebrands as 'Toilet Resources') being valorised as a

wide range of material and energy products. This is significant not only in technical/design terms, but in its effect on the economics of the whole system. The Toilet Board Coalition argues that the failure to reach 2.4 billion people with sanitation is an economic issue - traditional models making sanitation a large public or philanthropic cost are problematic, whereas circular models might yield new revenue sources which reduce the public cost and so speed scale-up.

SUPPLEMENTARY RESOURCES

For Task 3 the following videos and resources could help to inspire the discussion.

- The Evolution of Design thinking - Tim Brown CEO of IDEO, explains how the design process is evolving to support the circular economy. https://youtu.be/GeoqUkKM_-4
- Design for the Circular Economy - Tim Brown explains the circular economy and why designers have to get involved <https://youtu.be/yAvkM7B7BBs>
- Reinventing the toilet - helping to solve sanitation issues in low income countries - <https://www.cranfield.ac.uk/case-studies/research-case-studies/nano-membrane-toilet>

REFERENCES AND FURTHER READING

Biomimicry 3.8 (2017) What is biomimicry? Biomimicry 3.8 website. Available at:

<https://biomimicry.net/what-is-biomimicry>

This gives a biomimicry design 'lens'

Brown, T. (2008) Design thinking. *Harvard Business Review*, pp 1-10'

Cranfield University (2017) Nano membrane toilet website - includes publications/reports list and blog. Available at <http://www.nanomembranetoilet.org/>

Ellen MacArthur Foundation (2012) *Towards a circular economy. Volume 1*

Ellen MacArthur Foundation and IDEO (2016) *The circular design guide*. Available at: <https://www.circulardesignguide.com>

IDEO (2017) IDEO Design Kit website. Available at: <http://www.designkit.org/>

Moreno, M., De los Rios, C., Rowe, Z. and Charnley, F. (2016) A conceptual framework for circular design. *Sustainability*, 8(9), 937. Available at: <http://www.mdpi.com/2071-1050/8/9/937/html>

Toilet Board Coalition (2016) *Sanitation in the Circular Economy*. Available at: http://www.toiletboard.org/media/17-Sanitation_in_the_Circular_Economy.pdf

ACKNOWLEDGEMENTS

Many thanks to Simon Widmer at Ellen MacArthur Foundation for his guidance and help with this activity.

THUMBNAIL RESOURCES

CLICK TO DOWNLOAD HIGH RESOLUTION VERSIONS FROM BELOW

5:R1a Intro PPT slide

5:R1a ACTIVITY 05: NANO MEMBRANE TOILET - THROUGH FOUR LENSES OF CIRCULAR DESIGN

KEY ENQUIRY
What are the dimensions of circular design?

TASK(S)
1) Dialogue around the PowerPoint R1. Why is it important to provide a reference point to circular design through these four lenses? (Time)
2) Play the 'Lab story' video (Time)
3) Use the video to discuss in small groups how each of the four lenses is considered in the design of the nano membrane toilet (Time)
4) Feedback and debrief from each group to the plenary (Time)
5) Plenary reflection: what other dimensions do we need to consider when creating new mind sets for design? (Time)

5:R2 Lab Story video - interviews with research team members



5:R1 PPT explaining the four lenses of circular design

FOUR LENSES OF CIRCULAR DESIGN

Lens 1: Think about compatible nutrients and their flows
Use materials and resources that are 'nutrients' at all stages. Think about how materials and substances can never be a matter of concern.

Lens 2: Shape creatively to meet needs
Know inside out your final user so you can build high performing structures and systems that meet their needs. Prototype as much as you can to make sure your design stays agile in a changing context.

Lens 3: Embed digital intelligence
Use technological 'enablers' to catalyse flows of materials, resources and information.

Lens 4: Design with context in mind
Enhance the interaction of your design with the larger interconnected whole through systems thinking, empathy and collaboration.

5:R3 Video story board card prompts - excerpts of the R2 video interviews

LENS 1: THINK ABOUT COMPATIBLE NUTRIENTS AND THEIR FLOWS

CRAB TO ASK: WHAT'S THE BACKGROUND ON TYPICAL TOILETS IN DEVELOPING COUNTRIES? HOW DOES THE NANO MEMBRANE TOILET SYSTEM DIFFER?

CRAB TO ASK: HOW DOES THE NANO MEMBRANE TOILET SYSTEM DIFFER FROM A CONVENTIONAL TOILET IN THAT IT WORKS WELL IN RURAL AREAS? IS THERE A RISK OF IT BEING A FAILURE?

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5:R4a

LENS 1

THINK ABOUT COMPATIBLE NUTRIENTS AND THEIR FLOWS

- How can design happen with valuable 'nutrients' at all stages of their journey - not waste or substances of concern?
- Which avenues and circular loops are you designing for? How does this work in practice - what systems are or are not in place?
- How can design positively affect flows and stocks of materials, information and energy towards a regenerative, abundant and accessible future?
- Leakages in the system can occur, how can they act as feedback for another system?

Your notes on the video interview extracts:

5:R4b

Blank space for notes on the video interview extracts.

5:R5 The nano membrane toilet system configuration

5:R5 THE NANO MEMBRANE TOILET SYSTEM CONFIGURATION

System configuration

A schematic of the nano membrane toilet system configuration, showing the flow from the toilet to the membrane filter, then to the membrane filter, and finally to the water processing unit.

5:R6 Full transcript of the video

5:R6 FULL TRANSCRIPT OF THE VIDEO

TIME CODE	NAME	DIALOGUE
00:00:00	INTV-CRAB JOHNSON	What's the background on typical toilet and sewage systems in low income situations in rural? So what's the challenge for your nano membrane toilet system?
	ROSS TIERNEY	Oh, well first off, the whole project started because two and a half billion people don't have a toilet around the world. The choice for them to use are, in the majority of developing countries, pit latrines, public toilets. And these are the toilets that you find if you're in a rural area, about a mile or two from a town. There's just an open pit, very unsafe, that's a big problem and the spread of disease is pretty rampant. At least one and a half million children dying per year just from, basically lack of sanitation. So, what we're trying to do is work on a new system, which is going to be able to be in the person's home. And it's a self-contained unit. It doesn't rely on plumbing or sewage or water. Because that's a problem, that's what I've been thinking about for so many years, infrastructure's incredibly difficult.
00:00:10	ROSS TIERNEY	You can trip to an illegal well, that's fine, you can get electricity to the home, but you can't put in a plumbing system. That's where it gets really difficult. So this is a self-contained unit. About the other options, I'm a big fan of the simple technologies such as compost toilets. They're great, but within certain circumstances in rural environments they're perfect. In urban, dense urban, peri-urban environments, not so much. And that's just because the number of people who have to use it, the space it takes up, the time it takes to break down and so on, and then what do you do with it afterwards?
00:00:46	ROSS TIERNEY	In rural environments it's fine if you've got a farm and you can do something with that compost and manure, in urban environments they don't. You're not going to have a large farm to do it. So that's the problem. And our system is self-contained. It's going to be a few more years of development. What we're working on at the moment looks quite complicated, but I think the alternative is, it's much more complicated. Putting in the sewers is incredibly difficult. So what the challenge is to make a toilet which didn't use water, plumbing, electricity, and it had to not have that US centric sewer pipe system, which is a pretty big challenge (laughs).

5:R7 Sanitation economy diagrams from the Toilet Board Coalition

5:R7 SANITATION ECONOMY DIAGRAMS FROM THE TOILET BOARD COALITION

THE SANITATION ECONOMY

TOILET ACCESS & SERVICES

TOILET ACCESS & SERVICES

Two circular diagrams illustrating the Sanitation Economy. The top diagram shows the flow from 'TOILET ACCESS & SERVICES' to 'TOILET ACCESS & SERVICES' and 'TOILET ACCESS & SERVICES'. The bottom diagram shows the flow from 'TOILET ACCESS & SERVICES' to 'TOILET ACCESS & SERVICES' and 'TOILET ACCESS & SERVICES'.