

# Closing the Knowledge Gap on Circularity: the CBE Hub Lifelong Education Programmes

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**Abstract.** This paper discusses the relevance of academia in addressing complex contemporary issues and more specifically, its potential to help society transition to a circular built environment. Can academia provide society with a safe space for developing imaginaries and socially performing alternative political futures? Can it help reconnect the many knowledge domains that appear now to be dispersed and fragmented? And what is the role of adult learning in achieving this transition and in dealing with complex issues such as sustainability? The typology and goals of adult educational modules developed by the Faculty of Architecture and the Built Environment of TU Delft and in particular the Circular Built Environment (CBE) Hub are presented here as a response to the growing need of creating synergistic alliances between academia and the rest of society. Three different typologies are examined in this chapter for their specific contribution in raising awareness; inspiring professionals and instigating change in attitudes as well as contributing to the training of selected groups of stakeholders respectively. Authors reflect on the benefits of such interaction, its limitations as well as its future potential. Promoting the benefits of transitioning to a circular built environment and reaching the widest audience possible to assist with the transition requires that academia develops new educational formats. Attention should therefore be given not only to the content produced, but also to the modes of delivery; the effectiveness of the message that is ultimately delivered as well as the establishment of a continuous presence where different individuals or groups can return to when challenged by complex issues. Consolidating this relation can close the knowledge gap between the two: on the one hand society directly benefits from academic research, on the other hand, academia becomes more relevant for society.

**Keywords.** Circularity in the built environment, adult education, lifelong learning, TU Delft

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## 1. Introduction

One of the major contemporary challenges is addressing the discrepancy between the societal desire for economic growth and the ecological repercussions of growth. The complexity of the task at hand is further accentuated by the perseverance of the objectivist fragmentation of the world into isolated objects that become understandable only when abstracted from context: the usefulness of the vast amount and various forms of knowledge modernity generated, has been compromised by quarantining it into specialist silos (1). This extreme compartmentalisation of knowledge, keeps most people from understanding the basics of how the world works rendering the overhauling of

educational systems a necessary condition for obtaining a wider cross-disciplinary perspective (2). However, as the relevance of the role of education increases, academia faces a challenge of its own: that of carrying out research that can induce change with a wider societal input (3).

In this context, the re-emergence of circularity and in particular, circular economy as an organizing principle for managing the constraints of the assimilative capacity of the environment holds a fair promise: founded on both theoretical and technical background knowledge, circularity has a highly interdisciplinary character (4) marking the need to consider them in a systemic manner. Furthermore, it requires that the technical knowledge base produced

will be connected to business, organization and management study research communities further highlighting its social character (5). However, despite its premise and its increasing popularity, it is still a concept in-the-making and thus it needs to be dealt with caution; otherwise, any attempt to approach it risks being superficial.

For architecture schools in particular, the question now becomes whether they can provide with a safe space to facilitate the transition to a circular built environment. If so, how can architectural education and also adult, professional education, contribute to the better understanding of circularity and its wider dissemination across individuals and organizations? Can it help enhance the relevance of academia within society by establishing a new cooperative ethos? This paper argues for the potential of circularity to constitute a future vision and the socially performative role of academia in assisting this vision to materialize. It also describes how CBE Hub has conceptualized and organized its life-long learning programs in order to address the needs of multiple different learners' communities and to also benefit from this interaction.

## 2. Circularity: a concept promoted, contested, and imagined

**What it is, what is the scale of it** | Circularity “conceptualizes the integration of economic activity and environmental wellbeing in a sustainable way” (6). Circular principles have been fully embraced by China since the 1970's as their official state-led development goal (7). Western economies reflexes have been slower to catch up, however, nowadays, EU policies cannot afford not to mention circular economy (CE) (8). Circularity and CE are often used interchangeably, but how do they specifically relate to the built environment? CBE Hub members describe the Circular Built Environment (CBE) is a system designed for closing resource loops at different spatial-temporal levels by transitioning cultural, environmental, economic & social values towards a sustainable way of living. Alongside this definition, CBE Hub members claim that circularity pervades the built environment across (at least) six scales: from materials and components, to buildings and neighbourhoods, all the way to cities and regions (9).

**Challenges** | Despite its wide dissemination, circularity still remains a relatively young field of research and therefore it is often scrutinized for its conceptual fragmentation and lack of clarity in implementation, whereas circular innovations are considered to be hard to scale up (10). Circular economy in particular, is heavily criticized for rebooting and reforming capitalism where citizens are still considered predominantly as consumers and whose civic duties are performed primarily via consumption (11).

**The technical and social divide** | In this light, one of the major challenges lies in determining how circularity impacts society. In policy and business development, for example, CE is expected to provide high value materials cycles and therefore current research focuses more on the practical and technical levels; however, from a scholarly position, values and societal structures and the paradigmatic potential of CE remain largely unexplored (10). Marin & de Meulder (12) distinguish between what they call the 'objectivist' and 'constructivist' frameworks of circular economy: whereas in the first case they foreground technology and entrepreneurship, in the latter, they drive attention to practices of sharing, re-using and collaborating leading to either technocratic or political positions respectively.

**The potential of circularity as a future vision** | Casson and Welch (13) call circular economy an “imagined future” that informs and motivates different areas of the social world through “a range of rhetorical, representational, organizational and material activities”. But in order for these imaginaries to materialize, claim Volker et al. (8), they need to be collectively held, institutionalized and publicly performed.

## 3. The socially performative role of academia and the importance of adult education

Academia provides a framework for such imaginaries to be discussed not only as managerial or technocratic issues, but also as “politics of the future” and thus focus on the social processes and practices that allow imaginaries to become socially performative (14). “Our academic profession,” Gümüşay & Reinecke argue (15), “is uniquely placed to do so because of our distinct ethos that is not driven by profit objectives but rather by scientific and societal norms.”

**A safe place to do dangerous things** | School educates, say Hughes and Lokko (16), but training is a lifelong process happening after that. The two women, however, go beyond this statement; “inverting growth and our relationship to waste,” they argue, highlight our need to have “safe places to do dangerous things” (ibid). On a similar line of thinking, Callan (17) claims that a good education challenges settled beliefs and values and subjects them to critique ultimately making learners intellectually unsafe.

**Sustainability in education** | Considering academia as a safe space to experiment becomes even more relevant for matters of high complexity such as climate change or resource depletion that require out-of-the-box approaches. Sustainability is already tied to education via the SDG goals; target 4.7 in particular stipulates that by 2030, Member States should ensure that:

all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development (18).

**Combines practical and social benefits** | Adult education research shows an immense potential of adult learning programs in achieving higher outcomes and has a range of non-economic benefits: there is strong evidence that adult learning contributes to changes in attitudes and behaviours that promote social capital and, possibly, social cohesion (19). Adult learning, say Abedini et al., (20) is a lifelong process whereby knowledge is formed through the transformation of adults' experience. The strength of adult education in particular, is its dual epistemological mandate to meet practical learning needs of individuals, groups, and systems while also attending to inclusion, representation, participation, critical reflectivity, and diversity amid unity (21).

#### 4. The CBE Hub life-long learning programmes

Ever since its establishment in 2017, Circular Built Environment (CBE) Hub is focused -just like its name implies- on exploring the impact of circularity to the built environment. Counting more than sixty members from different departments and knowledge domains, CBE Hub has been able to collect significant evidence and to consolidate a body of knowledge on how circularity manifests across scales and across different aspects. Building on this experience, the Hub has been involved in a series of key activities, all aimed at promoting research and education both for on-campus students, as well as for professionals and adults.

Lifelong education holds a central position in CBE Hub activities developing different types of educational formats in this direction. Although the term was introduced as early as 1929 by Yeaxlee, it has only become more pertinent as late as the 1970's when learning became responsive to the demands of globalization and the transition of the industrial society to the knowledge society (22). Lifelong education now signals every institutionalized learning opportunity that has a humanistic basis and can occur at any stage in the life span (ibid).

For CBE Hub, lifelong learning programs regard different audiences both in kind and in number as well as multiple mediums of communication and with varied impact. Below, follows a taxonomy of the main online learning offerings of TU Delft's Faculty of Architecture and the Built Environment. These range

from the more standard modules such as Massive Open Online Courses (MOOCs) to more tailor-made learning settings that target specific communities. Collective learning is key to enhancing the transformative capacity of cities: this requires transdisciplinary approaches, in which universities interact with societal stakeholders also in defining their research questions (23). It is also key for closing the knowledge gap between different stakeholders thus enabling the implementation of EU circular objectives as these are expressed in the new CE 2020 action plan. Afterall, imaginaries are more likely to emerge as collectively performed ideas of desirable futures if actors are brought together in new settings for that repositioning allows them to break out of the 'scene-act-ratio' of their institutional routines (24).

#### 4.1 Typology of interaction

**Massive Open Online Courses (MOOCs)** | Ever since their original appearance almost a decade ago, MOOCs have presented institutions with numerous opportunities to broaden their audience and to help them rethink and redesign their pedagogical approach (25). A series of MOOCs that focus on circularity in the built environment have been launched by the Faculty of Architecture and the Built Environment since 2019, such as the "Circular Economy for a Sustainable Built Environment" MOOC. These modules were designed to appeal to a large international audience consisting of individuals interested in learning more about circularity across different scales: all the way from products to buildings, to cities, and regions. In this regard, their premise lies mainly in raising awareness on the subject, while also allowing for an informal exchange



between learners that in turn helps them identify how circularity manifests around the globe.

**Fig. 1** – First MOOC in collaboration with the Faculty of Industrial Design and Engineering at TU Delft (left) and perhaps the most popular MOOC on circularity in the built environment with more than 12,500 viewers worldwide (right).

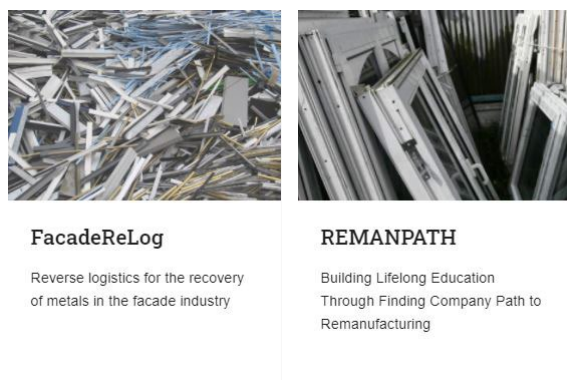
**Professional Education Courses** | Members of the CBE Hub have also been experimenting with yet another online learning format: that of Professional Education courses (ProfEds). These modules are more focused on a specific scale and have been developed around the idea of addressing

professional cohorts exclusively. Therefore, they are more effective in providing customized frameworks per sector or per industry. CBE Hub is currently running one ProfEd course for the product scale and another one for the regional scale. Whilst the first targets professionals from the building products' industry, the latter focuses more on individuals or groups involved in administration bodies. ProfEd cohorts are designed to be limited in number; thus, learners' exchange is more direct and feedback is more precise and systematic.



**Fig. 2** – There are two Professional Education courses available by the Faculty of Architecture and the Built Environment: the first focuses on the product scale (left) and the second on the regional one (right)

**Planned Collaboration Programmes (PCPs)** | Based on the experience of Professional Education courses and the increasing needs of companies to stay up-to-date with the latest developments in circular thinking and practice, the Hub has also engaged in what is called Planned Collaboration Programmes (PCPs). PCPs are based on direct interaction and exchange between academia and industry partners while focusing on one topic only. They can be held either online or in live meetings and they mainly consist of one-day long structured sessions that alternate between workshops and short lectures. Their strength lies in contextualizing the circular discourse around the participating companies' challenges, thus enabling the creation of more nuanced, individual approaches for each one of them respectively. CBE Hub has already run two PCPs: one on remanufacturing and another on reverse logistics for facades.



**Fig. 3** – Planned collaboration programmes that have

been implemented and funded by the EIT Raw Materials include one on Reverse Logistics for Façades (left) and another on Remanufacturing (right).

#### 4.2 Aims and goals

TU Delft has a long-standing tradition of online learning. However, there are several reasons why the CBE hub has engaged in trying out new educational formats. Each new type represents an attempt to reach a different audience, but also to increase the efficiency of the mutual exchange. Here are some of the key motives behind the Hub's educational initiatives.

**Integration of design and engineering knowledge into decision-making processes** | Engineering studies are said to constitute the biggest body of knowledge behind CE, however, they are not related to studies typical for social sciences and thus cannot lead to a paradigm shift (5). Circularity asks for systemic change and therefore also requires political intervention to some degree. This is why rethinking how knowledge gets mobilized for politics in an effective manner is essential and there is a need to engage people more viscerally in conversations about the future (24). Educational modules such as the ones described earlier provide with a means to openly communicate knowledge to a large audience thus raising awareness, but also -and most importantly- to specific individuals in key positions with the operational capacity to apply the knowledge in more strategic decision-making processes.

**Create shared understanding, identify barriers, provide alternatives** | All content included in the educational modules developed by the CBE Hub feeds directly from the Hub members' ongoing research. One of the Hub's main task then becomes systemizing those findings according to its own modelling of circularity in the built environment in a consistent narrative. What comes out of this process is later integrated in the various educational modules and the school curricula and even adapted depending on the type of the module. This is one critical point for making meaning, but still largely dependent on academic validation only.

Communicating the Hub's academic research to professionals in educational environments helps disseminate this knowledge to a bigger audience. But it can also provide with significant input as academic knowledge gets contested by the participants' experiential knowledge. Testing academic research against real-life examples through learners' interaction, helps identify its weaknesses, or shed light to various points for improvement. Furthermore, sharing notions of circularity across a wide array of stakeholders can help identify potential implementation barriers at multiple levels. At times, it can also lead to novel ideas.

In this light, academia informs practice of the ongoing research, and practice reciprocates the input

by contextualizing and situating this research in real case scenarios. This is why it is important that educational modules content meet the requirements of specific learning groups. This ensures that: a. the information is properly communicated to the designated audience; b. what is exchanged is pertinent to the participants' interests and abilities in so far as they can assess the validity of information exchanged and constructively contribute to any further discussion about it and thus, c. the relevance of exchange remains high throughout the duration of the course.

**Creating a community and a new cooperative ethos** | The social nature of cognition is seen as influential to adult learners' construction of knowledge (26,27,28) whereas dialogue is considered to be key to meaning-making processes (29). In the early 1980's Wenger's "Communities of Practice" and Lave's "Situated Learning" theories further promoted that learning takes place "through the communication and participation of members within a community" (ibid). The notion of community persists: in recent years, internet and the proliferation of digital technologies for learning caused learning communities to expand to the online realm. One of the major repercussions of this is that learning in the online environment has consistently challenged traditional modes of delivery and exchange giving way to multiple formats for fostering meaningful community interaction online. In that regard, CBE Hub learning offerings do not solely focus on delivering the technical knowledge produced within the Faculty, but also on creating different types of active learning communities at different scales.

Besides sharing educational content on circularity, CBE Hub programmes' set ups seek to implicitly establish active learning communities and ultimately distil the practice of working together with societal agents as a means for understanding and managing complexity. Participants in ProfEd courses for example are invited to check out their peers' projects and to also carry out live discussions on topics related to the learning objectives of the course during live webinars. This is why the experience of running this type of courses, is completely different every time largely depending on the profiles of the members of the cohort. Courses of this type that are addressed to either industry or administration professionals not only are built to allow direct exchange but they actually rely on it in order to provide learners with an opportunity to benefit from each other's knowledge.

## 5. Discussion: what we've learned so far, what we need to tend to in the future

**Change is possible** | Integrating circularity in educational modules such as the ones discussed in this paper can lead to both formal and informal

meaningful exchanges, contribute to a deeper understanding of circularity and even instigate change. Whereas audiences that only have a general interest in the subject can reflect on the implications of circularity on a more personal level, companies or organizations can significantly alter their status quo once exposed to academic research that is relevant to their scope. Planned collaboration programmes and to a certain extent ProfEd courses attest to that.

**Limitations** | There are, however, aspects that require special attention: one is assuring that all parties in the conversation are fairly represented: Schreiber-Barsch & Mauch (30) call this, "not only raising but also hearing voices as part of a dialogue in equal terms." Furthermore, in order to engage in conversation with an outside audience, academia needs to translate its work accordingly. Thus, every different type of module requires a revisiting of the format and the language to match the audience it addresses. Lastly, modules should always be susceptible to change themselves; their makers need to continuously evaluate the effectiveness of communication as well as the quality of exchange. As not all modules are efficient for all audiences, the weight falls primarily on academia to experiment with innovative formats and to determine new pedagogies for learning.

**Future challenges** | MOOCs as well as other online learning formats have enabled a free flow of information on different knowledge domains, however, as Barber et al., (31) argue, "current innovation and emergent thinking are taking place at the boundaries of disciplines, making traditional departmental silos a barrier to progress." In that regard, the task of academia needs to provide with innovative models that include and transcend traditional boundaries. CBE Hub learning communities of the future should be able to become more diverse and open up to an even wider spectrum of domains of expertise.

## 6. Conclusion

The understanding of circularity as well as its further development and integration are highly reliant on open cooperation between involved parties. CBE Hub has been trying to provide with different types of safe learning spaces that allow this concept to be socially performed. By proliferating courses in number, in kind and across different topics these courses also aspire to establish a continuous presence for academia and by that to rally different individuals or groups around the act of learning and working together with others as a means of tackling today's complexity and uncertainty. This is a time that challenges academia to reimagine its own future role and to explore its own potential in assisting the transition to a circular built environment. In that regard, CBE Hub efforts focus on transcending the traditional academic role of producing technical knowledge and strengthening circuits of capital towards also establishing new circuits of meaning

and values amongst affected stakeholders and society in general.

## 7. References

1. Buchanan, P. (2018). *Reweaving Webs of Relationships*. e-flux Architecture, overgrowth. Available from: <https://www.e-flux.com/architecture/overgrowth/221630/reweaving-webs-of-relationships/>
2. Ehrlich PR, Ehrlich AH. Solving the human predicament. *Int J Environ Stud*. 2012 Aug;69(4):557–65.
3. LERU Position Paper. *Productive Interactions: Societal Impact of Academic Research in the Knowledge Society*. 2017 March. Available from: <https://www.leru.org/publications/productive-interactions-societal-impact-of-academic-research-in-the-knowledge-society>.
4. Wiesmeth H. The circular economy – Understanding the concept. In: *Implementing the Circular Economy for Sustainable Development* [Internet]. Elsevier; 2021 [cited 2021 Dec 13]. p. 11–8. Available from: <https://linkinghub.elsevier.com/retrieve/pii/B9780128217986000028>
5. Korhonen J, Nuur C, Feldmann A, Birkie SE. Circular economy as an essentially contested concept. *J Clean Prod*. 2018 Feb;175:544–52.
6. Murray A, Skene K, Haynes K. *The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context*. *J Bus Ethics*. 2017 Feb;140(3):369–80.
7. Mathews JA, Tan H. Progress Toward a Circular Economy in China: The Drivers (and Inhibitors) of Eco-industrial Initiative. *J Ind Ecol*. 2011 Jun;15(3):435–57.
8. Völker T, Kovacic Z, Strand R. Indicator development as a site of collective imagination? The case of European Commission policies on the circular economy. *Cult Organ*. 2020 Mar 3;26(2):103–20.
9. Ioannou O, Geldermans B, Klein T, Konstantinou T, Overschie M, Wandl A. *Integrating Circularity in Education: the CBE Hub Approach at the Faculty of Architecture and the Built Environment*, Delft University of Technology. BK Books.
10. Corvellec H, Stowell AF, Johansson N. Critiques of the circular economy. *J Ind Ecol*. 2021 Aug 17;jiec.13187.
11. Hobson K, Lynch N. Diversifying and de-growing the circular economy: Radical social transformation in a resource-scarce world. *Futures*. 2016 Sep;82:15–25.
12. Marin J, De Meulder B. Interpreting Circularity. *Circular City Representations Concealing Transition Drivers*. *Sustainability*. 2018 Apr 24;10(5):1310.
13. Casson C, Welch D. *Histories and Futures of Circular Economy*. In: Bali Swain R, Sweet S, editors. *Sustainable Consumption and Production, Volume II* [Internet]. Cham: Springer International Publishing; 2021 [cited 2021 Dec 6]. p. 35–54. Available from: [https://link.springer.com/10.1007/978-3-030-55285-5\\_3](https://link.springer.com/10.1007/978-3-030-55285-5_3)
14. Oomen J, Hoffman J, Hajer MA. Techniques of futuring: On how imagined futures become socially performative. *Eur J Soc Theory*. 2021 Jan 27;136843102098882.
15. Gümüşay AA, Reinecke J. Researching for Desirable Futures: From Real Utopias to Imagining Alternatives. *J Manag Stud*. 2021 May 6;joms.12709.
16. Hughes F, Lokko L. A school willing to take risks. *Architectural Review* 2021.
17. Callan E. Education in Safe and Unsafe Spaces. *Philos Inq Educ*. 2020 Jul 15;24(1):64–78.
18. UN General Assembly, *Transforming our world : the 2030 Agenda for Sustainable Development*, 21 October 2015, A/RES/70/1, available at: <https://www.refworld.org/docid/57b6e3e44.html> [accessed 4 January 2022]
19. Feinstein L, Centre for Research on the Wider Benefits of Learning (London E. *The contribution of adult learning to health and social capital*. London: Centre for Research on the Wider Benefits of Learning; 2003.
20. Abedini A, Abedin B, Zowghi D. Adult learning in online communities of practice: A systematic review. *Br J Educ Technol*. 2021 Jul;52(4):1663–94.
21. Nicolaidis A, Marsick VJ. Understanding Adult Learning in the Midst of Complex Social “Liquid Modernity”: Understanding Adult Learning in the Midst of Complex Social “Liquid Modernity”. *New Dir Adult Contin Educ*. 2016 Mar;2016(149):9–20.
22. Jarvis P, Jarvis P. *Adult education and lifelong learning theory and practice*. London: RoutledgeFalmer; 2004.
23. Dirth E. *Imagining Urban Futures: Inaugural Festival of the Urban Futures Studio*. Universiteit Utrecht, March 16-17, 2017. Available from:
24. Hajer MA, Pelzer P. 2050—An Energetic Odyssey: Understanding ‘Techniques of Futuring’ in the transition towards renewable energy. *Energy Res Soc Sci*. 2018 Oct;44:222–31.
25. Hollands F M, Tirthali D. *MOCs: expectations and reality*. Full report. Center for BenefitCost Studies of Education, Teachers College, Columbia University, NY; 2014.
26. Vygotsky L. *Thought and Language* (revised edition). Cambridge, MA: MIT Press; 1986.
27. Bandura A. *Social Learning Theory*. New York: General Learning Press; 1971.
28. Zimmerman BJ. A social cognitive view of self-regulated academic learning. *J Educ Psychol*. 1989;81(3):329–39.
29. Stacey E, Smith PJ, Barty K. Adult learners in the workplace: online learning and communities of practice. *Distance Educ*. 2004 May;25(1):107–23.
30. Schreiber-Barsch S, Mauch W. Adult learning and education as a response to global challenges: Fostering agents of social transformation and sustainability. *Int Rev Educ*. 2019 Aug;65(4):515–36.
31. Barber M, Donnelly K, Rizvi S. (2013). *An Avalanche is coming: Higher Education and the Revolution Ahead*. Available from IPPR, Institute for Public Policy Research Report. <https://www.ippr.org/publications/an-avalanche-is-coming-higher-education-and-the-revolution->

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Data sharing not applicable to this article as no datasets were generated or analysed during the current study.