

**Questioning Collaboration in the Circular Built Environment  
Multi-cycle, Multi-scalar and Multi-level Perspectives in the Renovation Sector**

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# QUESTIONING COLLABORATION IN THE CIRCULAR BUILT ENVIRONMENT: MULTI-CYCLE, MULTI-SCALAR AND MULTI-LEVEL PERSPECTIVES IN THE RENOVATION SECTOR

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Research on the circular built environment has to date focussed mainly on technical aspects of circularity in the built environment, emphasising the development of methods, tools, and frameworks to facilitate technical solutions that can narrow, slow, close, and regenerate materials cycles. Despite progress made in understanding the technical possibilities of circularity in the built environment, and although there has been longstanding acknowledgement that new forms of inter- and transdisciplinary collaboration are needed to accelerate and scale up solutions for the circular built environment, studies have also consistently highlighted the lack of collaboration as a significant barrier. In this position paper, we argue that existing research tends to focus on collaboration at the level of the building project, and this neglect calls for developing longer-term collaboration for circularity as a multi-level transition that considers the interactions between multiple parties involved in extended and multiple product lifecycles traversing multiple scales beyond the building project.

Keywords: circularity; multi-cycle; multi-scalar; multi-level; transitions

## INTRODUCTION

Globally, there is growing interest in developing a circular built environment and to meet several societal and sustainability transitions, such as the energy transition and the provision of affordable housing. A critical challenge in these transitions lie in the need to transform, renovate, and adapt existing buildings at scale (International

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Energy Agency, 2020). Yet, at the same time, it is well-known that, relying on traditional linear-economy methods of ‘take, make and dispose’, the sector is extremely resource-intensive, consuming around 40% of the world’s raw materials with only a small proportion of these (for instance, around 3-4% in the Netherlands) being reused at the end-of-life (e.g., Schut *et al.*, 2015; Pomponi and Moncaster, 2017; Kanters, 2020; Wahlström *et al.*, 2020).

Research on making the circular transition has to date focussed mainly on technical aspects of circularity in the built environment, emphasising the development of methods, tools, and frameworks to facilitate technical solutions that can narrow, slow, close and to a lesser extent regenerate materials cycles (e.g., Pomponi and Moncaster, 2017; van Stijn and Gruis, 2020; Çimen, 2021). Experimental pilots abound that stress the importance of circular designs that promote a greater degree of standardisation and modularisation to facilitate demountability and reuse of materials (e.g., Buildings as Material Banks, *ud.*). Despite progress made in understanding the technical possibilities of circularity in the built environment, two significant scientific and practical blind spots remain under-examined. Firstly, research has focussed mainly on circular designs for new buildings, with far less attention on renovating and adapting existing buildings. Applying circular design and construction approaches to renovation is particularly challenging, since solutions must consider limitations and barriers stemming from the original construction and current user preferences (e.g., Stolker and van Stijn, 2021). And because renovations are often conducted with the aim of increasing the energy efficiency and thereby reducing emissions during the use of buildings, a ‘whole life cycle’ approach is thus necessary.

Secondly, although there has been longstanding acknowledgement that new forms of inter- and transdisciplinary collaboration are needed to accelerate and scale up solutions for the circular built environment, studies have also consistently highlighted the lack of collaboration as a significant barrier (see e.g., a recent review in Çimen, 2021; and Kooter *et al.*, 2021; Sudusinghe and Seuring, 2022). Knowledge and guidance are still lacking as to what and how these new forms of collaboration can be put to practice (e.g., Çimen, 2021; Adams *et al.*, 2017; Kirchherr *et al.*, 2018; Leising *et al.*, 2018; Ollàr *et al.*, 2020; Çetin *et al.*, 2021). In this position paper, we argue that research on collaboration in the built environment will need to expand the focus to consider how collaboration can be stimulated and sustained beyond the level of the building project. Where circularity is concerned in the context of building renovation, there is a need to situate collaboration within the context of multi-level transitions (Geels, 2020) that in turn accounts for the interactions between multiple parties involved in extended and multiple product lifecycles traversing multiple scales beyond the singular building project (e.g., Dokter *et al.*, 2021; Heurkens and Dąbrowski, 2020).

This position paper is developed as follows. First, we sketch out ongoing transition towards a circular built environment in the context of building renovation, highlighting how challenges of a conservative sector navigating through the uncertainties of the circular transition can stymie the potential for engendering collaborative practices. Second, while there has been longstanding interest in studying collaboration in construction management research, studies have so far focussed on fostering collaborations at the project level. These tend not to consider collaboration that stretches over multiple product lifecycles in the longer-term. Third, using real-world examples, questions are raised with a view to better understand and

develop collaboration that cuts across multiple levels of analysis and multiple spatial scales.

## **REVIEW OF PREVIOUS STUDIES**

The transition towards circular renovation of buildings is now in a turbulent period and has attracted societal and academic attention (Leising *et al.*, 2018). Although there have been experiments in pilot projects to address circularity in building renovation, these are limited in terms of scaling up new practices (van Bueren and Broekhans, 2013), in part due to the technical focus of these pilots. Consequently, this technical emphasis downplays social and psychological aspects, which are also (if not, more) critical for driving learning and behavioural change (see Stam *et al.*, 2023). The invention and acceptance of new construction techniques by the organisations involved in circular renovation asks for a change in the kind of collaborative behaviour in the construction chain, one that moves away from the adversarial climate of power play and competition often associated with the construction industry (van Marrewijk *et al.*, 2014; van Marrewijk *et al.*, 2016).

Indeed, the conservative culture of the building renovation sector is a well-known obstacle that prevents the sector from breaking away from well-known traditional routines and scaling up new management practices (Wamelink and Heintz, 2015). For example, the ‘renovation accelerator’, which is the bundling of renovation work, was intended to transform the renovation of social housing in the Netherlands by exploiting synergies and economies of scale. This has reportedly failed due to ossified cultural practices in the sector (van Belzen, 2021), which reflects a larger history of failed attempts to change the Dutch construction sector into a high-quality and innovative sector (e.g., Priemus, 2004; Nijhof *et al.*, 2008; Sminia, 2011; van Marrewijk *et al.*, 2014).

While the narrative of deficiencies in previous reforms persists, past prescriptive calls and roadmaps for cultural change can be difficult to realise since these do not emphasize reflective practice that stimulates how (rather than what) cultural change can happen, the constraints and contradictions that might emerge, and how practitioners can overcome these. A high level of uncertainty regarding the costs and benefits of interventions remains (Meglin *et al.*, 2022). This uncertainty prevents actors in the building renovation sector from looking more broadly than short-term financial impacts to their respective organisations, which in turn leads to non-collaborative behaviours (Liu *et al.*, 2019).

While the technical possibilities of circular solutions are relatively well researched, a significant yet under-examined bottleneck lies in driving behavioural change through inter- and transdisciplinary collaboration (e.g., Pomponi and Moncaster, 2017; Rios *et al.*, 2022). Although collaboration has been identified as a key factor to scale up and accelerate circularity in the built environment, studies that develop new ways of collaborating are rare, particularly in the context of building renovation. Except for Leising *et al.*, (2018), studies often reiterate the perennial problem of a lack of willingness to collaborate (e.g., Adams *et al.*, 2017; Kirchherr *et al.*, 2018; Ollár *et al.*, 2020; Çetin *et al.*, 2021; Dokter *et al.*, 2021; Kooter *et al.*, 2021) rather than to produce the practices, structures, and strategies on how to make collaboration work for the circular built environment.

Furthermore, where collaboration has been addressed in previous studies, these tend to narrowly focus on the single building project. For example, in a recent systematic

review of 110 studies on collaboration in construction, Deep *et al.*, (2021) identified a number of key enabling factors, including trust, commitment and reliability, that facilitate collaboration in the context of project execution decisions that can contribute to project productivity. Koolwijk *et al.*, (2022) also found that financial rules can create or constrain the conditions lead to the building of trust and a no-blame culture, which in turn lead to the promotion or prevention of long-term project collaborations.

A common feature in studies on collaboration in construction is the characterisation of the industry as a fragmented sector of different professional actors/roles vying for their respective self-interest, often identifying critical success factors to offer prescriptions for addressing such fragmentation. Yet, already two decades ago, such research has drawn critical attention. Murray and Langford (2003), for instance, argued that scholars have focussed narrowly on the usual suspects (i.e., the client, contractor, and designer), often centring attention on a narrow set of performance measures (typically of time and cost) when addressing the problem of fragmentation (see also Chan, 2023). In responding to the trend of partnering in the late 1990s, Bresnen (2007) critiqued prescriptions of strategic alignment, standardisations, and performance benchmarking, and argued that exhortations of collaboration downplayed the complexities, fragilities, and problems of collaboration.

Two decades on and confronting the challenges of circularity in the built environment, it appears such criticisms remain relevant. In calling for innovation to develop sustainable built environment, Lizarralde *et al.*, (2014) analysed 50 peer-reviewed case studies to highlight how studies have generally focussed on internal project stakeholders while ignoring collaboration and participation of external stakeholders, particularly engagement with community actors external to the project. They noted especially the need to go beyond integration of project teams to consider how multiple clients can come together to embark on more ambitious projects and champion innovation that goes beyond the status quo to meet stronger environmental and social goals. Raouf and Al-Ghamdi (2019) also reviewed 43 qualitative studies and 24 quantitative studies on integrated project delivery to show how time and cost performance measures within the boundary of the construction project still shapes studies into delivery models and analyses of collaboration and integration.

Indeed, in tracing the social networks of front-runners in circularity in the built environment, Gerding *et al.*, (2021) also demonstrated how networks of the usual suspects of clients, contractors and designers often keep new actors such as the circularity advisor at bay, thereby reducing the influence of these actors in pushing forward the circularity agenda. Chen *et al.*, (2021) also systematically reviewed literature on construction supply chains. They concluded that previous studies tended to dwell on the project level, by focussing narrowly on design-to-production, production-to-logistics, and production-to-site-assembly phases, reinforcing the enablers such as project-level contracts and incentives, knowledge sharing systems at the project level and technological enablers such as linked databases for design coordination, design for manufacturing software platforms and automated monitoring technologies. The emphasis on project-level collaboration constitutes, as Vosman *et al.*, (2023) argued, a significant barrier in developing what they termed as "project-transcending innovation" (p.458) that can transform the built environment considering the grand challenges of climate change adaptation and the circular economy.

Thus, to achieve a circular renovation industry there is a need to investigate and develop long-term collaboration beyond the scope and scale of the project. As



Jacobsson and Söderholm (2022) recently articulated in their essay on homo projecticus, project managers are often guided by temporal and scope bracketing, which, while reducing complexity and containing uncertainty within the confines of the project, can risk becoming "blinders that prevent decision-makers from seeing the bigger picture [...] unforeseen ethical consequences or consequences related to sustainability occurring as a long-term, or parallel, effect of the actions taken" (p.318). In the next section, questions are raised as to how, in addressing these sustainability consequences through the reuse of building materials and components, there is merit in considering the significance of multiple and extended product lifecycles, accounting for the dynamic interactions between multiple levels from projects to industry regime to society at large, and across multiple scales covering cross-sectoral cooperation at an area-based neighbourhood scale.

## **DISCUSSION**

### *Raising new questions about collaboration in circular building renovation: towards multi-cycle, multi-level, and multi-scalar perspectives*

Unlike project-based design and construction of new buildings, a key distinguishing feature of circularity in building renovation is the longevity of built environment products (e.g., structural elements, building services), with many lasting several years or even decades (e.g., Dokter *et al.*, 2021). The variety of built environment products also means that collaboration in the circular built environment must extend beyond the building project ('here and now'), to consider multiple product lifecycles that extend into the longer-term future (Rodríguez *et al.*, 2020). For example, solar panels are increasingly offered as a renovation option to provide a useful source of renewable energy to meet the energy transition. In 2020, the number of solar panels installed just in Amsterdam grew by 70%, with nearly half a million panels already installed in Amsterdam. Yet, more and more panels are replaced prior to reaching their end-of-life, leading to unnecessary use of new, increasingly scarce, and toxic metals (see Kerp and Jönsthövel, 2021). Furthermore, in the European context, new solar panels tend to be produced and imported from far away countries like China. Therefore, there are long-term uncertainties surrounding the supply, long-term maintenance, and safe decommissioning of solar panels at the end-of-life so that the hazardous materials contained in these panels can be reused safely and efficiently. Yet, this requires collaborative arrangements that go beyond the lifespan of the single project to cover the lifetime of the solar panels set within the uncertain context of renovation and maintenance decisions over the lifetime of the building. Thus, there is also the likelihood of developing collaborative relationships with not-yet-known parties in the chain, especially given how the lifespan of a building and its products may outlive the lifespan of the firms providing the products and services in the first place.

While projects have been conceptualised as portals of innovation for sustainable building (van Bueren and Broekhans, 2013), optimisation of project decisions can also jeopardise wider societal challenge of resource and energy efficiency. To avoid what Hall and Bonanomi (2021) termed as the "tragedy of the project" where partners withdraw too many resources from the project leaving a depletion of resources available in the common pool, project decisions need to be situated within a multi-level transition framework so that decisions for circular renovation can be done in coordination with transforming the regime and changing broader behavioural and societal norms and values (Heurkens and Dąbrowski, 2020; Rios *et al.*, 2022; Stam *et al.*, 2023). To date, though, consideration of multilevel perspectives in relation to construction projects is rare (see e.g., van Uden *et al.*, 2022; Chan, 2023).

In challenging current narrow focus on the building project, there is a need to rethink spatiotemporal dynamics of the activities and relationships (e.g., Jensen *et al.*, 2016) in producing the circular built environment. A perennial challenge with circularity is to secure the appropriate reusable and recyclable materials at the time and place that is needed (Chan *et al.*, 2021). This requires the timely involvement and embedding of emerging new actors that are currently not integrated, e.g., circularity advisors (Gerding *et al.*, 2021). In addition to inter-organisational project collaborations, there is scope to consider presently-underexamined inter-sectoral collaborations (e.g., between construction, manufacturing, and the logistics sectors) with a neighbourhood focus (e.g., Koch-Ørvad *et al.*, 2019; Hedborg and Karrbom Gustavsson, 2020; Çimen, 2021). Koch-Ørvad's *et al.*, (2019) study is a noteworthy example of taking a multi-scalar collaboration approach. They presented a case study of Gamle Mursten, a Danish company that specialises in cleaning and selling reused bricks. Although there is an estimated potential to reuse 47 million bricks a year, as a disruptor, Gamle Mursten faced many obstacles including the ability to stimulate demand in the market, getting access to old bricks, and regulatory hurdles in certifying the structural strength and quality of reused bricks. Koch-Ørvad *et al.*, (2019) observed that Gamle Mursten tackled these challenges by concurrently starting six projects, half of which were aimed at addressing the problem of access to reused bricks (i.e. supply-side problem) and the other half targeted at improving the documentation and certification problem (i.e. to stimulate demand), in order to build the ecosystem and secure their position as intermediary to stimulate supply and demand for reused bricks in Denmark (see also Vosman *et al.*, 2023).

Koch-Ørvad's *et al.*, (2019) study raises an important knowledge gap in terms of seeing beyond the construction project. When the 'project' is often examined in construction management research, there is often a tacit assumption that the project is a 'building' project. Attention is then placed on identifying optimal pathways to ensure that the building is completed on time and on budget. Yet, the analysis of Gamle Mursten shows that alongside the 'building' project, companies can often start other concurrent projects to facilitate change and innovation. This multi-project context is rarely considered in the construction management literature. Indeed, their study was also revealing of the multi-level practices of confronting and negotiating the existing regime (e.g., by offering alternative value propositions and collaborative opportunities to demolishers and finding ways to circumvent prevailing certification schemes) through micro-level routines in the building project. In so doing, they also show how Gamle Mursten combined both exploration and exploitation in growing the use of reused bricks.

## CONCLUDING REMARKS

This position paper builds on growing interest in the sustainability transition of moving towards a circular built environment. While studies on circularity have focussed on the design and construction of new buildings, circularity in the context of building renovations is relatively under-examined. Despite recognition of the importance of collaboration in the circular transition, existing studies have tended to highlight the challenges and problems with collaboration while falling short of presenting possible solutions. In this position paper, an argument has been made to consider collaboration beyond the project level, to take into account multiple and extended product lifecycles, multiple levels of engagement in the circular transition, and multi-scalar collaborations that consider the ecology of adjacent projects alongside and beyond the 'building' project.

In taking multi-cycle, multi-level and multi-scalar perspectives to study and develop ways to collaborate in circular renovation, several critical questions can be raised for future research. First, from a multi-cycle perspective, there is a need to shift our thinking away from project-based collaboration to collaboration over multiple product life cycles. Yet, given that part of the ambition of circularity is to prolong the lifespan of products, there is a need to address the challenges of collaboration in the context of the uncertainties associated with not-yet-identified partners, particularly in the repair and maintenance of products and especially since products are, in principle, likely to outlive the lifespan of the firms that produce these products in the first place. Second, from a multi-level perspective, the shift away from project-based collaboration necessitates collaboration with the less-usual stakeholders in the regime. How can new actors such as the circularity advisor and local communities external to the project be embraced and empowered to influence choices made at the project level? How can lessons be captured and spread from collaborations at the project level to transform the regime?

Third, from a multi-scalar perspective, in moving away from simply looking at the 'building' project, questions remain as to how scholars and practitioners can strengthen coordination across multiple projects, perhaps at a neighbourhood level. To date, research is limited in explaining how actors in/from one project (can) coordinate with actors in adjacent projects, within a firm (as in the case of Gamle Mursten) or across firms at an area level, so that the demand and supply of secondary materials in the market can be better connected. What are the opportunities and obstacles of collaboration beyond the local context of the project, including collaborations with actors at multiple scales such as neighbourhood area, city, national and inter-national scale, to facilitate the transition in circular building renovation? In any case, taking multi-cycle, multi-level and multi-scalar perspectives will likely alter the framing of the construction manager and her/his role beyond the narrow confines of delivering the project in a timely and cost-effective manner. In what ways will taking such perspectives alter the role of the construction manager, and their facilitation of collaboration beyond the project, remain an area for further investigation.

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## **REFERENCES**

- Adams, K T, Osmani, M, Thorpe, T, Thornback, J (2017) Circular economy in construction: Current awareness, challenges and enablers, *Proceedings of Institution of Civil Engineers: Waste and Resource Management*, **170**(1), 15-24.
- Bresnen, M (2007) Deconstructing partnering in project-based organisation: Seven pillars, seven paradoxes and seven deadly sins, *International Journal of Project Management*, **25**(4), 365-374.
- Buildings as Material Banks (undated) *Case Studies and Pilots*, Available from: <https://www.bamb2020.eu/topics/pilot-cases-in-bamb/> [Accessed 7 April 2023].
- Çetin, S, Gruis, V and Straub, A (2021) Towards circular social housing: An exploration of practices, barriers and enablers, *Sustainability*, **13**(4), 2100.

- Chan, P W, De Wolf, C and Koutamanis, A (2021) *The Digital Potential in Creating a Circular Construction Economy*, Working paper produced for the De Raad voor de leefomgeving en infrastructuur, Den Haag: Rli, Available from: [https://www.rli.nl/sites/default/files/essay\\_3\\_the\\_digital\\_potential\\_in\\_creating\\_a\\_circular\\_construction\\_economy\\_-\\_tu\\_delft\\_paul\\_chan\\_def\\_1.pdf](https://www.rli.nl/sites/default/files/essay_3_the_digital_potential_in_creating_a_circular_construction_economy_-_tu_delft_paul_chan_def_1.pdf) [Accessed 7 April 2023].
- Chan, P W (2023) Beyond the boundary and scale of the construction project, In: A Dainty and R Leiringer (Eds.) *Research Agenda for Construction Management Research*, Cheltenham: Edward Elgar, 117-139.
- Çimen, Ö (2021) Construction and built environment in circular economy: A comprehensive literature review, *Journal of Cleaner Production*, **305**, 127180.
- Deep, S, Gajendran, T and Jeffries, M (2021) A systematic review of 'enablers of collaboration' among participants in construction projects, *International Journal of Construction Management*, **21**(9), 919-931.
- Dokter, G, Thuvander, L and Rahe, U (2021) How circular is current design practice? Investigating perspectives across industrial design and architecture in the transition towards a circular economy, *Sustainable Production and Consumption*, **26**, 692-708.
- Fernie, S, Leiringer, R and Thorpe, T (2006) Change in construction: A critical perspective, *Building Research and Information*, **34**(2), 91-103.
- Geels, F W (2020) Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory, *Technological Forecasting and Social Change*, **152**, 119894.
- Gerding, D P, Wamelink, J W F and Leclercq, E M (2021) Implementing circularity in the construction process: A case study examining the reorganisation of multi-actor environment and the decision-making process, *Construction Management and Economics*, **39**(7), 617-635.
- Hall, D M and Bonanomi, M M (2021) Governing collaborative project delivery as a common-pool resources scenario, *Project Management Journal*, **52**(3), 250-263.
- Hedborg, S and Karrbom Gustavsoon, T (2020) Developing a neighbourhood: exploring construction projects from a project ecology perspective, *Construction Management and Economics*, **38**(10), 964-976.
- Heurkens, E and Dąbrowski, M (2020) Circling the square: Governance of the circular economy transition in the Amsterdam Metropolitan Area, *European Spatial Research and Policy*, **27**(2), 11-31.
- International Energy Agency (IEA) (2020) *The Netherlands 2020: Energy Policy Review*, Paris: International Energy Agency.
- Jacobsson, M and Söderholm, A (2022) An essay on 'Homo Projecticus': Ontological assumptions in the projectified society, *International Journal of Project Management*, **40**(4), 315-19.
- Jensen, A, Thuesen, C and Geraldi, J (2016) The projectification of everything: Projects as a human condition, *Project Management Journal*, **47**(3), 21-34.
- Kanters, J (2020) Circular building design: An analysis of barriers and drivers for a circular building sector, *Buildings*, **10**(4), 77.
- Kerp, H and Jönsthövel, I (2021) *Kansen En Uitdagingen Voor Circulaire Zon PV Met Focus Op Materiaal En Technologie*, Available from: <https://klimaatweb.nl/publicaties/kansen-en-uitdagingen-voor-circulaire-zon-pv/> [Accessed 27 July 2023].

- Kirchherr, J, Piscicelli, L, Bour, R, Kostense-Smit, E, Muller, J, Huibrechtse-Truijens, A and Hekkert, M (2018) Barriers to the circular economy: Evidence from the European Union (EU), *Ecological Economics*, **150**, 264-272.
- Koolwijk, J, van Oel, C and Bel, M (2022) The interplay between financial rules, trust and power in strategic partnerships in the construction industry, *Engineering, Construction and Architectural Management*, **29**(3), 1089-1108.
- Koch-Ørvad, N, Thuesen, C, Koch, C and Berker, T (2019) Transforming ecosystems: Facilitating sustainable innovations through the lineage of exploratory projects, *Project Management Journal*, **50**(5), 602-616.
- Kooter, E, Van Uden, M, Van Marrewijk, A, Wamelink, H, Van Bueren, E and Heurkens, E (2021) Sustainability transition through dynamics of circular construction projects, *Sustainability*, **13**, 12101.
- Leising, E, Quist, J and Bocken, N (2018) Circular Economy in the building sector: Three cases and a collaboration tool, *Journal of Cleaner Production*, **176**, 976-989.
- Lizarralde, G, Bourgault, M, Drouin, N and Viel, L (2014) Stakeholder integration champions and innovation in the built environment, In: F Orstavik, A Dainty and C Abbott (Eds.) *Construction Innovation*, Chichester: Wiley Blackwell, 47-64.
- Liu, Y, van Marrewijk, A H, Houwing, E and Hertogh, M (2019) The co-creation of values-in-use in the front end of infrastructure development programs, *International Journal of Project Management*, **37**(5), 684-695.
- Meglin, R, Kytzia, S and Habert, G (2022) Regional circular economy of building materials: Environmental and economic assessment combining material flow analysis, input-output analyses and life cycle assessment, *Journal of Industrial Ecology*, **26**(2), 562-576.
- Murray, M and Langford, D (Eds.) (2003) *Construction Reports 1944-98*, Oxford: Blackwell.
- Nijhof A, Karssing E, Wirtz R and de Bruijm, T (2008) *En Nu Doorpakken! Gedragsverandering in De Nederlandse Bouwsector*, Assen: Van Gorcum.
- Ollár, A, Femenías, P, Rahe, U and Granath, K (2020) Foresights from the Swedish kitchen: Four circular value opportunities for the built environment, *Sustainability*, **12**(16), 6394.
- Owojori, O M and Okoro, C (2022) The private sector role as a key supporting stakeholder towards circular economy in the built environment: A scientometric and content analysis, *Buildings*, **12**(5), 695.
- Pomponi, F and Moncaster, A (2017) Circular economy for the built environment: A research framework, *Journal of Cleaner Production*, **143**, 710-718.
- Priemus H (2004) Dutch contracting fraud and governance issues, *Building Research and Information*, **32**(4), 306-312.
- Raouf, A M and Al-Ghamdi, S G (2019) Effectiveness of project delivery systems in executing green buildings, *ASCE Journal of Construction Management and Engineering*, **145**(10).
- Rios, F C, Panic, S, Grau, D, Khanna, V, Zapitelli, J and Bilec, M (2022) Exploring circular economies in the built environment from a complex systems perspective: A systematic review and conceptual model at the city scale, *Sustainable Cities and Society*, **80**, 103411.
- Rodríguez, R W, Pomponi, F, Webster, K and D'Amico, B (2020) The future of the circular economy and the circular economy of the future, *Built Environment Project and Asset Management*, **10**(4), 529-546.

- Schut, E, Crielaard, M and Mesman, M (2015) Circular economy, *In: The Dutch Construction Sector: A Perspective for the Market and Government*, Rijkswaterstaat and RIVM.
- Sminia H (2011) Institutional continuity and the Dutch construction industry fiddle, *Organisation Studies*, **32**(11), 1559-1585.
- Stam, K, van Ewijk, E and Chan, P W (2023) How does learning drive sustainability transitions? Perspectives, problems and prospects from a systematic literature review, *Environmental Innovation and Societal Transitions*, **48**, 100734.
- Stolker, M and van Stijn, A (2021) *Handboek Circulair Renoveren Woningcorporaties*, Amsterdam: AMS Institute.
- Sudusinghe, J and Seuring, S (2022) Supply chain collaboration and sustainability performance in circular economy: A systematic literature review, *International Journal of Production Economics*, **245**, 108402.
- Thelen, D, van Acoleyen, M, Huurman, W, Thomaes, T, van Brunschot, C, Edgerton, B and Kubbinga, B (2018) *Scaling the Circular Built Environment: Pathways for Business and Government*, Geneva and Amsterdam: World Business Council for Sustainable Development and Circle Economy.
- van Belzen T (2021) *Renovatieversneller Was Van Begin Af Aan Een Dramaprogramma*, 19 April, Available from: <https://www.cobouw.nl/294772/renovatieversneller-was-van-begin-af-aan-een-dramaprogramma> [Accessed 6 June 2022].
- van Bueren, E and Broekmans, B (2013) Individual projects as portals for mainstreaming niche innovations, *In: R L Henn and A J Hoffman (Eds.) Constructing Green: the Social Structures of Sustainability*, Cambridge, Massachusetts: MIT Press, 145-168.
- van Marrewijk A H, Veenswijk M and Clegg S R (2014) Changing collaborative practices through cultural interventions, *Building Research and Information*, **42**(3), 330-342.
- van Marrewijk A H, Ybema S, Smits K, Clegg, S and Pitsis, T (2016) Clash of the Titans: Temporal organising and collaborative dynamics in the Panama Canal megaproject, *Organisation Studies*, **37**(12), 1745-1769.
- van Stijn, A and Gruis, V (2020) Towards a circular built environment: An integral design tool for circular building components, *Smart and Sustainable Built Environment*, **9**(4), 635-653.
- van Uden, M, Wamelink, H van Bueren, E and Heurkens, E (2022) *Reconfiguring Practices in Transitions Towards More Circular Systems: Two Framework Designs for the AEC Sector*, ARCOM Working Papers Compendium.
- Vosman, L, Coenen, T B J, Volker, L and Visscher, K (2023) Collaboration and innovation beyond project boundaries: Exploring the potential of an ecosystem perspective in the infrastructure sector, *Construction Management and Economics*, **41**(6), 457-474.
- Wahlström, M, Bergmans, J, Teittinen, T, Bachér, J, Smeets, A and Paduart, A (2020) *Construction and Demolition Waste: Challenges and Opportunities in a Circular Economy*, Eionet Report - ETC/WMGE 2020/1, Mol, Belgium: European Topic Centre on Waste and Materials in a Green Economy.
- Wamelink J and Heintz J (2015) Innovating for integration: Clients as drivers for industry improvement, *In: F Orstavik, A Dainty and C Abbott (Eds.) Construction Innovation*, Chichester, UK: Wiley Blackwell, 149-164.