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CIRCULAR INFRASTRUCTURE IN TERMS OF INSTITUTIONAL LOGICS

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The concept of the circular economy (CE) has gained popularity in addressing concerns related to environmental sustainability. However, difficulties arose in scaling up and integrating CE solutions into the infrastructure sector. This paper argues that the institutional logics underlying the current infrastructure sector are incompatible with the logics on which CE is based. To examine this, we conducted a study using literature and empirical evidence from the Dutch infrastructure agency though in-depth interviews. By relating the arguments of interviewees to values, norms, and worldviews, we were able to establish and compare the prevailing logics held by infrastructure professionals with those related to CE. The results reveal a conflict between the dominant market logic in CE development and the prevalent state and project logics that guide infrastructure practices. These findings highlight the importance of strong leadership from public clients to incorporate CE principles into construction processes. By addressing the institutional barriers to CE scaling, this paper contributes to the ongoing discussion on implementing CE in the infrastructure sector and provides valuable insights for policymakers and public clients.

Keywords: circular economy; institutional logics; transition; infrastructure; agency

INTRODUCTION

In European countries, circular economy (CE) has gained significant attention in addressing environmental sustainability concerns within construction. CE is generally understood as an integral set of principles to close, slow, and narrow resource loops (Mhatre *et al.,* 2021). Being in line with a sustainable future, circularity is presented as one of the promising directions for a future-proof construction sector. Despite its growing popularity in policy and the emergence of many pilot-scale initiatives and innovations, there is a gap in achieving upscaling and systemic embedding of CE solutions in the infrastructure sector (Circle Economy, 2023; PBL, 2023). In contrast, solutions in the domains of energy transition and carbon reduction seem to experience a more vigorous institutionalization, although falling behind their targets (OECD, 2022). While public organizations can stimulate and enforce circular requirements in projects through procurement and legislation, the systemic nature and contested solution direction of CE prevents the transition from being top-down implemented

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(Coenen *et al.,* 2023). Why is it difficult to get impactful circular solutions implemented and upscaled in the infrastructure sector? We argue that the institutional logics that underpin the CE concept are incompatible with the dominant logics of the public and project-based infrastructure sector. To support this argument, we examine in this paper the institutional logics that the CE concept has drawn from over the past decade through a review of literature and utilize empirical evidence from the Dutch infrastructure agency to compare the prevailing logics with infrastructure practices and to assess their (in)compatibility with CE.

Theoretical Background

Institutions and Institutional Logics

Institutions are generally understood as the humanly installed structures of formal and informal rules and norms that shape and constrain behaviour and interaction, or put more briefly, 'rules of the game' (North, 1991). Although institutions are persistent, they are reproduced by agency and can change over time. Rather than being tangible and enforceable devises, Dequech (2009, p. 70) described them as "socially shared patterns of behaviour and/or of thought". Institutions are situated in specific contexts, with, for example, spatial, cultural, domain-specific, and temporal dimensions. Within the field of institutional theory, which looks at the processes of change, creation, and persistence of these institutions, institutional logics acknowledge the often-implicit inclusion of the role of culture in institutional analysis (Thornton *et al.,* 2015).

Friedland and Alford (1991) introduced institutional logics as specific meta-level institutional contexts, defined by Thornton and Ocasio (1999, p. 804) as "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality". In addition to the structures of institutions mentioned above, institutional logics provide the symbolic aspects that help actors obtain legitimacy, status and reward incentives and include both the implicit and explicit values and assumptions that guide agency (Thornton *et al.,* 2015). Individual actors and actor groups can be confronted with multiple institutional logics and are argued to be capable of combining and exploiting multiple - possibly contradictory - ones to achieve their goals (Durand and Thornton, 2018).

Logics on the organizational level and organizational hybridity

Besharov and Smith (2014) highlighted that most organizations face organizational complexity resulting from the presence of institutional pluralism relating to multiple institutional logics in the organizational context. This multiplicity requires the organizations to respond to various institutional demands (Kraatz and Block, 2008). Existing logics can conflict, coexist, and blend and might be employed to navigate governance, yet they can also be a hindrance (Greenwood *et al.,* 2011). Organizations that draw from multiple logics are referred to as hybrid organizations (Jay, 2013). This hybridity concept is useful to study both the power struggles between internal logics that precede organizational change and the approach of organizations towards multiple institutional contexts. In this paper, we are primarily interested in the latter.

Hybrid organizations respond in diverse ways to external institutional pressures and demands. As Greenwood *et al.,* (2011, p. 342) remarked, "institutional pressures […] are interpreted, given meaning, and 'represented' by occupants of structural positions". Therefore, the interaction has different consequences for the organization in different situations (Farid and Waldorff, 2022). This notion of hybridity

necessitates specific responses for which some organizations or individuals within organizations may be better equipped than others, partly depending on their ability to draw from various logics. In public infrastructure, for example, demand is articulated by the society through the Government, while also the private sector parties executing infrastructure works have specific demands and practices that call for specific responses.

To capture both the public and private sector logics, in this paper we study the infrastructure sector from the perspective of a pivotal type of organization that acts as an intermediary between political clientship and market parties: infrastructure agencies. These organizations deal at least with the political institutional environment that governs the organization on the one hand (Brandsen and Karré, 2011), and on the other hand the professional logic-grounded project logic that arranges the interactions between private contractors and the public client organization (Frederiksen *et al.,* 2021; Matinheikki *et al.,* 2019). Public client organizations are inherently hybrid and, therefore, employ internal strategies to deal with these pluralistic institutional contexts (Kraatz and Block, 2008). These organizations are hence appropriate subjects to study the alignment between existing logics and logics that relate to CE in infrastructure.

The Logics of Circular Economy

This paper focuses on the external institutional demand related to the introduction of a systemic sustainability-oriented concept, the Circular Economy (CE). While environmental concerns are traditionally pushed by individuals and organizations with intrinsic and idealistic concerns, the realm of sustainability-orientation is often linked to economic models that are contra-capitalist and advocate degrowth (Khmara and Kronenberg, 2020). This clashes with the dominant neo-liberal market logic that aims for economic return and growth (Kemper *et al.,* 2019). From the early publications on CE onward, the reduction of environmental impact has been deliberately coupled to value retention and value creation, for example through the reinvention of business models and the concept of value to make sustainable behaviour economically profitable (e.g., Ellen MacArthur Foundation, 2013).

Although others advocate against it (cf., Bauwens, 2021; Corvellec *et al.,* 2022), the "economic viability" is often one of the main motivations for CE enthusiasts and has for that reason gained popularity in business and policy environments. To illustrate this, Aarikka-Stenroos *et al.,* (2021, p. 262) observed: "the CE seems to (re)shape the logic of value creation, not only for individual firms but also for value chains and networks, as the firm needs to acknowledge more and diverse actors and stakeholders for which the firm creates value." DiVito *et al.,* (2022) go even as far as to speak of a "circularity logic" as opposing to linear logics. Nevertheless, the high degree of contestation of CE (Coenen *et al.,* 2022), as well as the lack of institutionalized circular practices (Buser *et al.,* 2021; Greer *et al.,* 2021), indicates that CE is not yet a logic in itself, however draws from several existing logics - primarily the sustainability logic and the market logic. To embed CE in the infrastructure sector, it is vital to understand how these logics relate to and align with the logics that are dominant in structuring infrastructure practices.

METHOD

The goal of the study is to analyse how the logics on which CE is developed correspond with the dominant logics in the public and project-based infrastructure sector. In the public infrastructure sector, which focuses on the construction and

management of infrastructure assets such as roads and waterways, there is an apparent difference between public and private sector institutional pressures that result in misaligned and conflicting logics (Kuitert *et al.,* 2019; Van der Wal *et al.,* 2008). The executional body acts as a pivotal actor in the system, since it intermediates the Ministry as a formal client and market parties as executors and have many roles, including client, asset owner, and legislator. By examining the logic multiplicity of an infrastructure agency, sectoral institutional pressures and their interactions are revealed, which allows for comparison with logics related to CE in the sector.

To study the hybridity and compare the constellation and dynamics of logics to which the organization responds with the CE concept, twenty-one in-depth semi-structured expert interviews were conducted. Although being executed as open conversations, the interviews were semi-structured around several guiding questions (Hammer and Wildavsky, 1993): How is circularity part of your work? What are your actions to implement circular solutions, and why? What do you get and need to implement circularity? What stimulates and hinders you in advancing circularity in the organization, and why? What is the role of your organization in becoming circular?

To capture and represent the institutional pluralism in the sector, individuals were selected from across all ranks and divisions of the organization, including executive staff, line management, asset management, project management, management of major organizational programmes, strategy department, regional divisions, and the sustainability/CE department. This also included individuals on the organizational boundaries, such as members of public-private projects and policymakers. This resulted twenty-one interview transcripts of 7.000 to 12.000 words each. These transcripts were coded on four categories: values, CE implementation process, infrastructure management process, and institutional logics. Here, values refer to specific aspects of perceived importance; the CE implementation process to the activities related to the execution of circular practices and strategies; and logics to general categories of collections of practices, assumptions, values, beliefs, and rules that motivate individuals to act in a particular way. Indeed, values are also part of the logics yet are coded separately to emphasize and nuance differences in judgement of what is important to public infrastructure. Each theme was iteratively developed during the coding process and consists of 11 to 40 first-order codes. These were aggregated in second-order codes (Saldaña, 2013).

By linking the codes to interviewed individuals and their position within the organization, clusters of individuals were identified with respect to their adherence to specific collections of related logics. This collection of clusters and their associated features allowed us to study the interaction between internal clusters, the clusters in relation to the infrastructure management process, and between the logics related to the CE concept and particular clusters.

FINDINGS

First, the institutional contexts of the infrastructure agency are explained in terms of the four dominant clusters of logics. Second, these clusters are compared with the logics dominant in CE as explained in the theoretical background section.

Organizational Hybridity in the Infrastructure Agency

The studied infrastructure agency operates as the executional body of the Ministry of Infrastructure. This public nature is reflected by a state logic that emphasizes procedural orientation and adherence to traditional bureaucratic values. An

illustration of this logic was stated by an executive staff member: "It is up to the Ministry to consider how we spend the resources effectively and they will always try to justify [these spendings]. And we [as an infrastructure agency] just implement this policy." This quote highlights the organization's perception of its executional role in accordance with the state logic, which results in a devotion to transparent procedures and accountability for operational actions and expenditures. This logic can be found at the executive layer of the organization but is also dominant throughout middle and higher management and highly reflects the position of the Government.

The organizational production line is predominantly guided by the professional logic yet manifests itself in two distinct ways. Towards planning, budgeting and maintenance, there is a dominant asset management logic that is primarily concerned with the preservation of existing infrastructure through monitoring and maintenance. This cluster incorporates a long-term and asset-oriented view regarding the purpose of the infrastructure organization, with plannability, risk-aversion, and integrality as key values. However, it is worth noting that there are elements of both state logic and market logic at play, as a regional asset manager pointed out: "We leave a great deal of actual execution to market parties. When we need certain maintenance activities, we leave quite some room to manoeuvre to the market for selecting their preferred solutions". The asset management logic is strongly present in regional departments but can also be found in the central strategic planning departments.

Related but different is the project logic. This cluster is strongly represented among the interviewees and is highly task oriented. This logic draws more heavily from the market logic compared to the asset management logic, with a focus on project efficiency, feasibility, and scope delivery. As such, individuals that come under this cluster interact with external private sector parties in temporal organizations (i.e., projects), with project boundaries taking priority over asset boundaries. This was illustrated by a portfolio manager who stated: "we get the project scope imposed by the Ministry in an order form, including project budget. […] If they think circularity is important, they will include it in the scope form, and we will execute it." This group serves as the interface with private sector organizations in the sector and dominates the logics of contractors in the sector. Yet, most public organizations, including the infrastructure agency, can be identified as project-organizations too, given their project-oriented approach towards managing, maintaining, construction, and replacing infrastructure assets.

A distinct cluster within the organization is composed of individuals in the strategic and knowledge departments. This group is strongly motivated by personal and societal concerns and follows a sustainability logic that prioritizes values such as knowledgeability and innovation, and derives legitimacy from national and supranational agreements, missions, and ambitions in the environmental sustainability domain. However, within this cluster, there is a dominant believe that CE impact on infrastructure should be made in projects and that the existing explorative and knowledge-producing approach does insufficiently account for this. As a manager of the CE knowledge programme explained: "For years, the CE programme […] was very divergent by nature […]. However, as a team we are increasingly transforming from an explorative mindset to a demand-driven approach in relation to the formally designed transition pathways". While this group is grounded in sustainability logic, they are increasingly drawing from other logics to implement CE and foster change, and to bridge the various logics both within and beyond the organization. While the number of individuals that draw from this logic is limited and scattered throughout the

organization, it is represented in their relations with, e.g., consultancies and knowledge institutes, and draws from wider societal pressures.

Alignment of Logics Between the Infrastructure and the CE

How do these four clusters identified in infrastructure align with the logics related to CE concept discussed in the theoretical background section? The long-term treatment of infrastructure assets is determined by the asset management and state logics. These are in the hands of public asset owners and related to continuity, as well as clear and transparent procedures and processes. The logics in which CE is grounded (i.e., sustainability logic and market logic) do have little chance to be aligned in this planning and budgeting phase, since the values prioritized by these clusters, such as accountability and transparency, conflict with values that are covered by CE, such as sustainability and profitability.

Moreover, the institutionalized practices and processes leave little room for deviation, which was mentioned by many interviewees as a main barrier for implementing CE in the infrastructure processes beyond the project scope. Nevertheless, when reflecting on the role of CE, an asset manager remarked: "If we manage the assets, along their lifecycle, then we should be the ones that formulate [circular] requirements, particularly towards projects. […] But we do not have that role and leeway." While the major CE impact can be unquestionably made in these early planning and budgeting, there the least room to do so. Also in most interviews, projects were seen as primary vehicles for change, e.g., through procurement requirements and incentives for innovations, while the more systemic changes should be sought earlier in the asset management and planning process.

After the order form is formulated by the Ministry, and reaches a project manager, there project manager must stick to the scope. Here, often no particular CE goals or requirements are included by the state logic-centred Ministry. Following the project logic, the project management team is focused on completing the project according to the predefined boundaries. Only this late in the process, the sustainability cluster is involved, in which the knowledge department with the sustainability logic points at opportunities for CE. However, due to the restraining project boundaries, project managers and other project employees are reluctant to CE suggestions and knowledge from the knowledge and strategy departments. This is the case even though most of the interviewed project members are personally in favour of circular values yet, at this stage, CE logics conflict with the project boundaries. Illustrated by a project manager: "For who works in projects goes: […] there is a lot of thinking and dreaming on circular solutions, but is it tradeable for higher costs? Or for risks? Who [at the top] says, just do it and we will arrange the finances..." Therefore, implementing CE at this stage will take the project team a lot of effort, and additionally increases project risks.

It is only after this point that, often in consultation with engineering firms, private sector parties (i.e., contractors, suppliers, consultants) engage in the construction process. Following the market logic, occasionally combined with sustainability logic, these parties have in the past showed significant interest in CE, ranging from material innovations to novel business models. Since the scope of the projects is at this stage already strictly defined before entering the market space, there is little space for market parties to insert their circular solutions, especially when these require modification of processes beyond the project scope. Since the contractors are dominated by a market-oriented project logic, interviewees experienced a lack of investment by these parties, even if circular solutions are included in the tender. Even

more so when the solutions are either radical or when they address higher levels on the waste hierarchy due to the demand-driven nature of infrastructure solution. This is illustrated by a project manager in one of the few occasions in which the circular reuse of bridge components was established: "I receive the reusable [components], but I am not going to deconstruct them from the previous asset, nor am I going to store them in the meantime. […] That would be a project in itself." A market party could hence introduce a novel way of reusing components, but if the project governance on the client side (which is guided by project logic and eventually planned through state logic) is not aligned, the solution will not be implemented. This is propelled by the lack of knowledge and contestation on how circular solutions look like throughout the sector, which prevents further embedding in processes and norms.

Apart from the regular process, interviewees mentioned several initiatives in which the community logic was employed to create a safe space for both public and private actors to collaborate on and explore circular initiatives, leading to several successes. However, these initiatives remained outside the organizational structures, which limits chances for learning, institutionalization, and upscaling. In some cases, this is linked to market logic, for example regarding as-a-service business models, but more often, it is linked to match solutions with opportunities for implementation in a single pilot project. Given the demand-driven character of the infrastructure sector, the dependence on practices that draw from the state logic remains large - and systemic innovation and implementation opportunities therefore limited.

DISCUSSION

The results show that the decisions on how infrastructure is organized, managed, and built is strongly reliant on groups of people that draw from state logic. Being considered as systemic in nature (Aarikka-Stenroos *et al.,* 2021), as well as being coined as a "corporate-led model" (Corvellec *et al.,* 2022), indicates that the market logic plays an important role in CE. For instance, this could mean that entrepreneurs use specific types of recycling or reuse to eventually reach economic efficiency while reducing environmental pressure. The discussion from the CE perspective is primarily on building systemic incentives to make sustainability profitable, which is currently only practiced on the project level. The asset management logic and state logic, that eventually have the largest consequence on asset lifecycle choices of infrastructure (and hence material flows), lack a fundamental incentive to make sustainability profitable and hence cannot implement circularity the way it is promoted for many other sectors. As a result, the actors that eventually draw from the same logics as the CE concept, i.e., private sector parties, come only into play when the major lifecycle choices of infrastructure assets (e.g., maintenance, replacement, removal, reuse) are already made. This is a major reason why the majority of circular solutions relate to project-scale solutions, such as substitution materials, rather than solutions that fundamentally reduce resource use or environmental impact (PBL, 2023).

This differs from other developments and concepts in the domain of environmental sustainability, such as carbon reducing alternatives, as these can be achieved to a large degree within a traditional value frame (Kuitert, 2021). Therefore, these fit within conventional logics in the sector. Results of our study show that the existing logics in infrastructure do not facilitate the logics behind CE and therefore require other processes of implementation. This observation might seem disappointing, yet merely indicates that CE cannot be fundamentally implemented within the current alignment of logics and construction processes in the infrastructure domain. As such, it cannot

be expected that the transition towards a circular infrastructure sector will come from market parties (as would be expected considering the logics on which CE is based), but rather depends on how principles from the CE concept are embedded in the processes from the government side (Flynn and Hacking, 2019).

There are several ways in which the CE principles can be embedded in or aligned with existing logics. Particularly the asset management logic provides several opportunities to CE principles, especially related to strategies regarding lifespan extension, infrastructure planning, and a network perspective on infrastructure assets. However, this requires a strong leadership role of policy and public clients and lesser dependence on one-off public-private projects. For the individuals that are confronted with state logic, this is more complex since it would require a top-down order to change practices and processes into circular ones. This implies a close connection to political decision-making, with, apart from a potential lack of political will, the drawback that the people that are guided by state logic are usually not the ones that have in-depth knowledge on the infrastructure assets and related asset management processes. This group of policymakers should therefore draw from the sustainability logic, which can be provided by the experts in or outside the organization.

CONCLUSIONS

In conclusion, this paper provides insights into the challenges of implementing and upscaling circular economy solutions in the infrastructure sector using an institutional logics lens. Our study suggests that the institutional logics that underpin the current infrastructure sector are incompatible with the logics on which CE is developed. As a result, circular solutions are mostly limited to project-scale initiatives and do not fundamentally reduce resource use or environmental impact. Our research highlights the need for strong leadership from public clients to embed CE principles into infrastructure processes. As such, this paper contributes to the ongoing discussion on the challenges of implementing CE in the infrastructure sector and provides insights for policymakers and public clients on CE upscaling in the infrastructure process.

The ongoing alignment of logics suggests the ongoing emergence of a new, CE logic within the sector, even though it is not institutionalized yet. This CE logic should be sector-specific, since the large dependence on public clients does not allow for bottom-up institutionalization of innovative technologies, practices, processes, or norms. When constructing for the future, anticipated directions for change in the sector must align with the logics carried by the actors responsible for doing the work.

Future research could explore how CE can be integrated into existing institutional logics in the infrastructure sector, and how to overcome the current institutional barriers to the upscaling of circular solutions. Moreover, the paper sheds light on the emergence of a new logic, the CE logic, which requires sector-specific institutionalization. Future research can investigate how the CE is institutionalized in the infrastructure sector, and the role of the various public and private sector actors in this process.

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