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DOI
10.3390/su132112101

Publication date
2021

Document Version
Final published version

Published in
Sustainability

Citation (APA)
Kooter, E., van Uden, M., van Marrewijk, A., Wamelink, H., van Bueren, E., & Heurkens, E. (2021). Sustainability transition through dynamics of circular construction projects. *Sustainability*, *13*(21), Article 12101. https://doi.org/10.3390/su132112101

sustainability

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Sustainability Transition through Dynamics of Circular Construction Projects

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Abstract: The aim of this paper is to better understand the dynamics of circular construction projects and how these interorganizational projects contribute to the transition towards a circular economy. It is essential that the construction sector develops and adopts interorganizational initiatives to support the transition to a circular and low-carbon construction economy. A benefit of being involved in such initiatives is that organizations reflect on the emergence and acceptance of new practices related to changing organizational roles and responsibilities. In this paper, we study eight circular construction projects within the context of an interorganizational initiative to stimulate the transition towards a circular economy by exploring insights from evaluations thereof. We build upon literature from Sustainability Transitions Research (STR), circular construction research, and interorganizational project studies. Our findings show three clusters of dynamics that are relevant in the realization of circular ambitions in interorganizational construction projects: (1) prerequisites, (2) temporal dynamics in interorganizational projects, and (3) contextual influences. These insights highlight factors that enable the realization of circular ambitions in construction projects and contribute to our understanding of the dynamics of interorganizational construction projects and their role in the context of STR.

Keywords: circular transition; construction projects; interorganizational collaboration

Citation: Kooter, E.; Uden, M.v.; Marrewijk, A.v.; Wamelink, H.; Bueren, E.v.; Heurkens, E. Sustainability Transition through Dynamics of Circular Construction Projects. *Sustainability* **2021**, *13*, 12101. https://doi.org/10.3390/su132112101

Academic Editors: Sandra Schruijer and Petru Curşeu

Received: 31 May 2021
Accepted: 27 October 2021
Published: 2 November 2021

1. Introduction

To contribute to the transition towards a circular economy in the construction industry [1,2], public and private partners collaborate in interorganizational initiatives, in which they learn from the successes and failures of interorganizational construction projects with strong circular ambitions [3]. An interorganizational project is here understood as a group of organizations that interact reciprocally to coordinate their efforts for a complex service or product during a finite period of time [4]. The transition to a circular economy requires continuous monitoring and reflection on interorganizational circular projects for learning on goals, network activities, behavior, and management [5]. Collaboration in construction processes is power-ridden and not easy to change, as partners collectively appear to stick to well-known traditional routines and social practices [6]. To withdraw from these familiar and fixed social practices, it is of crucial importance that the construction sector develops and adopts interventions influencing both people and organizational behavior [7]. Interorganizational projects, therefore, are interesting settings for innovation, as members of diverse organizations with different work practices and cultures work together over a limited period of time [8]. Innovative solutions learned in these projects can stimulate

change in participating permanent organizations [9] and larger sociotechnical systems [10]. By doing so, they create tensions in terms of the institutional context of the construction sector. We study these tensions through the lens of the Multi-Level Perspective (MLP), a dominant perspective in Sustainability Transitions Research (STR) that explains the uptake of innovations (niche) by incumbent players (regime), often due to influences from a wider context (landscape) [11,12]. The perspective of actors in construction projects is used to understand the dynamics of these institutional tensions, which is a missing perspective in STR [13].

The central aim in this paper is to better understand the dynamics of interorganizational circular construction projects. Dynamics of interorganizational projects refer here to the process of relating activities across boundaries to maintain patterns of change and continuity through time, and to the forces that produce these patterns [14] (p. 636). For example, Levering et al. [15] identified in the shipbuilding sector the continuity of some interorganizational project practices and change of others, both influenced by combinations of self-reinforcing mechanisms. Ebers [16] understands dynamics of interorganizational projects to be related to partners' motives, preconditions, institutional forms, and outcomes produced. Scholars [14,15,17] argue these dynamics are not well understood. For example, Geraldi and Söderlund [17] have criticized research on interorganizational projects for understanding these as homogeneous static entities, while Sydow and Braun [18] missed a multi-level understanding of interorganizational forms of organizing. In addition, power relations between organizations are often not acknowledged in interorganizational project studies, though there are exceptions (e.g., [18–20]). Rather than perceiving interorganizational projects as episodic, fixed, and with limited issues of power [21], we understand these as relational, uncertain, and transpiring at different levels [22]. Tensions over power relations will arise in the interface of these levels as the reconfiguration of the construction sector transcends the sector boundaries, offering a redefinition of the rules by which the sector is operated [7].

Based on the discussion above, the central research question in this paper is: "Which dynamics in the execution of interorganizational construction projects are relevant to realize their circular ambitions, and how do these projects contribute to the transition towards a circular economy?" To answer this question, we studied the delivery of eight interorganizational circular construction projects within an interorganizational initiative, named "Accelerating Together", a consortium of public clients and private contractors in the Netherlands trying to reduce the emission of greenhouse gases and waste. To collect data, we used an engaged scholarship approach [23], in which the authors and project members jointly executed a qualitative evaluation of the projects. Our findings show three clusters of dynamics that are relevant to project members in the realization of circular ambitions in construction projects: (1) prerequisites, (2) temporal dynamics in interorganizational projects, and (3) contextual influences. These findings contribute to the literature on interorganizational projects [14,18] with a better understanding of their dynamics over time. Furthermore, the findings contribute to further development of the field of STR, as called for by scholars (e.g., [24,25]), by providing an in-depth understanding of the interaction between niche and regime and the role of interorganizational projects in this.

The structure of this paper is as follows. First, we discuss the theoretical foundations of STR, the MLP specifically, and the role of interorganizational projects in this perspective. In the Methods section, we introduce the Accelerating Together initiative, and we explain how the qualitative study of eight interorganizational circular construction projects has been executed and how the findings have been analyzed. Then, the findings from the evaluations on the interorganizational circular construction projects are presented in three clusters of dynamics. Finally, we discuss the relevance of these findings for the academic debate on interorganizational circular projects and sustainability transitions and highlight the most important conclusions and suggestions for future research.

2. Sustainability Transitions and Interorganizational Projects

The literature on sustainability transitions has received increasing attention over the past decades [13,24,26]. Sustainability transitions are "long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" ([24]: p. 956). Transition is here understood as a structural change—the outcome of developments that influence and strengthen each other in the areas of economy, culture, technology, institutions, nature and the environment [27]. Therefore, transition is a co-evolutionary process, involving change across a range of different dimensions (e.g., technologies, markets, infrastructures, behavior) and enacted by multiple actors, each with their own agency. Transitions are characterized by uncertainty and open-endedness, taking place on different levels and entailing multiple, interdependent developments [13].

We use the MLP, as it offers a framework to understand the transition as a whole, allowing us to look at the interaction between different levels with their respective rules [11]. We build on existing literature on the role of construction projects [28] and the role of individual actors in the interaction between niche and regime [12]. From this perspective, we can define conventional construction as a socio-technical regime, which we understand as a "continuous evolving hegemonic configuration of artefacts, actors, and institutions" [28]. It refers to dominant practices, activities, methods, and preferences that are bound by both formal and informal rules [22]. The regime is known to create lock-ins and path dependencies that make it hard to change [29]. The iron triangle of projects (time, scope, and budget) [30] is the main guiding principle in conventional construction projects [31]. Contrasting conventional construction, we can perceive circular construction as a niche innovation, distinguishing itself by a strong focus on minimizing the ecological footprint of construction. This is performed by limiting the number of resources used and by closing material loops [28] and/or by slowing material loops through designing reusable products that have a longer life cycle [3].

Furthermore, recent literature reviews show diverse factors influencing the transition towards a circular economy (e.g., [1,2,32–35]). For example, Manuro et al. [34] suggest the lack of clarity on circular business models and government support, e.g., laws, tax, and subsidies. In another example, Mhatre et al. [36] focus on tools to enable circular construction, such as the use of a BIM platform, the creation of an urban mine, or using a materials passport for material stocks. Furthermore, Charef et al. [35] found knowledge, stakeholder engagement, asset lifecycle, procurement, policies, incentive schemes, and technologies to be important factors. In addition, Adams et al. [2] provide three sets of challenges to the transition. The first set is related to the economics of circular construction projects, such as the lack of incentives to design for end-of-life, the low economic end-of-life value of products, and an unclear financial business case. The second set of challenges is related to the construction industry's structure, such as the fragmented supply chain caused by the multitude of actors, and a perceived general lack of interest, awareness, and knowledge on circularity. The third set is related to design, e.g., the end-of-life of a building and the uniqueness of designing buildings. Finally, Leising et al. [3] suggest four general requirements for circular construction: (a) a new process design where a variety of disciplines in the supply chain is integrated upfront; (b) the co-creation of an ambitious vision; (c) the extension of responsibilities to actors along the entire construction supply chain; and (d) new business and ownership models.

Although the construction sector has gained experience in circular construction through a number of (pilot) projects, upscaling to large-scale use in this sector is challenging [28]. Upscaling requires radical rethinking of the roles and responsibilities of clients, contractors, architects, and other firms and has serious institutional and legal challenges in the supply chain [37]. However, innovations diffuse rather slowly in the construction sector, while organizations collectively appear to stick to well-known traditional roles, responsibilities, and social practices [6]. Particularly, collaboration between organizations in the construction sector is laborious and issues around collaboration are

pertinent to this sector [32]. Therefore, changing the socio-technical regime of conventional construction by upscaling circular projects is challenging.

Scholars in the field of STR (e.g., [24,25]) suggest linkages with well-established (project) management and organizations studies can aid in maturing the field of STR. Especially, literature on interorganizational projects is interesting as a circular construction project can be understood as a temporary space where interactions between niche and regime take place, which can therefore be a potential portal for mainstreaming niche innovations [28]. From this literature, we learn that interorganizational projects are constituted by multiple practices, embodied in and accomplished by various actors, from different organizations and allow for the creation of innovations and change (e.g., [8,9,14,38]). Furthermore, in such projects, actors from different organizations bring along different work practices, narratives, norms, and values that shape changes [15]. Especially, "outsiders" who operate according to entirely different norms and values can bring disruptive innovation in construction projects [39]. This concept of outsiders can take shape as new organizations that play roles in construction projects, but can also be manifested by incorporation of new employees within companies dominated by regime institutions.

In the context of the construction industry, we understand the transition towards a circular economy as a multi-level and multi-actor process of continuous meaning-making, negotiating, and organizing in interorganizational projects [40], producing everyday changes [41], and simultaneously serving to (re)shape organizational processes, fields, and contexts. At the same time, it is important to acknowledge that the relation between these different levels of analysis is co-constitutive and recursive, as contexts, fields, and processes also shape practices and actors [42]. Therefore, change through interorganizational projects is an open-ended and continuous process of adaptation to changing conditions and circumstances across organizational and sectoral boundaries [43]. Circular ambitions, which require the entry of new players from "outside" the regime and a reconfiguration of existing relationships, make the dynamics in projects completely different from the "business as usual" dynamics [13]. In search of new roles and power, organizations might not rely on their known innovation mechanisms and practices, but may have to develop new ones [20], which might also challenge the role and boundaries of their organization, the way they relate and communicate with other organizations, and the way they perceive their objectives.

In sum, we understand interorganizational circular construction projects as co-constitutive, continuously changing, and deeply entwined interrelations between members of different organizations, where managers and employees have implications beyond their own organizational boundaries. However, these micro processes take place within a regime context that influences the possibilities for actions taken by actors in projects. This is why the temporal dynamics in interorganizational projects, where actors operate in the interface between niche and regime, are interesting to research and why actors' evaluation of these dynamics are the object of study for this paper.

3. Methodology

The study focuses on a specific interorganizational initiative, Acceleration Together, which is a consortium of public clients and firms with expertise on construction engineering, technology and construction process. The partners have ambitious goals of learning from their circular construction projects and agreed on sharing information, expertise, and evaluations. The consortium is organized in collaboration with an innovation platform for developing knowledge on the circular economy. We applied an engaged scholarship approach [23] in which researchers and participants of the Accelerating Together program jointly formulated evaluation questions, executed the evaluation, and discussed its results. To this end, circular projects involved in the Accelerating Together program and researchers agreed on the joint evaluation of the roles, practices, processes, and outcomes of eight circular projects, including three new building projects, two renovation building projects, one demolishing and (re)building project, one urban development project, and one new

infrastructure project. Although experienced in construction in general, for employees of six projects, this was the first time they worked in a project with high circular ambitions. The group interviews were held from December 2020 to March 2021, each centered around one of the eight projects. In total, 22 different construction professionals were interviewed, with the smallest group of just one person and the largest including four construction professionals (see Table 1).

Table 1. List of interviewees.

Interview No.	Interviewee No.	Project	Role
1	1	New building 1	Client
	2		Contractor
	3		Consultant
2	4	New building 2	Client
	5	New building 2	Client
	6		Client
	7		Consultant
3	8	Renovation building 1	Contractor
	9	Renovation building 1	Contractor
	10	Renovation building 1	Contractor
	11		Consultant
	12		Client
4	13	New building 3	Real estate developer
	3		Consultant
5	14	Demolishing and (re)building 1	Client
	15		Client
	16		Contractor
	11		Consultant
6	17	New infrastructure 1	Client
	18	New infrastructure 1	Client
	19	New infrastructure 1	Contractor
	6		Client
	11		Consultant
7	20	Urban development 1	Real estate developer
	21	Urban development 1	Real estate developer
	13		Real estate developer
	3		Consultant
8	22	Renovation building 2	Contractor
	3		Consultant

Data were collected through semi-structured group interviews, an interview method which uses a list of topics to guide the questioning [44]. Interviewees were asked to prepare for the interviews by describing their circular construction projects in terms of materials, energy, water, social, and management. This six-page document included questions such as "What is the level of demountability of the building in your current design?" and "What actions are you taking to get energy from renewable sources?" This document served as the basis for the semi-structured interviews, during which additional questions were asked about why a particular answer was given, and what contributed and what hindered them in their actions. For questions on management, a topic guide was used, and depending on the course of the interview, relevant questions were posed, such as "What do you consider constraining factors in the current form of collaboration?" or "Who has the power to lift

the circular ambitions in this project to a higher level?" The interviews lasted on average 134 min, with a minimum of 107 min and a maximum of 188 min, and were all conducted through video calls due to the COVID-19 pandemic. The interviews were conducted by two of the authors, alternating leading roles, and one circular construction consultant of one of the three involved consultancy firms. Such a researcher triangulation is helpful in assuring the quality of interview data [45]. This allowed for an efficient task division, documenting of the interviews, and cross-examination of the retrieved data. In six out of eight interviews there was also another participant of the Accelerating Together program present in order to pose critical questions and to stimulate learning between the involved partner organizations. In turn, they were also asked questions in order to unfold key differences or comparisons in the way they handle circular construction projects. These professionals are included in Table 1, but not listed under a project name. Group interviews offer richer data than one-on-one interviews, as groups allow for snowballing, where one reaction triggers the next, and offer a clearer understanding when there is or is not consensus on a topic, similar to focus groups [46]. The disadvantage of group interviews is that individuals might be reluctant to share personal information [47], although this is contested, fitting our results. A second disadvantage is that some people might be outvoiced by others [47].

The results were analyzed in a multi-step approach [45]. First, all interviews were analyzed by the researchers and the three consultants, offering a common vocabulary to talk about these projects, and allowing for preliminary conclusions that could be tested with other projects. Secondly, barriers and enablers were distilled from the interviews. These were then compared with those from the literature [2,3] and the quick analysis of the previous (explorative) round of the Acceleration Together program and summarized in a report for the program. This was first checked and commented on by our interdisciplinary team of researchers, then by the involved consultants, and finally by the participants of the Acceleration Together program. Third, with this information at hand, the transcripts were analytically generalized [48] on emerging first-order topics that gave explanations of the produced results or the lack thereof, which, following Cropper and Palmer [14], were named the dynamics of interorganizational projects. Then, using researcher triangulation, these were grouped in 22 dynamics under the headings of prerequisites, temporal dynamics in interorganizational projects, and contextual influences. This categorization emerged from interviews, where interviewees mentioned conditions that are necessary before the start of construction projects, factors within construction projects that influenced the realization of circular ambitions, and factors from outside the project influencing this. Based on these findings, our research team named the categories and grouped all dynamics accordingly. Note the difference between dynamics *of* interorganizational projects and dynamics *in* interorganizational projects. The former, as elaborated in the previous section, includes prerequisites, temporal dynamics *in* interorganizational projects, and contextual influences. The latter refers to the dynamics within construction projects and solely to the temporality of these projects themselves. These temporal dynamics have often been ignored by researchers [19], but offer possibilities to function as portals for the transition towards a circular economy [28]. Fourth, with our research team, we decided on combining certain dynamics, and letting go of less relevant ones. This resulted in the fourteen dynamics as described in Figure 1. Fifth and lastly, an overview of these fourteen dynamics including the categorization was presented to practitioners as a member check [45], offering possibilities for feedback and used for the final categorization of the dynamics. Writing was distributed among three writers, peer reviewed by the writers, and then by the whole research team.

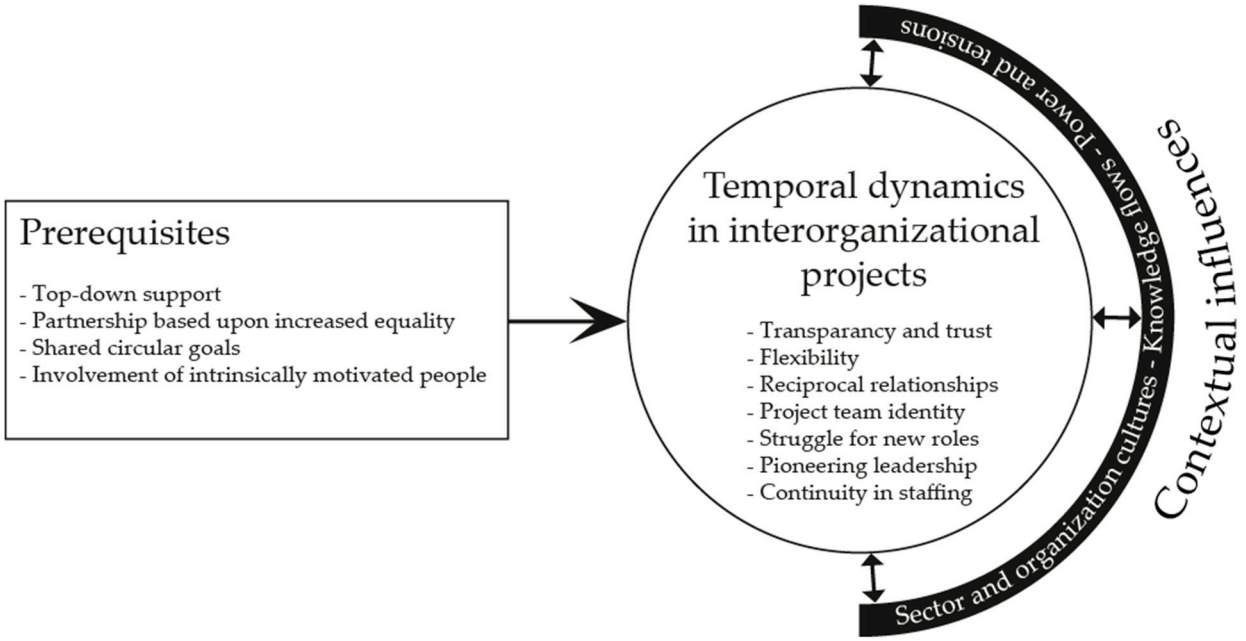

Figure 1. The interplay between the dynamics of interorganizational projects that are relevant in the realization of circular ambitions in construction projects.

4. Findings

The fourteen identified dynamics related to the realization of circular ambitions in construction projects can be divided into three clusters. The first cluster includes prerequisites that are needed for setting and realizing circular ambitions in construction projects. The second cluster contains the temporal dynamics that play a supportive role during the realization of circular ambitions in construction projects. The third cluster is related to contextual factors that influence temporal dynamics in interorganizational construction projects, which are in turn influenced by these. The interplay between the dynamics of interorganizational projects is visualized in Figure 1; it shows the relationships between prerequisites, temporal dynamics in interorganizational projects, and contextual influences.

4.1. Prerequisites for Circular Construction Projects

The first cluster of findings we discuss here are the prerequisites that, according to interviewees, are needed for setting and realizing circular ambitions in construction projects. Four prerequisites are mentioned: (a) top-down support; (b) partnership based on increased equality; (c) shared circular goals; and (d) involvement of intrinsically motivated people. These four dynamics are discussed below.

4.1.1. Top-Down Support

Support from higher levels of the organization seems to be one of the prerequisites for setting and realizing circular ambitions within construction projects, as was found in the organizations of all interviewees. Two interviewed clients agreed that "[. . .] if your management team, or director, or board of trustees don't believe in it [circularity], you won't get anywhere" (Interviewee 14). Three aspects are particularly notable. Firstly, an important aspect of support from the management team is being open to the possibility of change, a key element in transitions. Secondly, the higher management of organizations can support circular ambitions both formally, using policy documents, and informally, by encouraging or discouraging behavior on the work floor that stimulates circular construction. In projects where support is lacking, higher managers can still be persuaded by intrinsically motivated employees to support or even promote circular construction, if they are still approachable. Thirdly, it matters to what extent support of higher managers is entrenched in the whole

organization; management support is not a guarantee for success. If the management team supports circular construction, but the ideas or policies have not been implemented on lower levels, the effects of support remain minimal. This is exacerbated by strong project cultures; project leaders tend to do execute tasks their own way, and are often given freedom in this regard. To stimulate support throughout the whole organization, higher management could choose to hire people with a suitable profile, allowing support for circularity to materialize in daily practices.

4.1.2. Partnership Based on Increased Equality

Public clients traditionally set up tenders minimizing their own risks. However, since circular ambitions must take hold in all organizations involved, clients must work more dialectically with their contractors. This necessitates a more equal relationship, as explained by one public client: "traditionally we take on projects in a clear client-contractor role division, but we are convinced that we can only make the transition towards a circular economy together with our supply chain partners, [. . .] which is why we took on this project as equal partners" (Interviewee 17). Such a partnership based on equality is becoming more popular in the construction sector [49]. One contractor explicitly asked for a new approach: "you don't get most out of it for both parties like this [traditional tendering]. If you take on projects differently from both sides, identify the risks, come up with a process, a model for the risks present, you can properly tackle those. With [traditional tendering] organizations will either cover themselves, or not participate at all" (Interviewee 2). We found two reasons why more equal partnership is needed: (1) throughout the chain, contractors need to step into the project earlier than traditionally, as clients are in need of their knowledge; and (2) mutual dependency is higher, as circular projects are more uncertain and ask for adaption, e.g., because the availability of specific non-virgin materials cannot be guaranteed at the start of the project. We found a partnership can successfully be expressed, e.g., financially, by using a common budget to pay for unexpected risks, or an alliance contract with open bookkeeping.

4.1.3. Shared Circular Goals

Because circularity is easily overlooked due to many additional ambitions of construction projects, an explicit shared goal or vision on circularity is a prerequisite to realize circular ambitions (e.g., [3]). Often, visions are stated in the beginning of projects, but if no concrete goals are formulated and it does not become an explicit returning topic of conversation, they tend to lose value. One interviewee stated clearly that in the phases of a concept design and definitive design, 80% of the choices are made, implying that at this point, this shared vision needs to be clear for all project members. Coming to a common goal through conversation between the different partners involved seemed to be a preferred way of working, opposing projects where goals are formulated by one partner, with the belief that communication will result in better plans. However, for municipalities, this can be difficult; since tenders follow a strict judicial protocol, conversation is considered illegal and would allow for unfair advantages. This is why some interviewed real estate developers considered working solely on projects on their own initiative, allowing for conversation with the municipality (e.g., Interviewee 13). Partner selection based on a common goal seemed to allow for supportive temporal dynamics, such as trust and transparency, later on in the project. Interviewed real estate developers described the importance of partnering: "At first we selected partners based on a [shared vision] and only then looked at the financial consequences of that partnering. But [now we say] first 'what is our drive?', 'would we want to work together?', that was the first criterion" (Interviewee 20).

4.1.4. Involvement of Intrinsically Motivated People

Delivering construction projects within a priorly set time and budget is challenging, but delivering circular goals in construction projects within a linear system takes even more effort. Therefore, when circular construction is not the norm yet, one of the prerequisites for

setting and realizing circular ambitions is involving people that are intrinsically motivated, as illustrated by one client: "all projects that included sustainable or circular procurement, do so due to the project managers that adhered to those principles" (Interviewee 12). Intrinsic motivation seems important for three reasons. Firstly, project members may need to go the extra mile by continuously questioning actions, discussing alternatives to linear solutions, and challenging others to think outside the box. One interviewee explained: "It is in my DNA, but that is not the point, it is about starting a conversation to make sure it also gets into the DNA of the other. This is only possible through continuously expressing, promoting, and questioning it" (Interviewee 14). Secondly, to innovate, it is necessary that project members go beyond the beaten track. As one client explained: "It does ask something of your employees, they need to dare to do it differently than the five colleagues that went before him or her" (Interviewee 6). This closely relates to the support of higher management that can decide to hire people with a suitable profile, but also to partner selection. Thirdly, our analysis shows that like-minded people in a project can aid circularity. It is motivating for project members to work with others who are also intrinsically motivated and it may enhance transparency and trust, because no project member tries to slack off. A real estate developer expressed this: "we don't want to tick boxes; we want to spark" (Interviewee 20).

4.2. Temporal Dynamics in Interorganizational Projects

The second cluster of findings we discuss are the dynamics that, according to interviewees, play an important role in the realization of circular ambitions in construction projects, which we understand as temporal dynamics in interorganizational projects. Seven dynamics are mentioned: (a) transparency and trust, (b) flexibility, (c) reciprocal relationships, (d) project team identity, (e) struggle for new roles, (f) pioneering leadership, and (g) continuity in staffing. These are discussed below.

4.2.1. Transparency and Trust

One of the main supportive characteristics of the dynamics found in circular construction projects is the creation of transparency and trust, which is needed to create flexibility, achieve higher quality, and to stop greenwashing. However, we found, as is also often mentioned in the literature, that the dominant culture in the construction sector is based on distrust and avoidance of risks [49]. In contrast, transparency can only be created if project members dare to be open and vulnerable and create relationships based on trust, and this requires action. One of the clients explained that they did not feel the need to monitor or control the actions of the demolisher, as the demolishing process was very transparent (Demolishing and (re)building 1). When partners are honest and open about their actions, they can rely on each other, and the need to control one another diminishes.

In line with this, trust is essential for effective collaboration [50]. In a trusting relationship, a party expects that another party will perform particular actions, irrespective of the ability to monitor or control those actions [51]. This also means daring to be vulnerable, and, e.g., can imply accepting that nobody is a circular expert at the start of the project, as circular construction is still in the innovation phase (Urban development 1). Transparency and positive experience can in turn reinforce trust between partners [52]. Being open and vulnerable may include sharing risks and feelings about the progress and the completion of a project within time and budget. Through the creation of transparency and trust, collaboration in projects can grow and generate opportunities to support each other, which are essential in relation to flexibility in circular construction processes.

4.2.2. Flexibility

In circular construction projects, flexibility is needed because of the uncertainty created by circular ambitions and the continuous lack of practical knowledge. Circularity exists out of many different elements and is as a whole unmeasurable. In addition, innovations come with risks and potential failures, often creating the necessity to adapt or fully change

concrete solutions. Therefore, clients cannot uphold their traditional role as knowledgeable planners and controllers, which is often desired to avoid insecurity and risks. One contractor explained: "if you are asked to step out of your comfort zone, because you do not know beforehand how to realize [the circular ambitions] exactly, then by definition you have to move away from all that is familiar" (Interviewee 10).

In order to innovate and employ circular possibilities, flexibility, both in terms of planning and budget, seems necessary. In practice, the preparation phase of circular construction and demolishing may take more time, due to additional practices, e.g., investigating potential measures, finding recycled materials or off-set possibilities for harvested materials. A compensating advantage might be that the construction phase is often shorter than in traditional construction processes; therefore, the whole project is not necessarily prolonged. Similarly, the project budget would benefit from flexibility, without necessarily increasing total expenses. A contractor argued: "sometimes, it is in the benefit of the project, if the installation engineer receives a little bit more budget, and we a little bit less. It is a tension field because everyone has to stay within their own budget, even though you could manage it more efficiently" (Interviewee 8). Other projects illustrate that when clients create room for maneuver in terms of budget and/or planning, and are therefore willing to take risks, possibilities arise for higher levels of circularity than previously perceived possible.

Finally, flexibility seems to be better achievable with transparent relations, due to the awareness about the stakes of other project members. Moreover, knowing about potential risks for other team members might minimize surprises and the need for flexibility in the first place.

4.2.3. Reciprocal Relationships

Traditionally, relations in construction projects are formal, based on a contract. When adaptations in the plan are made, often one party bears the risks and consequences. In a circular project, actors are interdependent and need to take a shared responsibility to realize circular ambitions, without blaming each other [49]. Interviewees recognized the need for a reciprocal atmosphere. In reciprocal relationships, partners keep a close eye on the exchange of resources in which all parties contribute to circularity or benefit according to their needs. Additionally, scholars acknowledge trust and reciprocal dependency as important dynamics for effective collaboration in projects (e.g., [49]).

One project developer explained that "one of the success factors [of circular construction] is involvement of a particular type of person. [...] In a project with an integral approach it makes sense to select people that are tempted to make a connection with others. Do not take this the wrong way, I am not saying we are chilling and sitting around the campfire together, but it is decisive for your success" (Interviewee 20). Reciprocity then implies that partners acknowledge the efforts others make in realizing circularity measures and help each other find solutions when problems arise. For example, in one of the projects, the client, a Dutch municipality, gave suggestions to the contractor for alternative circular measures when the original plans did not work out (Interviewee 4). Another contractor explained that it works well if trade-offs are not only based on money, but when other stakes of the involved partners are taken into account, as well (Interviewee 10).

4.2.4. Project Team Identity

An important change dynamic mentioned by the interviewees is the creation of a project identity. Identity is here understood as the identification of project members with project's goals, values, and norms [53]. Project members frequently experience a double identity—being a member of a circular project and at the same time a member of their own organization. Tensions between project members can emerge because of this double identity. The creation of a shared identity can be helpful in focusing on project goals; for example, in one project, members were aware of their different identities and decided to organize "Circular Tuesdays" every week to be on the same page. One interviewee elaborated: "in those meetings we took decisions, we discussed the progress of the project, and we held

each other accountable in terms of planning and budget. This was extremely motivating; I looked forward to it every week, and I thought it was amazing" (Interviewee 19). A shared identity can be created by developing trust and by explicating a shared vision and mission on circularity. Furthermore, this process is strengthened by the development of a reciprocal relationship, in which partners exchange knowledge, solutions, and small successes. According to the interviewees, reciprocity is an equalizing and binding force in circular projects as it is beneficial for all partners.

Circularity, in turn, can aid in creating a project team identity, as explained by one interviewee: "I believe circularity definitely encourages good relationships within the team, even if just small measures are taken, it does influence the general atmosphere, which is nice" (Interviewee 8). Creating a project identity requires time-consuming effort and budgets. Yet, the interviewees mentioned that a strong project identity increases their motivation.

4.2.5. Struggle for New Roles

Circular construction processes differ in several aspects from traditional construction processes. Often, a more explicit vision is needed, new demands have to be taken into account, certain areas of expertise become more important in different phases, new types of materials come into play, guarantees on building products of which little is known are needed, and deconstruction becomes an integral part of the process. Actors take on new roles to fulfil these functions, but these roles need to be renegotiated in every project, where the comfort of traditional roles remains attractive.

First, circular construction urges clients to include new tender criteria, such as circular visions that are difficult to judge and compare. They are no longer simply controllers, but become part of a dialectic visioning process. However, now, many lessons are embedded in tendering procedures, so the tendency rises to return to previous roles and judge projects quantitatively. Second, by focusing on closing loops, the end-of-life of buildings becomes more important, giving more responsibility to deconstruction firms. One interviewee argued that this makes them interesting parties to replace contractors and become builders themselves (Interviewee 14). Third, contractors (and in some cases, installation engineers), due to their technical knowledge, become useful advisors during the earlier design stages, both on construction and on harvesting non-virgin materials. However, as this means taking part of the role of architects, contractors are often not tempted to take on this role. Fourth, real estate developers mentioned they took on less directive roles, due to the flexible nature of circular construction projects. This means partnering more out of trust and stimulating actors (at least temporarily) to take over each other's roles. They also mentioned the need to take up a more proactive role by focusing on larger areas in order to reach circular goals, and no longer participate in (small) tenders.

Taking on new roles seems difficult, takes some parties more time, and does not immediately translate to new business models. One contractor added that current contracting forms are based on traditional roles, and that taking on new roles also demands new contracting forms, such as Rapid Circular Contracting (Interviewee 10).

4.2.6. Pioneering Leadership

As there are many other project goals besides circular ambition, the latter is easily lost. To realize circular ambitions, it can be beneficial to appoint a project member to take responsibility to put circularity on the agenda. Especially when experience with circular construction is lacking, this can increase awareness among project members about the need for a circular construction process and the non-traditional elements used therein. This applies especially to projects with high circular ambitions, since these often demand non-traditional solutions and more flexibility. In one project with high circular ambitions, the project leader argued that if they (the real estate developer) would not have set the bar, the project would still be circular, but end up in the midranges concerning the level of

circularity. With a drive for circularity, they inspired other project members to take up a similar circular mindset and sustain the ambitions throughout the project (Interviewee 20).

Pioneering leadership is related to power and money, as it is often only possible to realize circular ambitions if sufficient budget is available. In most cases, the client exercises power by deciding on budgets for circular ambitions, and thus has a decisive role. Although leadership can also be taken up by other project members, this is within the limits set by the client. Furthermore, the level of autonomy of a project vis-à-vis its mother organization influences the possibilities of project members to take up a leadership role. A certain level of integration of projects with mother organizations is required [49] to prevent projects from drifting off, creating potential difficulties in the realization of circular ambitions.

4.2.7. Continuity in Staffing

Although continuity in staffing is essential in all construction projects, this applies even more to projects with circular ambitions that deviate from business as usual. Projects with circular ambitions can highly benefit from continuity in staffing in different forms: within projects, in between projects, and between different organizations.

When project members diverge from standards, more in line with circularity, replacing them is an even greater loss than in traditional construction. Construction projects are already strictly divided in the design and construction phases, where first architects and then contractors usually take on a leading role (Winch, 1998). Municipalities also use this distinction in phases to appoint project leaders, which risks the loss of information and hinders innovation. Furthermore, continuity in staffing is important to reach a high-quality level and to stimulate trust. However, sometimes changing project leaders is necessary when personalities, behavior, or stances towards circularity do not match project goals.

Continuity in staffing also has advantages within an organization, between projects, because knowledge remains within a team. One public client mentioned that a preferred team is when one-third of the team has experience in circular construction and two-thirds are without experience, to both take advantage of the knowledge available and open a platform for learning within the organization (Interviewee 18).

Our findings show that continuity can also come about between organizations, e.g., when a project management firm takes on all construction projects within a certain area, so knowledge, a good relationship, and a shared vision between this organization and the municipality can develop over a longer period of time.

4.3. Contextual Influences on Circular Construction Projects

The third cluster of findings is related to contextual issues that influence the realization of circular ambitions in construction projects. Three dynamics are discussed here: (a) sector and organization cultures, (b) knowledge flows, and (c) power and tensions.

4.3.1. Sector and Organization Cultures

It is widely recognized that cultures at national, organizational, and project levels have influence in the realization of construction projects [20]. Culture is here understood as the sum of values, norms, rituals, and practices shared by a group of people [54]. We found two dominant cultural issues influencing the dynamics in projects with circular ambitions: (1) the traditional construction sector culture and (2) differences in circular mindsets within organizations. Firstly, this sector culture is perceived to be oriented towards technology instead of strategy, avoiding risks, and having a strong focus on short term cost reduction. Interviewees blame the sector culture for slow innovation in circular construction. The failure to innovate and learn from other sectors has been acknowledged by scholars [55]. Furthermore, the sector culture is characterized by deep distrust between public clients and private contractors. According to interviewees, contractors are perceived as "criminals" with no conscience and a strong focus on profit. In return, contractors perceive clients as untrustworthy, frequently changing their policies, and leaving project risks to the contractors. This mutual distrust results in notorious controlling and checking of agreements and

contracts, frequently seen in construction projects [49]. Furthermore, with such attitudes, short-term goals prevail over long-term goals of constructing circular buildings.

Secondly, differences in organization culture, and especially differences in circular mindset, were mentioned to influence circular projects. As construction projects are interorganizational projects, diverse organizations with different values, norms, and practices must work together to realize a project. For example, one client used the norm that the reuse of material was allowed, but without being visible, which only became clear after reused materials were visibly applied (Interviewee 22). These different circular mindsets are based on an organization's culture and influence how circular ambitions are translated to project goals. Interviewees mentioned that the best ways to stimulate circular mindsets are to set appealing examples, to have direct colleagues with circular mindsets, to repeat the circular message (over and over again), and to add a more personal component in the message. Some stated that especially younger employees picked up circularity more easily, as they are not trapped in routines and ask more questions. Older generations then hook up on the enthusiasm of these "ambassadors".

4.3.2. Knowledge Flows

Since circular construction is a relatively new concept, practical knowledge is often lacking. In practice, this new knowledge is also accompanied by a new way of speaking, or a new vocabulary, which tends to need a lot of repetition before it is taken over. Different actors have different issues regarding knowledge. Here, clients, contractors, and real estate developers are discussed.

First, clients say they learned a lot over the last five years, starting with tenders on vision, and now focusing on universal indicators. However, very few employees have the technical knowledge to interpret plans on these indicators; often, only one person within a major municipality has such knowledge. The unique skill lies in the combination of know-how on both tendering and the circular economy. Sometimes circular networks are used to fill gaps of knowledge, or external advisors are counseled. Contractors mention that despite these solutions, clients are still behind on the newest options, since they do not work on circular construction on a daily basis. Second, when contractors take on the role of advisors, ready knowledge is needed to be useful in discussions during the design phase. However, knowledge is often project-specific, calculations on the environmental impact of the project might take a long time, and sharing project knowledge with the rest of the organization easily leads to a dumping platform, where information is irretrievable. This is also true within a project itself, where BIM models can have hundreds of sub-models, impeding finding the right information. Third, real estate developers mention the necessity for ready information on circular construction to be able to make deals with partners. Comparable with other actors, knowledge sessions are used to gain information, but knowledge on the practicalities of circular construction measures are often still lacking, partly because proper evaluation of projects is uncommon. Thoroughly calculated reference projects have been found useful for ready knowledge, but since projects are so different, these have limited value.

Although seldom used, different ways to monitor lessons from projects with circular ambitions have been found; real estate developers used qualitative scoring lists, a municipality set up a committee for circular tender improvements, and an architecture firm used a wiki to capture the lessons from projects. A difficulty in monitoring, however, is that construction does not always strictly follow the design, and the actual outcomes of a project are seldom known. Monitoring can lead to ready knowledge about circularity among project members, but it is also important that they integrate this knowledge in their existing frame of reference to be able to apply it to daily practice. A way to achieve this is by continuously repeating the message and offering knowledge in diverse ways. One client explained this strategy: "Sometimes, when you hear a song for the first time, you don't like it, but if you hear it several times, you do. [. . .] and that is what we also

do with [circularity]; if you come in contact with it enough, it becomes fun after a while" (Interviewee 14).

4.3.3. Power and Tensions

We analyzed the two most important power issues influencing the dynamics in our studied circular projects: (1) the dominance of clients and (2) the tensions between permanent and temporary organizations. Firstly, the dominance of clients was frequently mentioned during interviews and evaluations. Clients have a leading role in the ambitions and budget of a circular project, the demarcation of roles, and the embedding of circular projects in permanent organizations. Circular construction demands different types of collaboration with partners in the construction chain. For example, the presence of reused materials is of importance; this must be agreed upon at the start of a project. However, during the realization of circular projects, clients often change their ambitions, leaving partners with other circular ambitions with no choice but to follow. Especially, when projects become more expensive, as they frequently tend to do, circular ambitions are adjusted downwards, to the frustration of partners. The short-term goals of clients, such as budgets, prevail over long-term goals, such as total costs of the construction and the development of partnerships with chain partners. However, clients also lack power—the circular goals which are agreed upon with contractors are difficult to control and maintain in a fragmented construction chain.

Secondly, related to the dominance of clients, there are tensions between permanent organizations and temporary organizations when executing circular construction projects. Support from top management is needed to start a circular project and to select and implement innovative ways of collaboration with partners. Furthermore, permanent organizations try to standardize work processes, tools, and decision-making procedures for circular projects. However, projects often strive for autonomy. Certain autonomy is needed for innovative projects, but too much autonomy results in project isolation with no translation of innovation from temporary to permanent organization [9]. Therefore, a recursive connection with top management and the permanent organization is crucial for successful circular construction projects, which might mean that employees with a different profile, more oriented toward maintaining relations between temporary and permanent organizations, are needed [9]. Lastly, project management offices have been used to commission projects, not only based on the traditional triangle of scope, budget, and time, but also on the value of circularity. This value-based management is becoming increasingly more important [56].

5. Discussion

In this paper, we explored the dynamics of eight interorganizational circular construction projects in the Accelerating Together initiative and how these projects can contribute to the transition towards a circular economy. By taking an actor perspective, as called for by others [3], our findings showed three clusters of dynamics that are relevant in the realization of circular ambitions in interorganizational construction projects: (a) prerequisites, (b) temporal dynamics in interorganizational projects, and (c) contextual influences. Furthermore, the joint reflection on these dynamics by clients and contractors helped to develop a shared understanding of how to better realize future circular ambitions, thus supporting the large-scale transition called for in the construction sector [28]. These findings contribute to the debates on interorganizational circular construction projects and on STR.

Firstly, the findings are relevant to the debate on interorganizational circular construction projects [3], with a more in-depth understanding of the dynamics of interorganizational projects, as others have called for (e.g., [14]). By zooming in on project actors, we provide insights into how actors deal with challenges in practice. The findings show that interorganizational projects are not homogeneous static entities [17,18] but dynamic interactions between project actors, in which, among others, trust, reciprocity, and flexibility

are important for the successful realization of circular ambitions. The challenges stemming from these dynamic interactions reveal the barriers and enablers for implementing interorganizational circular projects. Most of the barriers and enablers found in our study were identified in earlier studies (e.g., [1,2,32–34]). In addition to these studies, we found four prerequisites and seven temporal dynamics needed for successfully realizing circular ambitions in construction projects as well as three contextual influences. With our focus on actors, we offer a more holistic and power-sensitive overview of how different dynamic elements influence each other, which is frequently missing in the interorganizational project debate [18].

Secondly, our findings contribute to the STR debate (e.g., [11,12]) with a better understanding of how actors in interorganizational circular projects can contribute to the transition towards a circular construction economy [13,24,26]. By focusing on the experiences of actors involved in these projects, we provide an understanding of the interaction between different levels (niche, regime, and landscape), which, up until now, have mainly been discussed from a systemic perspective in transition literature [24]. Based on our findings, we distinguish three ways in which actors in interorganizational projects say they can contribute to the transition: (a) actors from diverse organizations influence each other in interorganizational circular projects; (b) actors bring their experience with and knowledge on circularity to their mother organizations; and (c) experiences and lessons learned are, according to interviewees, transformed to new circular projects in network platforms and other collaborations with future partners. These three ways are discussed below.

First, some actors act from a regime-oriented mindset, implying that they act in line with existing conventional practices and routines, backed up by formal and informal rules. Other actors have a niche-oriented mindset, and try to apply circular principles in their work practices. These orientations are situational, as actors can shift between different mindsets, depending on what they deem suitable in a specific situation. In line with earlier findings [9,38], our study shows that interorganizational projects have the potential to shift project actors' mindsets. Actors from different organizations bring in different work practices, narratives, norms, and values [15], which creates an opportunity for exchange. Most project members had no previous experience with circular construction, and some started off with a skeptical stance towards this niche innovation. However, most of them reported a much more niche-oriented mindset by the end of the project and can be considered intrinsically motivated people, as discussed in our findings. Actors involved in interorganizational projects, despite having different stakes, can remind each other of the common circular goals that have been set. We noticed that if different actors take up this niche-oriented mindset, they can positively contribute by making sure everybody sticks to the ambitions and takes action to realize them.

Second, according to the interviewees, it is of crucial importance that actors bring their experience with and knowledge on circularity to their mother organizations. Successful but also unsuccessful projects can function as drivers for change within mother organizations by pressuring shifting, frequently informal rules within the dominant regime [37]. Project actors bringing in their newly learned practices can spread circular ambitions within their own organizations and thus contribute to this niche–regime interaction. In this interaction, intrinsically motivated actors, the larger part of the project actors, interact with actors with different mindsets. For example, some project actors said they became ambassadors within their own organizations and successfully challenged other employees to reflect on their regime-oriented mindsets. This can result in top-down support and chances for change in, for instance, organizational policy or tender procedures. If shifts in mindset are not adopted or translated into different practices, rules, and/or policies, effects may fade out and actors can lose intrinsic motivation or become burned out.

Third, actors can contribute to the transition through transforming their experiences and lessons learned to new circular projects. Interorganizational initiatives, such as Accelerating Together, create possibilities for exchange and learning across projects. For example, this program contributes to niche–regime interaction through the development

and implementation of a list of both minimal and ambitious goals on various circular project themes. This document, which is openly accessible for consultation while setting up new projects, must inspire actors throughout the supply chain. In this way, niche innovations of circular construction can be strengthened, as learning between actors is fostered, while developed knowledge is brought to the often regime-oriented mother organizations. Moreover, the opportunity of learning between project actors is created over time; new projects create new spaces for niche–regime interaction. For example, when actors with a niche-oriented mindset collaborate with actors with a regime-oriented mindset in new projects, an opportunity for niche–regime interaction, and thus for learning and change, is created. Finally, learning can be strengthened by continuity in staffing, as discussed in our findings, to avoid knowledge loss, and to contribute to a relationship of trust.

6. Conclusions

In this study, we answered the question of "which dynamics in the execution of interorganizational construction projects are relevant to realize their circular ambitions and how do these projects contribute to the transition towards a circular economy?" We identified fourteen dynamics of interorganizational projects, consisting of prerequisites, temporal dynamics in interorganizational projects, and contextual influences. The seven temporal dynamics found to support the realization of circular ambitions in construction projects are (a) transparency and trust, (b) flexibility, (c) reciprocal relationships, (d) project team identity, (e) struggle for new roles, (f) pioneering leadership, and (g) continuity in staffing. In addition, we identified four prerequisites that are needed for setting and realizing circular ambition in construction projects: (a) top-down support, (b) partnership based on increased equality, (c) shared circular goals, and (d) involvement of intrinsically motivated people. Moreover, we found three contextual factors that influence temporal dynamics, which in turn are influenced by them: (a) sectoral cultures, (b) knowledge flows, and (c) power and tensions.

Additionally, through this lens on projects, we give an insight into the potential contribution of these projects in the transition towards a circular construction economy as a whole. It is widely recognized that the existing construction regime is under increasing pressure stemming from global environmental concerns, as is recognized in international, European, and national sustainability agendas [13]. These goals are translated into regulations on environmental performance and transition platforms, which are established to bring about regime change. At the same time, however, the fragmentedness of the sector minimizes opportunities for niche–regime interaction, thereby perpetuating the existing construction regime [28]. Whereas direct collaboration offers space for actors to stimulate each other for circular decision making, and therefore allows niche influences on the project, this influence fades when it affects decision making further down the chain. Here, it becomes clear that not all elements of circular construction, e.g., the creation of circular supply chains, have had the protected space common to niches. Furthermore, due to the locked-in structures and processes [29], the regime inhibits flexibility, which is needed to redistribute time and money and to alter plans, and the option for actors to take on new roles. If actors in the construction chain continue organizing construction projects according to these locked-in practices, possibilities to realize circular ambitions are very limited. However, interorganizational projects can be opportunities for niche–regime interaction, with actors from diverse organizations influencing each other, and also bringing back their experiences with and knowledge on circularity to their mother organizations. Finally, we have seen that learned lessons and actor experiences can be transformed into new circular projects in interorganizational initiatives and to future partners.

Limitations of our study can be found in the online collection of data due to the pandemic. Face-to-face evaluations were not possible, thus limiting the interaction and observing of interviewees, normally an important source of rich data [20]. Furthermore, all of our evaluated projects were situated in the Netherlands, which makes it difficult to generalize beyond the national scope. However, recent studies (e.g., [32]) share several

of our found supporting temporal dynamics in an international context. Nevertheless, it should be noted that circular construction takes on many forms that might all influence temporal dynamics in interorganizational projects. We recommend future research to deepen knowledge on the dynamics found in this paper and to make the relation between them clearer by looking at a wider variety of case studies. Moreover, we recommend researchers to further investigate the interaction of circular construction niches with the regime, both on an organizational and a sectoral level. Our study shows that projects can aid the regime in taking up the niche of circular construction. Yet, at the same time, the limitations of them become clear, since the whole sector, and even parts beyond it, need to change to mainstream circular construction processes [57]. Therefore, more research should be conducted that focuses on actors outside the scope of construction projects and their influence on these projects.

This research's societal relevance is the transition towards the construction and renovation of buildings according to circular principles and thus, significantly reducing CO_2 emissions, resource use, and waste production. Learning from and experimenting with circular construction projects are both important in the transition towards circular construction economy for national and local governments and other organizations in the construction sector. This will support the needed change in collaboration in the construction chain related to organizational roles and responsibilities [7]. Through the program "Accelerating Together", integral thinking was stimulated as people from different types of organizations exchanged their perspective on the process of circular construction. Based on our results and the feedback given during the Accelerating Together program, we endorse the continuation of these types of programs to serve as a platform for shared learning and reflection in an interorganizational setting. Furthermore, we recommend practitioners to take heed of the temporal dynamics in interorganizational projects discussed in the findings, such as making someone explicitly responsible for putting circular ambitions on the agenda during project meetings, and create some flexibility in terms of planning and budget, in order to have room for potential setbacks and innovation during the project. Lastly, we recommend public clients to create a shared vision with architects and contractors before tender procedures, in order to make optimal use of the expertise of each actor and work towards integral solutions.

Author Contributions: Conceptualization, E.K. and M.v.U.; methodology, E.K. and M.v.U.; validation, E.K., M.v.U., A.v.M., H.W., E.v.B. and E.H.; formal analysis, E.K. and M.v.U.; investigation, E.K. and M.v.U.; writing—original draft preparation, E.K., M.v.U. and A.v.M.; writing—review and editing, E.K., M.v.U. and A.v.M.; visualization, M.v.U.; supervision, H.W., E.v.B. and E.H.; funding acquisition, A.v.M., H.W. and E.v.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Dutch Research Council, grant number 40319213.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Vrije Universiteit Amsterdam protocol code Data Management Plan and 23-9-2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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