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RETHINKING SUPPLY CHAINS AS NEIGHBORHOODS

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Abstract

This paper explores the implication of a neighborhood model for interfirm interactions that explicitly tries to create an equality matching relationship among firms in an industry. The aim is to examine what would happen if these firms worked to gain trust with each other with an eye toward maximizing the value of the collaboration across projects rather than just maximizing revenues in individual projects. A review of extant literature and an analysis of in-depth interviews yielded three actionable strategies that support the creation of a sustainable neighborhood in the construction industry: 1) Hub Strategy, 2) Trust Exercise Strategy, and 3) Sustainable Neighborhood Strategy. As envisioned in this study, the hub is a concentrated, inter-organizational structure for supply chain participants in large, complex projects. Importantly, hub members engage in a variety of technical activities that infuse ongoing and future projects with innovation, scope optimization, and operational efficiencies. Additionally, other activities within the hub are designed to purposefully allow participants to develop trust through collaboration before or outside of their primary contractual engagements. At present, this model has been examined for construction megaprojects, but the general neighborhood concept could be applied to many different industries and settings including manufacturing supply chains and collaborations among communities engaging in economic development. Future work will explore whether mechanisms like the hub and trust exercises can be applied in these other settings as well.

Key words: Supply chains, trust, collaboration, construction, strategy, long-term decision making

Introduction

Few businesses in any industry provide end-to-end service without requiring additional suppliers or subcontractors to complete the work. This observation is particularly true in large-scale construction projects where hundreds of firms may be involved in design, labor, and supplies. The involvement of a network of suppliers and contractors allows firms to specialize in a particular manufacturing technique, lead a particular contractual role or provide a unique labor force. Project owners can play the role of a conductor, bringing together firms on an ad hoc basis tailored to the specific needs of the project.

However, this structure has disadvantages. In large projects, firms can spend considerable time, effort, and resources just to reach agreement with all of the subcontractors and suppliers. Firms participating in a project are often motivated to maximize their profit for each and every project and to minimize their risk exposure. Consequently, studies estimate that more than half of expenses in large construction projects are spent on coordination among firms rather than on the final product itself (Sarhan, Pasquire, & King, 2017).

Large-scale construction projects have been studied extensively and although successful collaborations have been documented, failure is common (Bresnen & Marshall 2000a, b; Larson & Drexler, 1997). A significant source of failure is the "lowest-bid-wins" approach that creates different incentives for prime contractors and subcontractors, leading them to compete rather than collaborate, which can reduce trust and ultimately performance (Kadefors, 2004). Trust is a key component in successful ventures and is influenced by both organizational and contractual aspects of a construction project (Zaghloul & Hartman, 2003).

When firms work together often, though, they are able to develop some familiarity in the way they operate. Wong, Cheung, and Ho (2005) find that for construction developer clients and contractors in Hong Kong, the cycle of building a trusted relationship between partners is predicted by a contractor's reliable, competent performance and transparent communication with the client, and the client's reciprocating trust in the contractor. This trust can in turn reduce some of the friction that is responsible for the high administrative costs of projects. In this paper, we explore a few approaches to reducing the conflict among firms in large projects. Then, we propose a neighborhood model that explores methods for getting firms that have developed trusted relationships to move beyond a focus on single projects to maximizing the value they can provide each other over time. We suggest that this model also has benefits in enabling firms to reduce inefficiencies in project designs. Finally, we suggest methods for codifying this structure.

The neighborhood metaphor

Research by Alan Fiske (1991) identified four types of relationships among people that characterize the ways that people engage with each other. Three of them are particularly relevant here. The first—*market pricing*—is a low-trust relationship in which people settle up transactions in the moment. This is the kind of relationship most common among strangers as well as individuals who do not trust each other. The second—*equality matching*—involves higher levels of trust and engagement in which people expect to give and get things of equivalent value over time, though particular transactions may be weighted more heavily in favor of one party or the other. This relationship is common among neighbors and colleagues. Finally, there is the *communal sharing* relationship which involves high levels of trust and engagement and in which people do not try to settle up their debts. This relationship is typical of families who take care of other family members without requiring a specific balancing payment in return.

Much of the basis of modern organizational structure is rooted in the assumption that actors in organizations are operating in their enlightened self-interest at any given time. Without making this point explicitly, these models assume a market pricing relationship among individuals in which individuals are responding to the reward structure in the environment at that moment rather than taking the longer time-horizon that an equality matching neighborhood structure might support. Likewise, the focus on interfirm interactions tends to be on individual projects rather than on determining the value of the interfirm relationship over time and taking actions to maximize that long-term value. This tendency has been exacerbated by the dictum that publicly traded companies maximize shareholder value, which is strongly influenced by short-term quarterly performance (Rapoport, 1986).

In this paper, we explore the implication of a *neighborhood model* for interfirm interactions that explicitly tries to create an equality matching relationship among firms in an industry. The aim is to examine what would happen if these firms worked to gain trust with each other with an eye toward maximizing the value of the collaboration across projects rather than just maximizing revenues in individual projects.

To date, most of our research has focused on firms involved in large-scale construction projects, and so we will draw examples from that industry throughout this paper, though other industries with significant supply-chain relationships may benefit from the same approach. The neighborhood provides a structure for organizations to come together in a cooperative network that promotes trust and collaboration, and that spans formal contractual engagements for individual projects. Firms should seek to cultivate sustainable relationships with partners and suppliers that enable them to minimize the effort required to negotiate new agreements as new projects arise. They should also seek to communicate the value of these relationships when bidding on contracts in order to help potential clients to recognize the long-term cost savings that emerge from healthy functioning business neighborhoods. We find that the neighborhood model offers a structure for long-term, mutually beneficial relationships among a collective of firms that could potentially persist over several contractually defined projects.

The construction industry has recognized that a collaborative environment would likely ease problems that arise during particular projects as well as accelerate the process of reaching agreements in new projects. In the next section, we review five models that have been proposed to address these issues: Integrated Project Delivery (IPD), Aligned Construction Enterprise (ACE), Systems Integrator, and Service-Dominated Logic (S-DL), which informed our analysis and shaped our findings. In addition, we briefly review the *innovation reef* model, which was developed after analyses of successful startup incubators. On the basis of this review and our own explorations, we argue that three neighborhood creation strategies: *hub, trust exercise,* and *sustainable neighborhood,* appear likely to produce trust-building collaboration.

Five models of interfirm collaboration

The most common methods for awarding large-scale construction projects are Design Build and Design Bid Build structures (as shown in Figure 1, Panel a). Design, Bid, Build (DBB) projects are most restrictive for general contractors, because architecture and engineering for the projects have already been completed prior to bidding the job, and so the owner seeks a general contractor and subcontractors who will follow specifications that have already been set. Design Build (DB) projects are somewhat less restrictive, because the general contractor and subcontractors have more opportunity to work with the project owner to influence the implementation of the project.

Two problems with these models have been the target of new approaches to contracting. First, there is little opportunity (in the case of DBB projects) or incentive (in the case of DB projects) in these projects for the general contractor and subcontractors to make recommendations in the design process that will minimize the cost or time to completion of the project. In addition, neither of these structures promotes teamwork among the participating firms.

1. Integrated Project Delivery

Integrated project delivery (IPD) is a model in construction project administration where the project owner works with contractors on a project team to define and manage the project before construction begins (see Figure 1, Panel a). Agreed-upon project goals and responsibilities, shared financial incentives, and continuous and transparent communication among partners in the project team led to IPD success (Xie & Liu, 2017).

IPD provides an innovative mechanism to promote engagement and cooperation among participating firms: the multiparty contract that is established before the design stage. A key element of this framework is that all participants fund a shared risk management bond that is used to cover the expenses of project disruptions. At the end of the project, funds remaining in the shared bond are returned to participants in proportion to their initial contribution. This multiparty framework facilitates co-creation of common approaches to relationships and contracts between firms early on in the project and establishes a shared precedent for ongoing communication and problem-solving, in response to unexpected project disruptions.

In a review of a large sample (n=113) of capital projects, Suprapto, Bakker, Mooi, and Hertogh (2016), found that partnering projects that included behavioral incentives were found to have improved relational attitudes and teamworking qualities compared to lump sum or reimbursable projects. However, the actual role of incentives on those outcomes was less clear. While incentives to motivate behavior change in a project may contribute to improved relationships between firms, this consequence may be more incidental than intentional. IPD advocates argue that intentionally improving relational attitudes and teamworking quality among project participants improves project performance.

IPD is based on collaborative involvement with key participants early in a project and has been shown to outperform "bid and build" (DB) and "design, bid, and build" (DBB) project management systems (El Asmar, Hanna, & Loh, 2013). In a "bid and build," the customer specifies the work to be done. In a "design and build," the customer communicates the end requirements, and the contractor develops and executes the solution to fit the requirements. As shown in Figure 1, IPD brings participants together, without the hierarchy of traditional approaches.

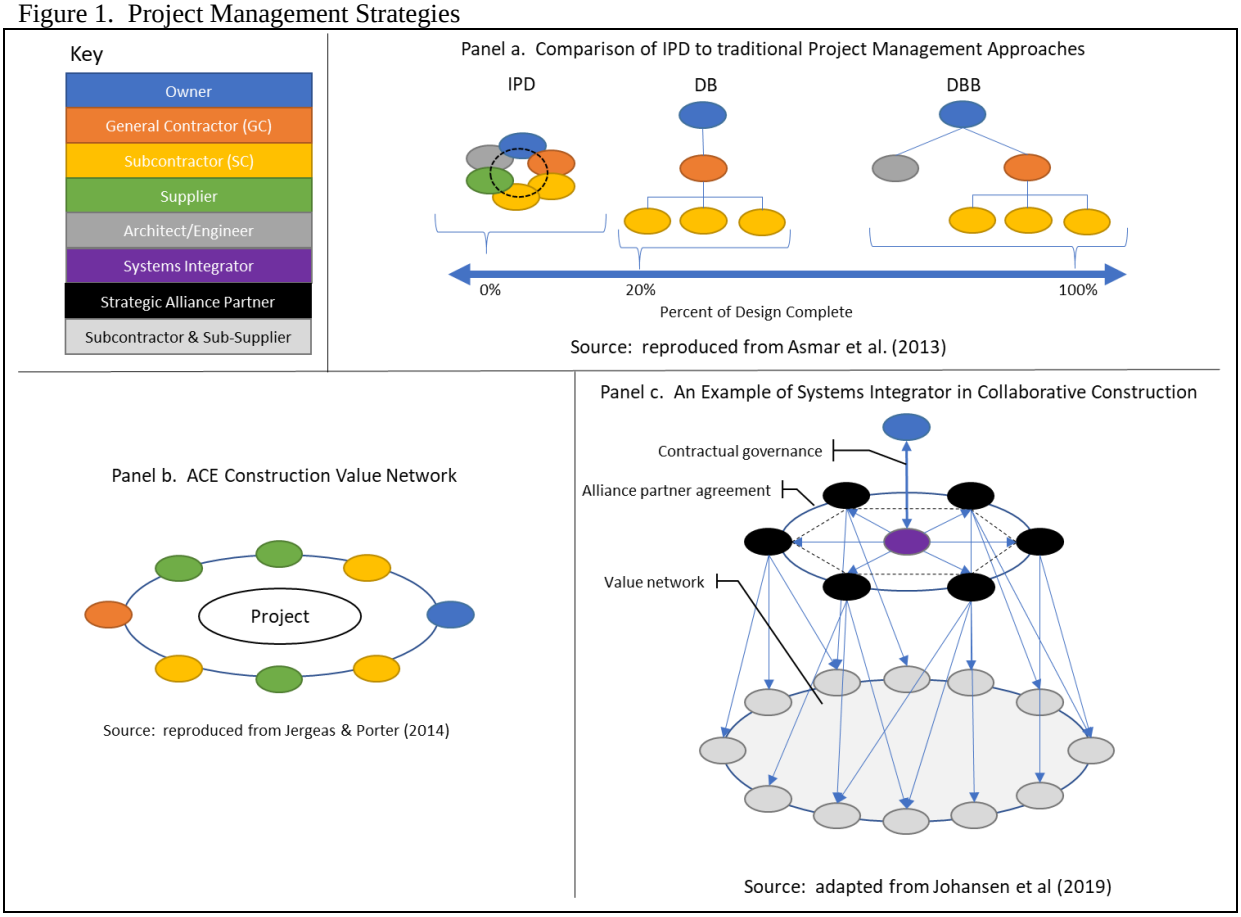
2. Aligned Construction Enterprise

The Aligned Construction Enterprise (ACE), proposed by Jergeas and Lynch (2014), is a collaborative project delivery model designed to address the structural and organizational deficiencies often seen in the delivery of megaprojects. Similar to IPD, ACE brings participants together early in a project and additionally focuses on a value network with participation by all relevant parties. Figure 1, panel b illustrates a crucial systems integrator function at the center of the value network. A key element of the Systems Integrator is joint ownership and control by all project participants. The systems integrator center is envisioned to contain expertise on a variety of skills, including lean IPD. An important philosophical contribution of ACE is the shift from thinking about supply chains, with owner at the top, to value networks based on common values, organizing principles, best practices, risk management, and project schedule.

3. Collaborative Contracting

Johansen, Olsson, George, and Asbjørn, R. (2019) expand the systems integrator concept by building on ACE. Now more than a function, the systems integrator is more formally defined as an intermediary that can be an independent person or firm with a sound understanding of major-project complexities that sits between the owner and suppliers and encourages collaboration. More than a project manager, the systems integrator sets common project goals and maintains the focus on long-term collaboration among owners and suppliers. Figure 1, Panel c, taken from Johansen et al. (2019), depicts contractual governance from the systems integrator and alliance partners with the double-ended arrows and strategic alliance agreement structures with dotted circle.

Figure 1. Project Management Strategies

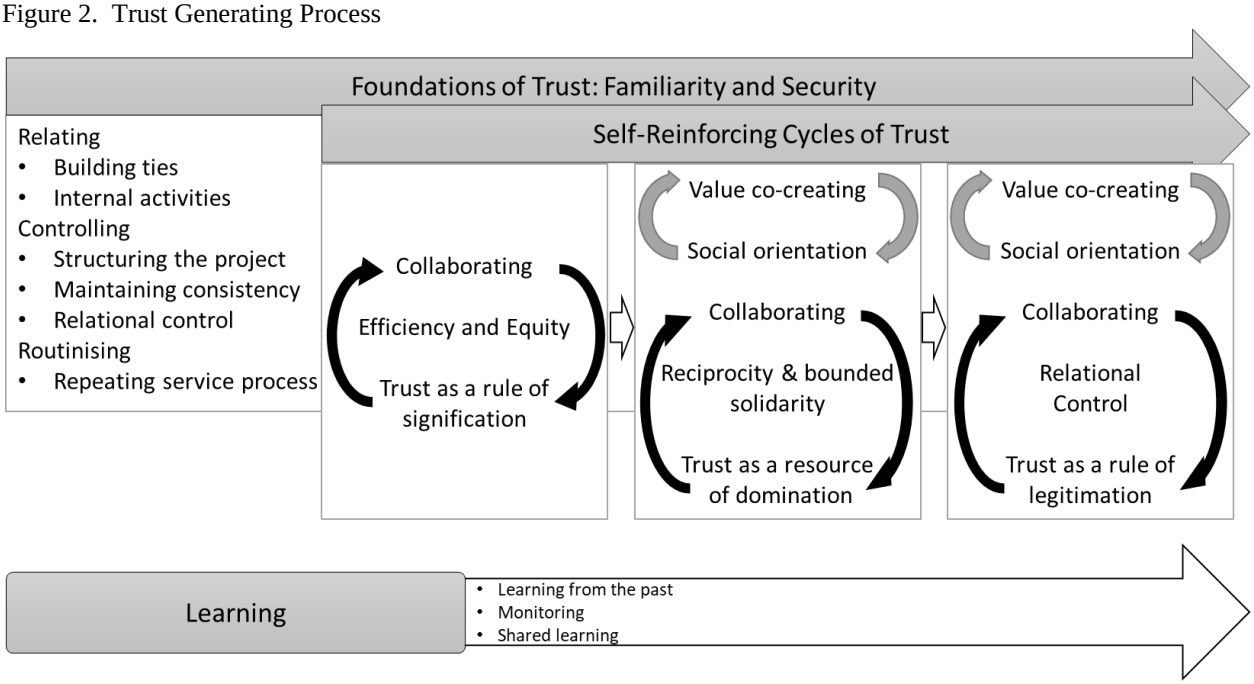


Caption: Panels a, b, and c depict the evolution of project management strategies from the hierarchical (bid build (DB) and design bid build (DBB) toward more cooperative strategies. Integrated Project Delivery (IPD), Aligned Construction Enterprise (ACE), and Collaborative Construction use circular orientations among participants to emphasize horizontal power relationships instead of hierarchical power relationships.

4. Service-Dominated Logic

Networks with collaboration centers innovate how projects are managed. Xu, 2020, addresses operational models that look at resources and enterprise value prioritizing service-dominated logic (S-DL) instead of individual transactions (Lusch & Vargo, 2014). S-DL is an example of how the organization of ACE could be centered on a value of service instead of a value of minimizing individual firm risk and maximizing individual firm profit. In S-DL, value is co-created through the social capital of relationships and reciprocal transactions. Trust is an emergent process that can be fostered through activities, including learning, relating, controlling, collaborating, and routinising (Munro & Childerhouse, 2018). Trust is enhanced through self-reinforcing cycles, as shown in Figure 2. Xu frames S-DL as a model that "shifts the focus away from projects, goods, and services toward service ecosystems." Within this ecosystem, construction participants co-create value with owners and even users of the built environment that is produced by the completed project. Xu focuses on trust within individual projects, but trust within an ecosystem is a concept that has the potential to influence longer-term inter-organizational relationships.

Figure 2. Trust Generating Process



Source: Xu (2020)

5. Neighborhood

Drawing from the literature reviewed, we adapt the neighborhood to the field of supply chain and multi-institutional construction projects. The systems integrator approach suggested a key role for a stakeholder playing the role of a "hub" in a neighborhood. As we envision it, the hub is a concentrated, inter-organizational structure for supply chain participants in large, complex projects. Importantly, hub members engage in a variety of technical activities that infuse ongoing and future projects with innovation, scope optimization, and operational efficiencies. Additionally, other activities within the hub are designed to purposefully allow participants to develop trust through collaboration before or outside of their primary contractual engagements. Pre-project value engineering and feasibility studies are complemented by, for example, disaster preparedness activities where participating organizations work through real-world project scenarios, like supply disruptions or natural disasters, before they occur in contracted engagements.

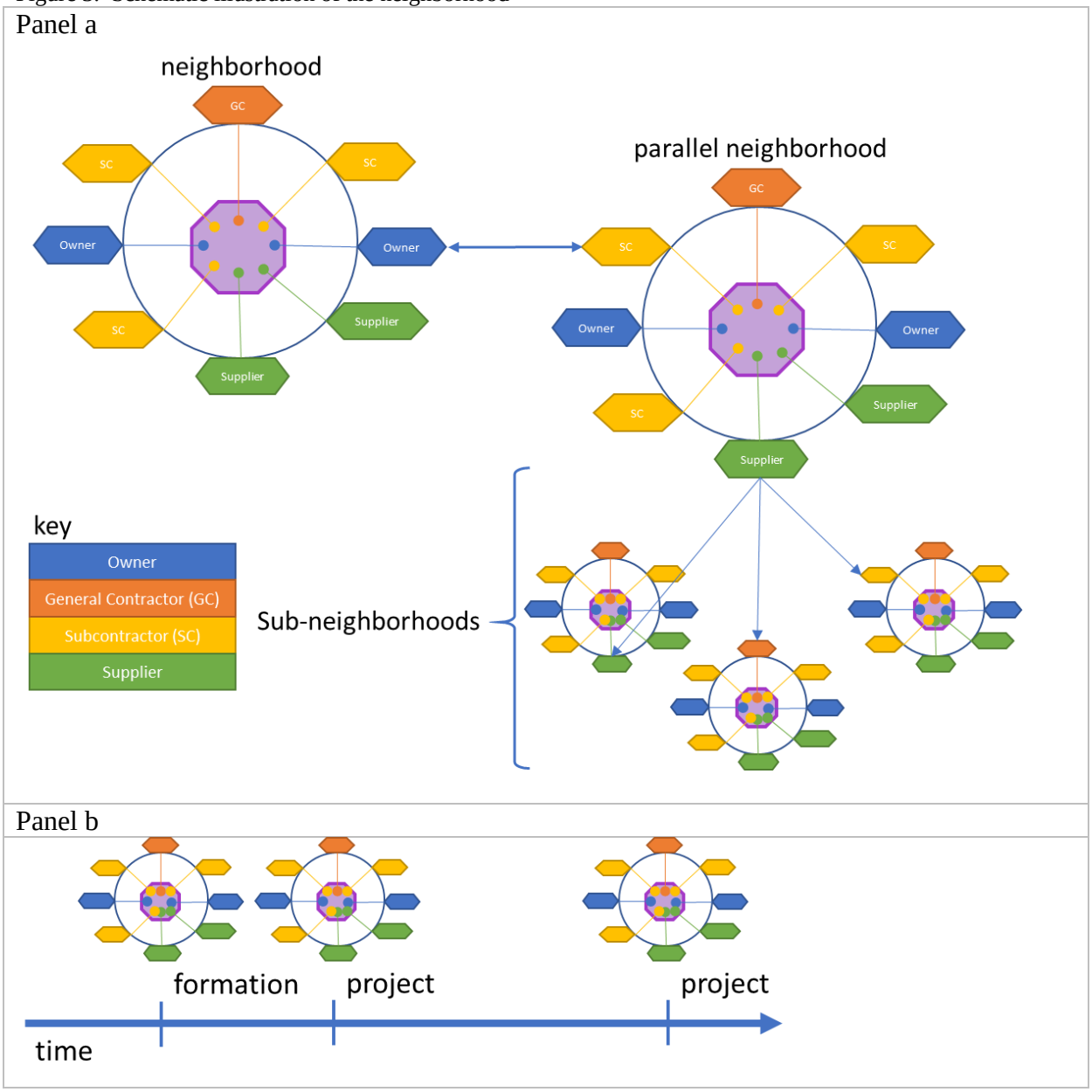
In addition, to think about implementing a neighborhood, we also draw from the *innovation reef* metaphor that emerged from studies of successful business incubators such as the Austin Technology Incubator (Markman, 2012; Pogue et al., 2016). An institution like an incubator provides a structure to bring the right people together in an innovation network that promotes the diffusion of ideas and practices to the marketplace through entrepreneurial activity. While the structure of the innovation reef primarily gathers people to innovate and advise, the structure of the neighborhood promotes cooperation. These two models are related in that the envisioned neighborhood, like the reef, supports innovation beyond the aforementioned reduction of waste and excess cost. By supporting a long-term view of collaboration, participants trust their neighborhood partners to innovate by optimizing partners' scope for collective benefits, rather than simply looking at short-term gains for their individual firm.

Figure 3, panel a, illustrates some of the structural attributes of the neighborhood. Participants in a neighborhood may participate in another neighborhood, at times with a different role. For example, a subcontractor in one neighborhood might be a general contractor (GC) in another. Some neighborhoods might be viewed as parallel neighborhoods; others might be more accurately thought of as sub-neighborhoods.

As illustrated in Figure 3, panel b, neighborhoods are formed outside of the confines of an existing project for the explicit goal of sustaining themselves over time across multiple projects. As dynamic ecosystems, neighborhoods also evolve over time, with new participants joining and, perhaps, established participants exiting. These exits might reflect neighborhood members who find other firms with whom to work, but maintaining an equality matching relationship within the neighborhood also requires that firms that do not provide positive value to the neighborhood over the long-term be removed from it. In the absence of strategies for removing participants who do not add value, neighborhoods run the risk of promoting "free riders" who take advantage of their status without contributing to the long-term success and efficiency of the cohort. Finally, the roles played by a participant may change over time.

Despite the alignment reviewed in Integrated Project Delivery (IPD), Aligned Construction Enterprise (ACE), Systems Integrator, and Service-Dominated Logic (S-DL), the construction industry seems fixated on the individual project as the transactional unit for relationship management between firms. From our interviews, we find that the normative, albeit disappearing, practice among project managers, firm executives, and corporate leaders follows structuring supply chains with contracts that reallocate risk to maximize the return from a particular project or the next quarter's results. Just as neighbors invest in homes with 30-year mortgages and infrastructure like roads, parks, and schools, so too should industries invest in trusted supply chains that both incentivize long-term relationships in a portfolio of capital projects and encourage market entry for new firms to spur innovation.

Figure 3. Schematic illustration of the neighborhood



Method

Solving new problems successfully requires generating a variety of unique problem statements (Markman, 2017). Our aim with these interviews was to characterize the current state of collaboration on significant projects to better understand the gap that must be bridged by a collaborative approach. Our analysis also benefitted from the iterative review of our research question and interview guide.

Semi-structured interviews were conducted with 15 industry participants from firms involved at various levels of the construction supply chain. Four interviewees were from multinational corporations. Three of the corporations were leaders in the oil and gas industry. Interviews from the multinational corporations provided insights from the perspective of a project owner, although some interviewees also had pervious employment at firms in the supply chain. The remaining interviews were with firms who at times were the lead contractor or a subcontractor. Interviews followed a flexible discussion guide that allowed for probing and follow-up to newly revealed ideas. All interviews lasted about an hour and

involved multiple members of the research team. All interviews involved a primary participant, although some interviews included multiple participants. Interviewees shared their perspectives anonymously, and thus all identifying information has been removed from the same firm.

Results

Our interview participants described using practices related to the concepts embedded in the five models of interfirm collaboration summarized earlier. For the firms that we interviewed, four primary issues emerged from our analysis: 1. The same people working together, 2. The scale and length of time that people will work together, 3. The process for regular communication, problem-solving, and innovation, and 4. The sharing of risk and reward. We refer to the firms we interviewed using the letters A, B, E, S, and W.

1. The same people working together

E, a leading oil and gas company with a global scope, has used strategic alliances as a purchasing mechanism to reduce friction and improve project execution with its suppliers. Although E did mention that relationships established with subcontractors during cooperative bidding processes did pay off, as a procurement process, the focus was more on qualifying vendors and setting pricing structure than establishing cooperative behaviors from which trust might emerge. As a consequence, the alliance program was ultimately discontinued.

S, a third global oil and gas company, has long recognized that coherent teams of suppliers bring a multitude of benefits to a series of projects, but has also recognized that those benefits are largely driven by two primary factors: continuity of the people involved and of the type of work being performed from project to project. From S's perspective, a shift in personnel is only one of many possible disruptions to an interorganizational cooperation. However, as researchers, we believe that retaining the same personnel could improve responses to other disruptions over time.

W, a road and waterworks construction contractor in a large Southwestern U.S. state, is an example of an organization that organically evolved in the direction of the neighborhood model through an evolutionary process, as they navigated the competitive contractual processes of winning business from governmental agencies and municipalities. W employed an agency whose role was to act as a hub for W's contractors. However, W's supplier noted that they experienced inefficiencies in working with W when their contact at the hub agency changed.

2. The scale and length of time that people will work together

In line with concerns about personnel turnover, S also believed that maintaining a climate of cooperation is easier for smaller projects. They believed that improvements to efficiency disappear when key personnel are not retained and when project parameters, like geography, governance systems, enabling technology, and economic climate, shift. These parameters seemed more likely to shift in the context of large-scale projects.

B, a leading mineral extraction company also with a global scope and significant operation in oil and gas, recognizes the need for certain aspects of its business to be sustained across projects. B typically breaks mega projects into subprojects that occur in stages; mega projects can last for several years. These large projects involve a selection phase that often runs for 18 to 24 months wherein three contractors will work with B in parallel (and in competition) to optimize the approach used for the project. B uses an organizational structure, where services needed in all projects, like purchasing and legal, are shared across projects. Even so, interactions with suppliers still occur within the context of an individual project, instead of interacting with suppliers in the context of multiple projects.

3. The process for regular communication, problem-solving, and innovation

For B's mega projects, optimization involves trade-offs among 5 – 10 objectives. This process allows the owner to test the competing contractors' capabilities, experience, and innovation. As the selection phase proceeds, the number of participating contractors is trimmed to one who will execute the project in the field. In addition to technical assessment, this selection process allows the owner to gain familiarity with the contractors' business philosophy and mindset, allowing the selection process to be informed by perceptions of common goals and commitment to meeting the needs of the project. B used a series of interorganizational meetings comprised of participants from their project team and key suppliers to work through issues that arise during project execution.

In response to the description of the hub strategy, one participant from B recalled success at a prior firm working with a consultant that set up a hub-like model for a previous project where some of the benefits of our neighborhood hub were actually realized. In that instance, a consultant was hired, during an early phase of a mega project that had suffered schedule delays, to work with the project owner and the selected contractors and suppliers to create a formal business entity to which employees from all participating firms were assigned. The process took several weeks to implement, but it broke the adversarial mindset so common in mega projects and the project was then able to respond more quickly and efficiently to existing and subsequent disruptions. One year later, the project's schedule was within 10% of the original plan. Based on that previous success, B wondered if the neighborhood model might be piloted in a specific project, a current but early-stage offshore megaproject.

A is an organization that likewise evolved its own operating philosophy along the same lines as the neighborhood concept. As a builder of buildings, A operates at different levels within the construction supply chain, depending on the project. When the scope of a project is the construction of a building, A is the prime contractor interacting with the owner. When they build a component of a larger project, e.g., an oil and gas refinery, A is a supplier to the engineering, construction, and procurement (EPC) firm that was hired by the oil and gas owner to execute the larger scope of work.

A was also in a unique position to understand the point of view of owners and suppliers because A had established relationships of trust as a supplier with several owners, allowing them to innovate in multiple projects for the owner. In addition, A has its own supply chains for larger jobs and has implemented the same sort of trust and collaboration relationship with its suppliers. Among large corporations, owners may be competing with each other to maximize short-term profit for the individual corporation, instead of investing in its supply chain, by taking on shared risk in large projects.

Much of W's work falls contractually into what is referred to as "bid and build," but some of their work falls into the DB model. These two project archetypes illustrate different neighborhood potential, with DB affording the firm a much more participatory interaction with its customer, one that is more aligned with the collaborative ideas of the neighborhood.

4. The sharing of risk and reward

Earlier we described how, as a procurement process, E used strategic alliances as a purchasing mechanism to reduce friction and expedite project execution. The focus was more on qualifying vendors and setting pricing structure than establishing cooperative behaviors from which trust might emerge. Additionally, that process was also intended to reduce risk on future projects because contracts were focused on pre-qualified suppliers.

"Bid and build" projects afford far fewer opportunities for cooperative neighborhood behaviors to emerge, due to the tight budget and financial controls within the contracts for such projects; parties will usually stop work when a project disruption occurs so that they can assess the impact and level of responsibility for each firm. These kinds of delays increase costs but could ideally have reduced impact in a neighborhood where trusted relationships

have already been built and structures for shared financial risks and rewards have been established before project execution. For example, in a bid and build project, a contractor for W described how its client quickly shouldered additional costs when its design was faulty, instead of delaying the project to negotiate additional costs with W and its contractor; W's trusted relationship with its client and contractor led to a quicker return to fixing the problem.

For B's mega projects, planning includes extensive risk analysis and assignment of risk, through stage-gate decision making. Early involvement in this process allows the owner and contractors to develop a sense of common and committed purpose. However, one of the drawbacks of this transactional approach is that contractors who are involved early in a project, including scope optimization and value engineering, often tend to be more conservative about the scope and submit a higher budget when competing for the larger, later-stage execution contract. Other contractors, with less or no experience during the competitive selection phase, can be more aggressive in their budget assumptions, appearing to be more price competitive than the firms who have worked with the owner to optimize the project approach. This myopic shift invariably leads to the selected contractor abusing the change order process to increase their budget as the project proceeds. In a neighborhood, participants would be motivated to collaborate earlier and resolve scope issues with less impact on the overall project.

Discussion

Our interviews confirm that all participants in the present study have experienced trust as an emergent process that takes far more time to develop than it takes to destroy or diminish. Participants also perceive that current transactional processes associated with large capital projects are untenable because of built-in inefficiency and myopia. Owners, who currently control much of the structure and form of the common interactions with suppliers, recognize the potential benefits of the neighborhood concept, but appear less willing or able to engage in formative activities to test and develop a pilot hub. In contrast, suppliers, appear more willing and able to engage in the process. Our interviews reveal a common perception that the industry, in the pursuit of short-term profit and efficiency, has developed a mindset that needs to be disrupted in order to survive in post-fossil-fuel-dominated markets.

Suppliers who serve owner organizations are themselves the customers of their suppliers. This research suggests that an initial neighborhood hub might be formed in the supply chain at least two levels from mega project owners. Such owners are enslaved by their own simple, bottom-line metrics (ROI, NPV, etc.) and culture. They see the need to change, but they are stuck. But they control how opportunities are created and presented to contractors (DB, DBB, EPC, etc.). Thus, testing the neighborhood at a set of nodes in the construction ecosystem where the lead owner has also experienced the negatives of being in a contractor role will increase the likelihood that all parties will engage in the creation process. Larger firms like E, B, and S appear to function only as owners, and while they recognize the merit of the neighborhood, they appear to have less ability to engage in a trial of the neighborhood than smaller firms like W and A who, at different times on different projects, function as an owner, a general contractor, or a subcontractor.

One of the benefits to a supplier of being a member of a neighborhood is that having won the trust of an owner, firms are now in an incumbent position for future projects. That trust is typically developed over a series of projects. This track record can lead owners to think of particular suppliers as partners rather than as one of an interchangeable set of firms that might participate in a project. This trusted-neighbor status allows (and creates an incentive for) suppliers to engage in projects more deeply while simultaneously requiring less strict oversight from the owner. In practice, however even after having earned that status, such suppliers are at times unable to retain their level of performance. Because future work

is still speculative, they seek contacts with other owners to grow their business, motivating the first owner to solicit proposals from multiple core suppliers. The proposed neighborhood envisions engagement among neighborhood participants that facilitate sustainable relationships that bridge inevitable gaps between individual projects.

As always, caution about unintended consequences is warranted. One set of issues that can lead to potentially unintended consequences is the establishment and communication of the neighborhood's goals. For example, it is hard to predict how neighborhoods will efficiently engage new firms in potential and established business partnerships. On one hand, the informality of a neighborhood may promote permeability over more typical, formal multi-corporation relationships. Neighborhoods may offer an ease of introduction and engagement with new firms through ongoing, but tangentially related, projects. However, such engagement of new firms is suspected to require active knowledge, collaboration, and interface with members of the neighborhood. This could be problematic when minority-owned businesses are relatively under-represented in particular industry clusters.

Further, the influence of established trust networks could strengthen existing relationships and reduce permeability of new firms into the neighborhood. For example, one strategy that minority-owned businesses have employed is to support each other and target customers with similar identities, as a way to counteract their exclusion in formal and informal ways from the dominant business culture and climate. This homophily strategy has proven to be a powerful way to breed trust, enhance satisfaction, and develop a stable cooperative neighborhood. And, such a specialized neighborhood may perfectly serve the needs and aspirations of its members, but such business enclaving has also been shown to limit growth. More broadly, neighborhoods should consider strategies facilitating broader interactions with new firms, innovative approaches to identify and vet new candidates who could offer improved performance, and setting inclusion criteria or operational constraints that enhance alignment and common purpose in the short term, but do so in a way that limits growth of the neighborhood.

In the next section, we explore a few structures and strategies that might be useful for developing and supporting inter-firm collaboration.

Strategies for neighborhood development

A review of extant literature and an analysis of interviews summarized here yield three actionable strategies that support the creation of a sustainable neighborhood in the construction industry.

1. ***Hub Strategy: Interorganizational Collaboration through an Intermediary, Alliance, or Consortium***.

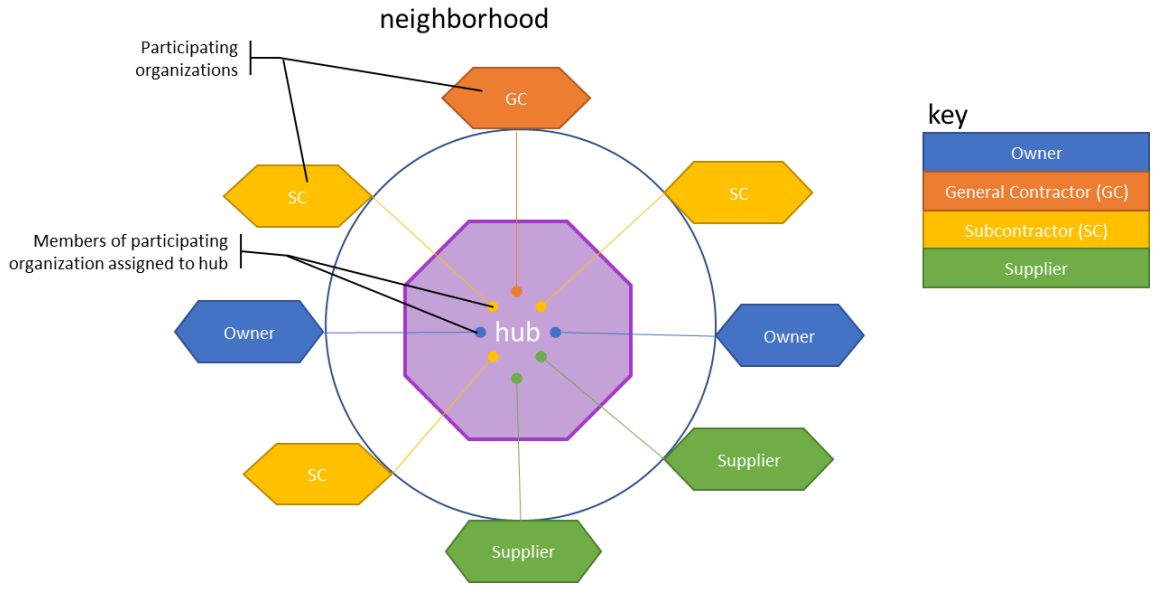
The hub is a (relatively) small interorganizational business unit whose stakeholders/participants include dedicated staff from project owners, prime contractors, key subcontractors, and critical suppliers. This small interdisciplinary and interorganizational team is the nexus for cooperative behaviors and a concentrator for the development of those behaviors. This concept is envisioned to have flexible instances optimized for the industry and supply chain focus. Like the innovation reef, the hub is a structure that convenes the appropriate participants, now fit for service as a concentrator for emergent behaviors. As discussed above, versions of this concept are well supported in prior project management research, e.g., IPD, ACE, and S-DL. The neighborhood model with the hub as the focal point was tested in several interviews with uniformly favorable support for the idea.

Our interviews reinforce several principles required for the hub to be viable. Trust emerges over time, organically based on shared experiences. Larger projects with diffuse scopes of work, many participants, and broad geographies create challenges to the development of trust. A hub is an environment that can be fitted to the problem domain that

convenes the needed parties around a common set of goals. At the very least, the investment of resources in a hub acknowledges the expectation of inevitable issues and the expectation that all stakeholders are committed to cooperatively solving those issues as they arise. Critically, the hub envisioned here is not created just for the duration of a single project. A hub that is sustained for more than a single project would facilitate workflow, reduce project costs, and increase profit, due to the accrual of shared problem-solving in previous projects.

For example, within the neighborhood, the circles in Figure 3 above represent a different kind of governance, perhaps in the form of a memorandum of understanding (MOU) that complements the neighborhood charter or set of bylaws represented by the dotted circle for the alliance partnership. As members of the neighborhood, who are participants in the hub initiate individual projects, the established and trusted neighborhood structures are carried over to inform specific contractual clauses, allowing the neighborhood to set the covenant that is implemented in the contractual terms. As depicted in Figure 4, participating organizations with assigned or dedicated employees to the hub, bring representation from all organizations the circle of the neighborhood into the hub, the neighborhood center.

Figure 4. The neighborhood hub



2. *Trust Exercise Strategy*.

Clearly, trust can be built up over time among firms that work together on projects. However, this trust may also be accelerated through exercises that enable key firm stakeholders to work together and get a feel for how other stakeholders think and act. This can be done through a series of trust exercises.

The trust exercise strategy involves problem solving in response to real-world "what if" scenarios, over a series of meetings in parallel with the "get to know you" scoping and contracting activities during the pre-contract stage of large projects. Wong, Cheung, Yiu, and Pang (2008), note that trust plays, at best, a small role in construction contracting in spite of the apparent advantage it could offer in a field where "collaboration among contracting parties is essential in order to accomplish sophisticated tasks that require multi-parties' involvement." (Wong et al., 2008, p. 828). The power dynamics and confrontational style of contract negotiation and enforcement appear to overwhelm the potential advantage of collaboration and create the common dominant relational environment. The authors further tested the contributions of three types of trust: system-based, cognition-based and affect-based expressions. They found that all elements contributed equally when trust building

occurs arguing that knowledge and understanding in relationship, feelings and emotions experience, as well as performance and faith in an overarching system are critical to trust in this industry.

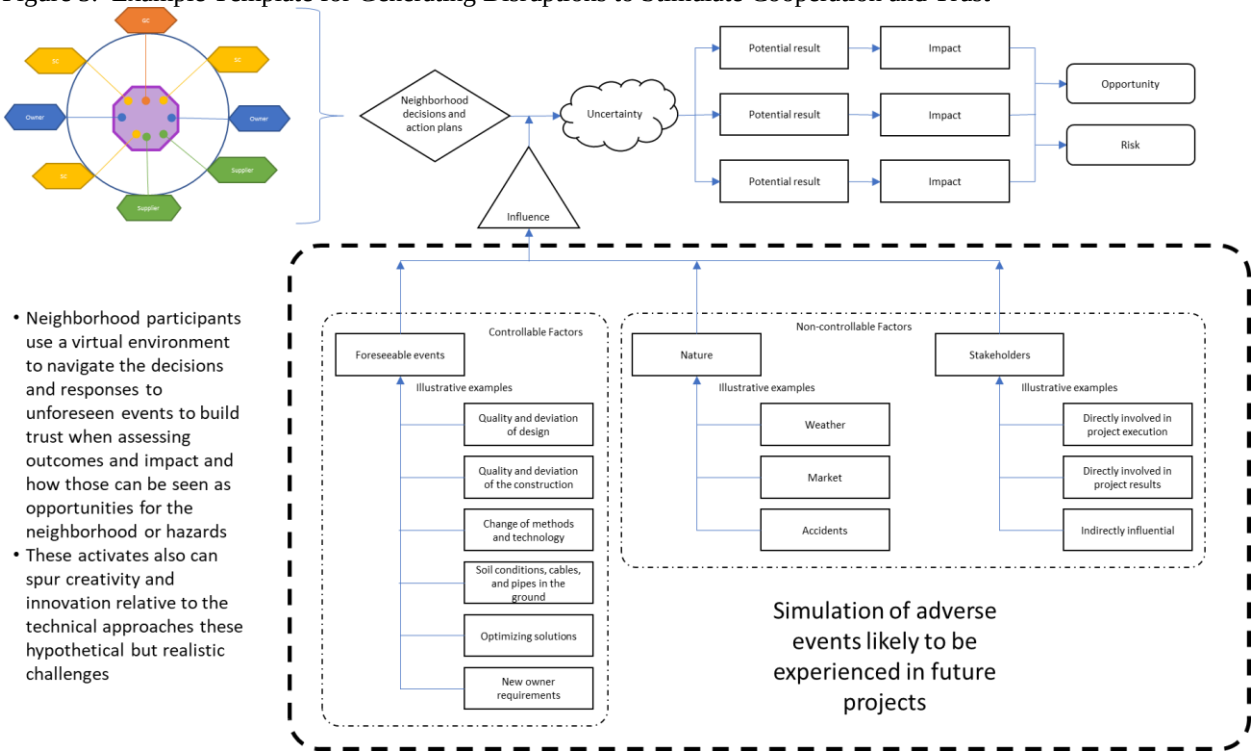
The development of trusted relationships has been explored in commercial settings. Laeequddin et al. (2012) reviewed various trust-building concepts and five trust models to develop an integrated conceptual model for building trust in supply chains. Diverging from other scholars, they conclude that "supply chain members should strive to reduce the risk levels to build trust rather than striving to build trust to reduce the risk" (Laeequddin et al., 2012, p. 550). They further assert that, rather than being an emergent process, trust-building can be achieved instantly if risks can be evaluated. Part of this assessment process is to ensure that appropriate control mechanisms are put in place, including legal frameworks, contacts, agreements, and insurance.

Figure 5, adapted from Johansen et al. (2019), illustrates a typical project management workflow for dealing with unplanned events. The traditional process involves a sequence of steps to characterize the disruption, analyze the uncertainty introduced into the project, assess the impact, and apportion the response into whether it offers an advantageous opportunity or simply adds risk that needs to be mitigated. Simulated events and activities logically include both those that are controllable and commonly part of planning activities as well as non-controllable factors that often disrupt projects.

We suggest that this same process be incorporated into planned activities as part of the trust exercise outside of a formal project. There are some parallels with disaster preparedness training exercises, in which teams with distinct roles go through controlled and realistic rehearsals for rapid response to a disaster (Legatt & Clark, 2011). There are also parallels in the logic of public health prevention, like with vaccines, that prepare for plausible risk to the body instead of treatment and recovery after disruption to homeostasis.

These kinds of preemptive activities might be done in a moderated workshop that would be augmented with discrete event or agent-based simulation components to allow the scenarios to mimic the randomness of real-world situations. This "game" effect would allow for the consequences to be felt in a sped-up virtual reality. In addition to experience with the competence, creativity, and communication of partners, these kinds of trust-building exercises might allow contracts to have "collaborative mediation" clauses that guide cooperation between trusted partners. This would be more easily implemented through firms involved in a potential or active neighborhood relationship. By comparison, current approaches are often more focused on the assignment of responsibility and budget impact before beginning the development of a solution to the disruption. Such assessments and assignments frequently result in a sequence of additional project disruptions as participants assess what is best for their firm rather than how to resolve the issue efficiently. Additionally, these trust-building exercises (while not focused on technological innovation) may serendipitously reveal opportunities to innovate with existing methods, processes, or tools across firm domains.

Figure 5. Example Template for Generating Disruptions to Stimulate Cooperation and Trust



Source: adapted from Johansen et al., 2019, p.40

3. Sustainable Neighborhood Strategy

In order to promote a sustainable neighborhood, trust exercises can provide a groundwork for helping firms learn to collaborate and share risk, while a hub can coordinate activities across members of the neighborhood. These strategies are a good fit for construction megaprojects in oil and gas, because these projects are typically large, complex, and take place over several years going through a number of phases.

Although neighborhoods may be formed in response to a specific project opportunity, neighborhood planning should explicitly recognize common sustainability goals and include a mechanism that incentivizes engagement outside the scope of contracted projects. Participants would ideally view themselves as partners and be motivated to contribute in the near term with an ability to trust that such contributions will pay off in the future.

Our research to date suggests that novel measures of effectiveness may in fact be the critical set of criteria for the successful formation of neighborhood. As reviewed earlier, substantial thinking and professional practice has been and remains focused on the project, a perspective that at times has been extended to a series of similar projects or, among large projects, phases of similar effort executed sequentially. Owners and alliances of owners in joint ventures appear to drive much of this project-based orientation because they approach these interorganizational commitments from a capital investment framework that reduces measures of success to metrics like return on investment and net present value that reduce behavioral trajectories (viz., projects) to simple measures that can be easily compared. Alternatively, another approach is exemplified by significant research and practice that addresses the covenant that precedes or surrounds a contract. As one example from interpersonal relationships within a social context, Strom and Faw (2017) develop a measure to assess the interaction, interdependence, and community aspects with faith-based systems that contrast with contractual elements in personal relationships that focus on the individual, personal needs, and clauses that provide for exiting relationships. Our interviews reveal a prevalent expectation that business relationships have a finite lifespan, as expressed by one

participant as "4, 5, or maybe 6 years." This practical limit can be addressed, in the mind of this participant, by including additional evaluative criteria that address valuing the consistency of the people involved from project to project and then addressing the technical and business scope of effort for a project.

Rinkus, Dobson, Gore, & Dreelin (2016) provide an example of a partnership in watershed permit management to show how "intermediate measures of partnership effectiveness" can be used in a feedback loop to establish and sustain a neighborhood through changes in external industry context and internal turnover of stakeholders within the neighborhood. The authors identify the following five measures that we can conceptually apply to the neighborhood concept: perceived personal, organizational, and community benefits of participation in the neighborhood, shared ownership and commitment to the collaborative effort of the neighborhood, perceived effectiveness of the neighborhood's ability to achieve its goals, perceived effectiveness of the neighborhood process, and future expectations of neighborhood effectiveness. The authors find that participants in the watershed partnership identified capacity building, networking, and increasing awareness across the watershed as the most positive outcomes from the partnership process. The authors also identify certain structural and functional aspects of the partnership process that were more important to its success, like having an outside facilitator and incorporating "learning sessions" where outside technical expertise was brought in to decrease the knowledge gap between participants. Note the similarity of this structured approach to the proposed trust-building exercises.

The trust generation process discussed by Xu (2020) in the context of S-DL provides a means for elevating the learning process of trust creation through cyclical engagement that expands collaboration to cocreation and reciprocal control with a social orientation. Emergent value is found in a transaction, granting unexpected forms, quantities and repeatability of value in addition to monetary transfer. Our research suggests that contractors and suppliers are ready for this shift, and that owners recognize the need. The enduring challenge will be shifting the mindset of owners and their investors to a degree that behavior can also change.

Future Research

Within the construction industry, there is much work to be done to determine how to implement a neighborhood. The interviews conducted so far indicate an interest in this concept and a general willingness on the part of firms to engage with models that reduce friction among participants in large projects. The next steps in this work involve exploring the sentiment among a large range of firms around the neighborhood in comparison to the other collaborative agreement models reviewed earlier. In addition, the hub and trust exercise approaches will be piloted.

This paper represents an initial attempt to develop a viable model of interfirm collaboration in large-scale industrial projects that persist across the span of several projects. At present, this model has been examined for construction megaprojects, but the general neighborhood concept could be applied to many different industries and settings including manufacturing supply chains and collaborations among communities engaging in economic development. Future work will explore whether mechanisms like the hub and trust exercises can be applied in these other settings as well.

A significant challenge to be addressed in future research is that trusted collaboration involves decisions and interactions over time that are difficult to qualitatively or quantitatively. Business planning is replete with net present value comparisons that equalize projects of various lengths and different risk profiles in a single (monetary) metric at a single (present) point in time. The collaborative interactions envisioned for the neighborhood will

require something akin to true age or true health (Shmueli, 2003). For individuals, true health combines multiple heterogeneous measures of health and quality of life across age, gender, income, ethnicity, etc. in a common (unobserved) scale based on several different observable metrics. Such a measure of neighborhood health would allow participants to assess the current state of their neighborhood and explore with other participants possible plans and interventions to manage the health trajectory of the neighborhood. Like a care team in healthcare, participating firms in a neighborhood would contribute to a partnership.

Finally, we pointed out several potential negative impacts of developing a neighborhood including the prospect for free riders, and the difficulty that new firms (particularly those that might be owned by under-represented groups) might have in gaining admission to the neighborhood. As this work moves forward, we are particularly interested in looking for evidence of these drawbacks as well as developing strategies to minimize these limitations.

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