Governing Collaborative Project Delivery as a Common-Pool Resource Scenario

Daniel M. Hall1 and Marcella M. Bonanomi2

Abstract
When collaborative project delivery models such as integrated project delivery (IPD) combine project resources, share decision-making rights, and distribute risk-and-reward among participants, the project can be conceptualized as a common-pool resource scenario. Multiple project appropriators have contractual rights to withdraw units from the shared resource system (i.e., the project budget). This theorization suggests project managers avoid the tragedy of the project by crafting effective self-governance structures in the face of pluralism. Using IPD as an example, this article suggests these project governance structures reflect Ostrom’s design principles for the successful governance of long-enduring common-pool resource scenarios.

Keywords
commom-pool resources, integrated project delivery, project alliancing, project delivery model, project governance

Introduction
Complex construction engineering projects are increasingly procured using collaborative project delivery models (Lahdenperä, 2012) such as integrated project delivery (IPD; Abdirad & Dossick, 2019; Fischer et al., 2017; Hall & Scott, 2019), project partnering (Bresnen, 2007; Bygballe & Swärd, 2019; Papadonikolaki et al., 2016), and project alliancing (Guo et al., 2014; Hietajärvi & Aaltonen, 2018; Lloyd-Walker & Walker, 2011; Walker & Lloyd-Walker, 2015). In general, a project delivery model describes how multiple parties involved in a temporary project are organized and managed (Davies et al., 2019). Classical project delivery models (e.g., design-bid-build) are managed using command-and-control project management with layers of contractual and organizational hierarchies (Barnes, 1988; Levitt, 2011; Reve & Levitt, 1984).

By contrast, collaborative project delivery models seek to change the institutionalized contractual and governance structures that help parties create and capture value (Davies et al., 2019). Project governance refers to “the use of systems, structures of authority, and processes to allocate resources and coordinate or control activity in a project” (Pinto, 2014, p. 383). Collaborative project delivery models often set up interorganizational governance structures to jointly manage complex projects across firm boundaries (Hall et al., 2018; Zhang et al., 2020). These project delivery models seek to avoid the adversarial behavior common in the construction industry through the use of more cooperative and integrated approaches (Bygballe & Swärd, 2019).

An emerging and institutionalizing form of collaborative project delivery models is IPD, which first began in North America (Hall & Scott, 2019). Through the use of a single, multiparty contract, IPD makes a significant departure from classical project delivery models. IPD formally unites multiple, independent design and construction firms to collectively share financial risk and reward among themselves and with the project sponsor (Fischer et al., 2017; Hosseini et al., 2018; Lahdenperä, 2012; Thomsen et al., 2009; Yeung et al., 2012). IPD projects can be characterized by participants who freely and jointly (1) share the project resource pool, (2) share the project decision-making rights, and (3) share in the project outcome. The result is a highly pluralistic organizational setting (Denis et al., 2011), where the project sponsor abdicates decision-making autonomy (Gil & Pinto, 2018).

In the spirit of this special issue, this article suggests a new conceptualization to understand the governance of collaborative project delivery models. We suggest for a project setting such as IPD, the financial resources of the project do not resemble standard economic models of a market or a hierarchy. Instead, IPD project resources more closely align with the definition of a common-pool resource scenario (Ostrom, 2010b). This is because IPD project resources are subtractable and have multiple appropriators (Gardner et al., 1990). Project resources are subtractable...

1Institute of Construction and Infrastructure Management at ETH Zurich, Switzerland
2Polis Lombardia, Milan, Italy

Corresponding Author:
Daniel M. Hall, Institute of Construction and Infrastructure Management at ETH Zurich, Zurich, Switzerland.
Email: hall@ibi.baug.ethz.ch
because resource units withdrawn by one firm are not fully available to the other firms on the project. Project resources have multiple appropriators because several firms concurrently withdraw resource units from the project resource system. Once the multiparty contract is signed and the pool is set up, it is very difficult contractually to limit potential beneficiaries from withdrawing from the common budget (Gardner et al., 1990; Ostrom, 2015). Therefore, there is potential that the tragedy of the project can occur if firms appropriate resources at a higher than optimal rate (i.e., overgraze or overfish). When partners withdraw too many resources from the project, the result is a downward spiral of resource availability and loss of profit for all involved firms. To avoid this, project managers should craft governance structures based on design principles found to successfully manage common-pool resource scenarios (Ostrom, 2015).

To further describe this conceptualization, this article is divided into four sections. First, the article details how the governance of collaborative project delivery models such as IPD depart from classical project delivery models. Past collaborative project delivery model scholarship emphasizes the change in practices between collaborative and classical project delivery models. This practice-oriented approach describes the specific new work routines, management practices, and mechanisms for collaboration employed by collaborative projects. However, this practice-oriented approach falls short of theorizing more broad and holistic conceptualizations of how project governance fundamentally changes in collaborative project delivery models. Second, the article describes the proposed conceptualization in detail. We illustrate how the definitions of resource systems, resource units, appropriators, providers, and producers from common-pool resource scholarship can be applied to the project management domain. The tragedy of the project is introduced as the expected degradation that can occur from a pluralistic setting if project firms continue to overdraw resources from a shared project budget. Third, drawing inspiration from the Nobel Prize-winning work of Elinor Ostrom, the article describes how common-pool resource governance principles can be operationalized for the collaborative project delivery model (Ostrom, 2010b, 2015; Ostrom et al., 1994). We further explain how Ostrom’s design principles can be found already within many of the best practices currently used to govern collaborative project delivery models. Throughout the article, short examples from IPD scholarship help illustrate the conceptualization. Finally, the article concludes with a discussion of the limitations and possible future research to extend and improve upon the presented theorization.

**Governance of Collaborative Project Delivery Models**

The governance of collaborative project delivery models such as IPD departs from traditional project delivery models in three notable ways. First, the multiparty contract of the IPD model creates a shared financial resource pool for the project. The language of pooled resources is specifically reinforced by IPD consultants, lawyers, and scholars, who describe the financial resources of the project using terms such as contingency pool (Darrington & Lichtig, 2010), profit pool (Cheng et al., 2012), incentive pool (Kent & Becerik-Gerber, 2010), at-risk pool (Ashcraft, 2011; Ballard et al., 2015; Cohen, 2010), and common pool (Thomsen et al., 2009). The project resources become contractually available for free use by any of these signatory parties.

Second, to manage these shared financial resource pools, the participants of IPD projects share decision-making rights over the future of the project. This creates a highly pluralistic organizational setting (Denis et al., 2011). The project sponsor exchanges decision-making autonomy for consensus mechanisms among the project team members (Gil & Pinto, 2018). The decision-making power is no longer centralized but diffused among multiple parties. These parties must undertake long discussions to seek mutual understanding, strike consensus (Thomson & Perry, 2006), and align decisions and actions (Tillmann et al., 2014). Shared decision-making rights can reduce uncertainty and de-risk projects, but without proper governance structures they can increase the risk of inaction among pluralistic stakeholders (Gil & Pinto, 2017).

Third, the participants share the financial risks and rewards of the project outcome. Project teams must self-organize (Bertelsen, 2003) to determine the appropriate payoff rules. This includes who has access to the shared pools and what the conditions are for withdrawal (i.e., appropriation) of the pooled financial resources. Therefore, governance structures must be arranged to manage both the initial allocation and later appropriation of the project resources in order to fairly distribute the overall project reward for all participants. Scholars have identified challenges for this pluralistic self-organization during the strategic planning (Gil & Pinto, 2017, 2018) and design stages (Gil & Baldwin, 2014) of projects. IPD adds additional complexity by extending this plurality throughout the entire life cycle of the project—including the shaping, design, construction, and commissioning phases.

Despite these three significant departures from classical project delivery models, we find relatively little scholarship developing alternative conceptualizations or theorizations for project governance models that can guide collaborative project delivery. For example, collaborative project delivery model literature has overwhelmingly taken a practice-based approach to explain IPD governance. This literature contributes with rich and detailed descriptions of specific management practices, such as a colocated “big room,” joint decision-making, agile cost shifting, target value design, and early involvement of trade contractors (Bygballe et al., 2014; Hall et al., 2018). As currently understood, IPD governance can be best described as the combination of multiple practices (Hall & Scott, 2019; Laurent & Leicht, 2019), norms (Harper et al., 2016), or mechanisms (Bygballe et al., 2018; Cheng et al., 2016). Theoretical justification for these practices comes from existing theories of relational contracting (MacNeil, 1974) and transaction costs (Williamson, 1979), sometimes with additional formulation through the lens of institutional theory (Abdirad & Dossick, 2019; Henisz et al., 2012). However, new theory that provides a more holistic
conceptualization for the governance of collaborative project delivery models is less common.

The practice-based perspective has made important contributions to scholarship; the identification of specific practices is useful for project managers to understand which mechanisms to employ and repeat. Still, we suggest that there is opportunity for more theory building in collaborative project delivery model scholarship. Too seldom has collaborative project delivery model scholarship interacted with broader theorizations of project governance (Müller et al., 2016; Too & Weaver, 2014), including relevant concepts of stewardship (Joslin & Müller, 2016), pluralism (Gil & Pinto, 2018), or resource allocation (Engwall & Jerbrant, 2003). The study of collaborative practices in isolation has limitations; project managers faced with the complex reality of pluralistic governance cannot rely on prescriptive accounts and implementation “toolkits” alone (Bresnen, 2007, p. 373). In particular, it remains difficult to explain when, where, why, and how the constructs of “relational contracting can effectively mitigate contractual hazards” (Henisz et al., 2012, p. 50). Therefore, scholars have called for investigation of deeper philosophical and empirical foundations and constructs for collaborative project delivery models (Bresnen, 2007), including the development of rich ontologies that can explain project organizations and work methods (Levitt, 2011). In other words, there is a need for governance theory that can explain why project managers should deploy these specific practices, when and where other practices might or might not be effective, and how project managers should craft the governance structures to enable project success.

Common-Pool Resource Scenarios

A common-pool resource is defined as a sufficiently large natural and/or manmade resource that is shared among many users (Ostrom, 2015). Examples of common-pool resource systems include natural resources such as lakes, groundwater basins, or forests and manmade constructs such as parking lots or digital wiki libraries. It becomes costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from their use (Gardner et al., 1990). For example, it is difficult to exclude an individual from fishing in a lake or a driver from parking in an empty lot. These resources are also considered subtractable; the catching of one fish or the parking of a car in one lot space means that a specific resource unit will not be available to any other potential beneficiary (Gardner et al., 1990).

Within a common-pool resource scenario, it is important to distinguish between the resource system and the flow of resource units produced by the system (Ostrom, 2015). The resource system represents the stock variables that are capable under favorable conditions to produce a maximum quantity of resource units without harming the stock or the resource system itself (Ostrom, 2015). For example, resource systems include fishing grounds, grazing areas, or parking garages. Resource units are then what individuals appropriate or use from the resource system (Ostrom, 2015). Resource units are distinct from but interdependent upon resource systems. There are single resource units (e.g., one caught fish), which can be represented by metrics of resource unit flows (e.g., tons of fish harvested from the fishing ground). Other examples include the tons of fodder consumed by animals from a grazing area or the number of parking spaces filled.

The process of withdrawing resource units from a resource system is appropriation. Appropriators are parties who make such withdrawals (Ostrom, 2015). Examples of appropriators are the fishers, herders, or commuters who are withdrawing the fish, fodder, or parking spaces from the resource system. Appropriators often withdraw units for their own use or consumption. However, they can also use these units as inputs into other production processes (e.g., common irrigation water is applied to fields to produce rice) or transfer ownership rights of the resource units to others (e.g., fishers who sell their catch; Ostrom, 2015).

Providers are those who arrange for the provision of a common-pool resource. This might be a central authority or local group that organizes for collective action. Producers are parties who actively construct, repair, or act to ensure the long-term sustenance of the resource system will be maintained. For example, a local farmer who repairs a fence around the commons is considered a producer. Providers and producers are frequently the same individuals but they do not have to be (Ostrom, 2015). Table 1 provides a short summary of the above definitions for the resource system, resource unit, appropriator, provider, and producer.

The Tragedy of the Commons

The expression tragedy of the commons describes the expected degradation of the environment where many appropriators overdraw upon a common-pool resource. The tragedy is best explained using the example of a pasture open-to-all that several herders might use to raise cattle. Because each herder receives a direct benefit from their own animals and suffers delayed costs from the deterioration of the commons due to their or others’ cattle overgrazing, rational-acting herders are incentivized to continuously add more animals (Hardin, 1968). In doing so, they receive the full direct benefit of their own animals while only paying a share of the costs that result from overgrazing.

The tragedy can emerge for two reasons. As described, common-pool resource units are fully subtractable. While multiple appropriators can simultaneously or sequentially undertake the actual process of withdrawing resource units from the resource system, the actual “resource units are not subject to joint use or appropriation” (Ostrom, 2015, p. 31). In other words, the pasture grazed by one herder’s cattle cannot be grazed by another’s cattle. The resource system is subject to joint use, but the resource unit is not. The overuse or crowding effect of the resource leads to the possibility of approaching the limit of the number of resource units available in a common-pool resource (Ostrom, 2015).
Further, appropriators face the temptation to avoid contributing to long-term maintenance of the resource system. This is known as the problem of free-riding. Once the multiple appropriators rely on the resource system, improvements to the system are simultaneously available to all appropriators (Ostrom, 2015). It is costly (and in some cases infeasible) to exclude one appropriator of a resource system from improvements made to the resource system itself. All of the appropriators benefit from improved resource system performance due to the maintenance of a bridge, fence, or pavement system. This is regardless of whether they contribute or not to the act of maintenance. Thus, the pursuit of the herder’s own best interests can result in the overuse and subsequent ruin of the common pastures.

**Conceptualizing the Collaborative Project Delivery Model as a Common-Pool Resource Scenario**

When a project creates a shared resource pool, shared decision-making rights, and shared risk and reward for project outcomes, we suggest the project can be conceptualized as a common-pool resource scenario. For the example of IPD, the multiparty contract creates a pooled project budget that is available for use by all signatory parties (Darrington & Lichtig, 2010; Thomsen et al., 2009). The allocation of project resources can be a complex process of “politics, horse trading, interpretation, and sense making” that will also address incentive structures, accounting systems, and other embedded features of an organization (Engwall & Jerbrant, 2003, p. 408). To further explore this conceptualization, this article attempts to reinterpret key definitions for common-pool resource scenarios in an IPD project context. These interpretations are a preliminary thought-exercise; it is possible that alternative conceptualizations exist. Table 1 summarizes these interpretations.

For simplicity, we conceptualize the primary resource system as the overall project budget created through the multiparty contract. This resource is pooled and accessible to all signatory firms. The resource units are therefore the individual costs for each scope of work. Cost units are allocated to specific firms during the design phase and withdrawn by those firms during the construction phase. The resource units are not subject to joint appropriation. Cost units can be appropriated (i.e., withdrawn) by firms but, once appropriated, those resource units are no longer available to all other firms on the project. Thus, cost units cannot be jointly used, but the overall project budget is subject to simultaneous joint use (Ostrom, 2015).

In reality, cost units are also a function of multiple interacting systems such as schedule, scope, space, and human capacity. A full description of the project commons requires consideration of subresource units such as the temporal space occupied in a project schedule and the physical space taken by the construction crew. An argument can be made that the time resources (e.g., the schedule requirements) and human resources should be considered separate-but-interdependent resource systems. These exercises lie beyond the scope of this article; for now, let us consider temporal, space, and human resources as subresource units of the larger cost resource units.

The appropriators are the signatory firms to the multiparty contract. These firms have full access rights to the common project resources. Appropriators on collaborative project delivery models have two options to appropriate cost units. They have the opportunity to consume the resource units themselves, which means they will use the cost units themselves (e.g., to pay their employees). They also have the option to sell the resource units, which is done by subcontracting the work using a dyadic contract with parties outside the shared risk/reward pool. For the typical IPD project, the greatest appropriators of cost units by total cost will be the trade contractors. Allocation of most cost units occurs during the design phase, but the true appropriation of the cost units takes place when the production of work occurs or when the contractor enters into a contract to sell the work outside of the pool.

| Term               | Common-Pool Resource Scenario Definition | Common-Pool Resource Scenario Example | Collaborative Project Delivery Model Example |
|--------------------|------------------------------------------|--------------------------------------|---------------------------------------------|
| Resource system    | Stock variables                          | Lake; pasture; parking lot           | Overall project budget                      |
| Resource unit      | Item that is appropriated                 | Tons of fish; tons of fodder; parking spaces | A unit of cost, which may be freely appropriated by any of the signatory firms |
| Appropriator       | One who withdraws resource units from a resource system | Fisher; herder; commuter | Trade partner (e.g., mechanical contractor); design partner (e.g., structural engineer) |
| Provider           | Those who arrange for the provision of a common-pool resource | Central authority; local group that arranges for collective action | First the project sponsor; later the signatory project firms |
| Producer           | One who actually constructs, repairs, or takes actions that ensure the long-term sustenance of the resource system itself | Farmer who repairs a fence around the common pasture | Signatory project firms; project managers; team facilitators and coaches |
The initial provider is the project sponsor who has arranged for the finance of the project. The project sponsor has created the common-pool resource under the assumption that the total appropriation value for themselves (and for other appropriators) will exceed the cost to set up the resource pool. The project sponsor does not do this independently but in concert with a local group of actors (i.e., the signatory firms) who, the sponsor believes, can best produce and maintain the project resource system until the completion of the project. The project sponsor typically then gives these firms the authority to self-organize the project governance system, so they then become the long-term providers and producers of the maintenance activities related to the common-pool resource (Ostrom, 2015). Project managers of these firms must provide and design the initial governance structures and practices that guide the project. They must also produce and maintain the fences that govern the actors on the project to deter free-riding. Specific individuals might emerge, including project managers, team facilitators, and coaches tasked with these producing and providing activities.

At the conclusion of the project, a healthy resource system will have protected cost units. These remaining cost units can be appropriated at the end of the project as final profit. Upon project completion, the resource system is terminated.

The Tragedy of the Project

Like pastures, lakes, and forests, the collaborative project can be subject to over-appropriation of the resource system, resulting in suboptimal returns for all parties. In the tragedy of the commons, “everyone knows that the basic problem is overfishing” but “those concerned cannot agree how to solve the problem.” (Ostrom, 2015, p. 1). In the tragedy of the project, everyone knows the basic problem is overdrawing from the project budget. Resources should be carefully governed so that the available resource pool (e.g., the budget) can last until successful completion of the project. However, the tragedy of the project emerges when multiple project stakeholders overappropriate from the resource pool. Project overfishing might occur where a firm uses more cost units than is optimal for the overall project. When these claims for extra work are not planned or anticipated, the resource pool is further depleted and other parties must contend with a less healthy resource stock (i.e., available budget) for future decisions. Additional problems could occur from project overcrowding where multiple appropriators wish to use the same physical construction space. Because the space used by one trade firm is not available to other firms during that time the overall schedule is delayed, ultimately requiring more cost units to be allocated from the budget.

Project managers also face the problem of project free-riders. For example, managers must deal with self-interested actors during the production phase of the project who appropriate cost units from the budget without assisting in the maintenance (e.g., providing reliable information or suggesting improvement of production processes) of the project governance system. The development of appropriate governance structures to deal with overcrowding and free-riding will be discussed later in the article.

Governing the Commons

Original tragedy scholars (e.g., Hardin) believed incorrectly that individual rational actors could not self-organize effective governance frameworks to manage the commons. Their position was backed by modern resource economists, including non-cooperative game theorists, who concluded that “where a number of users have access to a common-pool resource, the total of resource units withdrawn from the resource will be greater than the optimal economic level of withdrawal” (Ostrom, 2015, p. 3). Although their fatalistic view of the commons was later proven wrong, their beliefs have caused lasting negative real-world implications for governance of the commons. Numerous policy recommendations for common-pool resource scenarios positioned that the only effective solution to the tragedy of the commons must be top-down through centralized state intervention or private ownership (Dietz et al., 2003).

The economist Elinor Ostrom challenged the fatalism of commons scholars with her seminal work Governing the Commons: The Evolution of Institutions for Collective Action first published in 1990 (second edition in 2015). Using extensive case study research from fisheries, forests, groundwater basins, pastures, and other settings, Ostrom finds numerous and systematic failures of common-pool resource scenarios with top-down governance. Failures of central government and private ownership suffered from the implementation of a one-size-fits-all policy lacking local knowledge of the resource at hand. Furthermore, despite warnings by tragedy scholars to the contrary, field research finds that common-pool resources can often be successfully governed by local actors (Gautam & Shivakoti, 2005; O’Mahony, 2003; O’Mahony & Ferraro, 2007).

Ostrom rejected arguments for simple common-pool resource models and prescriptions to be applied uniformly by a centralized agent. There is no one size-fits-all solution. Organizing the appropriators within a common-pool resource scenario is often an uncertain and complex task (Ostrom, 2015). It is not clear how the actions of one appropriator might or might not affect the resource system, the yield of the resource units, or the outcomes of other appropriators. Yet the appropriators are interdependently tied together. Because they “are dependent on a given common-pool resource as a source of economic activity, they are jointly affected by almost everything they do” (Ostrom, 2015, p. 38).

Ostrom’s scholarship finds that, instead of centralized control, successful governance of common-pool resource scenarios arises from organization derived by local actors. Successful governance of common-pool resources requires consideration of the local rules. Such rules take into consideration the biophysical conditions of the resource system, the local attributes of the community, and rules-in-use that specify common
understanding and practices of how collective actions are taken (Crawford & Ostrom, 1995). The rules-in-use often evolve over time in common-pool resource scenarios, as actors interact with one another or self-consciously decide to work with one another to change the governance framework (Crawford & Ostrom, 1995).

Using combinations of the rules-in-use, local actors craft governance structures for common-pool resource scenarios to address problems caused by resource subtractability and free-riding. Through the synthesis of numerous case studies, Ostrom abstracted a set of eight general design principles that effectively accomplished this linkage (Ostrom, 2015). These design principles explain under what conditions trust and reciprocity can be built and maintained to sustain collective action due to the pluralistic dilemmas posed by common-pool resources (Cox et al., 2010). The design principles are summarized in Table 2.

These design principles should not be confused with rules, prescriptions, or blueprints (Cox et al., 2010). Successful common-pool resource scenarios utilize many different types of specific rules-in-use. However, when participants crafted governance frameworks with rules-in-use that addressed each of Ostrom’s eight design principles, they were found to best limit overuse of natural resources and ensure long-term economic viability (Cox et al., 2010). Furthermore, case studies on the failure of common-pool resource scenarios often noted an absence of one or more of the design principles. In other words, the tragedy of the commons occurred when participants failed to address some or many of the eight design principles described above (Ostrom, 2010a).

**Governing the Collaborative Project Commons**

If collaborative project delivery models such as IPD can be considered a common-pool resource scenario, Ostrom’s design principles can act then as a theoretical starting point for scholars to conceptualize the governance structures of these project commons. Such theoretical conceptualization can guide project managers as they craft the governance structures and practices of future collaborative project delivery models. Furthermore, we suggest that the existing governance practices of collaborative project delivery models, such as IPD, already abide with several of Ostrom’s design principles. In other words, Ostrom’s design principles are already embedded implicitly within many IPD practices and thus help explain the success of IPD. What follows is an abbreviated explanation to describe how IPD practices already operationalize Ostrom’s design principles.

Successful governance of IPD projects begins with clearly defined boundaries for the users (design principle 1a). The boundary is set through the negotiation of the multiparty contract (Ashcraft, 2011). The participating firms collectively determine who is a risk and reward partner and who is not. Once the initial team is established, future partners can be brought into the risk and reward pool only if the other existing team members agree. Instead of low price, the selection process emphasizes firm qualifications, team culture, trust, and reciprocity (Pishdad-Bozorgi & Beliveau, 2016; Townes et al., 2015). When IPD first emerged in North America, this user boundary was drawn around only three parties—the project sponsor, architect, and prime contractor (Hall & Scott, 2019). Recently, the total number of project signatory firms has steadily increased. For example, the contractual structure in a recent case study granted 24 independent firms access to the shared risk and reward pool (Cheng et al., 2016). Such examples illustrate the need for a clear boundary structure and determination of the inside group. Some insiders must become the producers responsible for constructing, repairing, or taking actions to ensure the long-term sustenance of the resource system itself (Ostrom, 2015). Other insiders appropriate the resources for themselves (by laying claim to budget or schedule resources) or sell stake in the resources (by subcontracting resource claims to other actors outside of the user boundary).

IPD projects also require clearly defined boundaries for the resource(s) (design principle 1b). The specific common-pool resource must be separated from the larger socioecological system. In other words, which specific aspects of project scope and budget are open to all, and which are not? IPD projects negotiate the resource boundaries at the early stage of the project through a validation study. The period of the validation study is the time to ensure all appropriators are aligned and agree on the expectations about scope, cost, and schedule. Boundaries can be drawn around multiple resource pools (e.g., reimbursed costs pool, profit pool, and cost savings pool). Different pools can require different governance rules regarding appropriation and payoff functions (Elghaish et al., 2019). The end result of this validation period is a go/no-go decision about moving the project forward (Ashcraft, 2011), where all parties have agreed upon the terms of the resource boundary.

IPD projects should demonstrate congruence between the appropriation of resource units and the local conditions (design principle 2a). Appropriation rules regarding when, where, and how project resource units are to be claimed must align with the current state of the project. For this reason, IPD emphasizes the *early involvement of key stakeholders*. Trade contractors are engaged much earlier in the project life cycle than in traditional project delivery models. These contractors often have experience with and/or knowledge of local conditions, such as availability of labor, material, work routines, and other resources required. Their early involvement provides the rest of the project team with a holistic understanding of the project conditions. The trade contractors can provide specific insight into the cost, time, and value of each planned appropriation of a resource unit. This in turn allows designers to carry out informed decisions about the design, which hopefully will lead to more effective collaboration, increased efficiency, minimized waste, and a unified objective (Song et al., 2009; Sødal et al., 2014).

Successful IPD governance also requires congruence between the appropriation and provision rules (design principle 2b). In other words, the benefits obtained by users must be
Table 2. Design Principles for Common-Pool Resource Scenarios

| Design Principle (Ostrom, 2015) | Description (Cox et al., 2010; Ostrom, 2015) | Example Practice(s) From IPD |
|----------------------------------|-----------------------------------------------|--------------------------------|
| 1. Clearly defined boundaries     |                                               | Multiparty contract: The participating firms collectively determine who is a risk and reward “partner” and who is not. |
| a. For the users                 | Individuals or households who have rights to withdraw resource units from the common-pool resource must be clearly defined | Validation study: The common-pool project resources are separated from the larger socioecological system. In other words, the project sponsor and project team collectively define which specific aspects of project scope and budget are open to all and which are not. |
| b. For the resource              | The boundaries of the common-pool resource must be well-defined | |
| 2. Congruence                    | Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions. | Early involvement of key stakeholders: Trade contractors, for example, are engaged much earlier in the project than in traditional project delivery models. They often have experience with and/or knowledge of local conditions, such as availability of labor, material, work routines, and other resources. |
| a. With local conditions         | The benefits obtained by users from a common-pool resource, as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules. | Weighted participation: The level of participation in the risk/reward pool is weighted according to a firm’s individual cost structure or accounting practices, its period of involvement, and/or influence on the outcomes. |
| b. Between appropriation and provision rules | | |
| 3. Collective-choice arrangements| Most individuals affected by the operational rules can participate in modifying the operational rules. | Joint decision-making: Firms that have signed the multiparty contract are entitled to participate in management group functions and to vote on decisions that directly concern their work and area of expertise. |
| 4. Monitoring of the users and the resource | Monitors are present and actively audit common-pool resource conditions and appropriator behavior. | Transparent, open-book finances: Participants share information on resources, costs, profit, and performance openly and transparently. |
| a. Presence                      |                                             | Target value design: Team creates cost targets and then tracks the weekly withdrawals of resource units, monitoring for deviations. |
| b. Accountability                | Monitors are accountable to or are the appropriators | PPC: At each weekly meeting, each team member will stand up and make commitments about the work to be completed. This metric tracks the percentage of items promised last week that were completed and is publicly reported to all team members. |
| 5. Graduated sanctions           | Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, officials accountable to these appropriators, or both. | Public reporting of PPC; removal of individuals or firms: PPC scores are aggregated by subteam, firm, or individual and tracked from week to week. Sanctions can increase due to continuous non-conformance or underperformance, leading to the removal of individual participants and/or firms if necessary. |
| 6. Conflict-resolution mechanisms| Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials. | Liability waivers: Project participants craft conflict resolution mechanisms that include clear dispute resolution strategies intended to avoid costly litigation proceedings. |
| 7. Minimal recognition of rights to organize | The rights of appropriators to devise their own institutions are not challenged by external governmental authorities. | Ability to override wishes of project owner: Conflict resolution mechanisms recognize participants’ rights to organize and make collective decisions, even including procedures for the team to override the wishes of the project sponsor. |
perceived as equal or greater to the amount of effort required. IPD achieves this through weighted participation. The level of participation in the risk/reward pool is weighted according to a firm’s individual cost structure or accounting practices, their period of involvement in the project, and/or their influence on the project’s outcome (Cheng et al., 2016). Numerous cooperative game theory studies search for the optimal payoff rules to achieve fair and efficient allocation of the incremental benefits of cooperation among the cooperating participants (Asgari et al., 2014; Han et al., 2019; Jung et al., 2012; Pishdadian & Srivastava, 2018; Teng et al., 2019; Zhang & Li, 2014).

Collective-choice arrangements (design principle 3) enable most individuals affected by the operational rules of the IPD project to participate in modifying these rules. In contrast to the command-and-control of classical project delivery models, IPD projects enable users to participate in crafting and modifying any rules-in-use through joint decision-making. Firms that have signed the multiparty agreement are entitled to participate in management group functions and have the right to vote on management group decisions that directly concern their work and area of expertise (Perlberg, 2009). IPD projects create decision-making structures to enforce joint project control while avoiding deadlock in decisions (Ashcraft, 2011).

Monitors should be present to actively audit the resource conditions and the appropriate behavior of the users (design principle 4a). The monitoring system acts as a guard to ensure that all parties are adhering to agreed-upon tasks. IPD resources are monitored through the use of transparent, open-book finances. Project participants share information on resources, costs, profit, and performance openly and transparently with the other partners (Cheng et al., 2016). The cost management practice known as Target Value Design creates cost targets and then tracks the weekly withdrawals of resource units, monitoring for deviations (Zimina et al., 2012). The team also monitors risks and opportunities. Ideas to provide for the resource system (e.g., innovations, better processes) are noted as opportunities, while potential dangers to the health of the resource system (e.g., cost escalations, undefined scope, schedule delays) are noted and monitored as risks (Hall & Lehtinen, 2015).

Furthermore, the monitors should be accountable to or should be the users (design principle 4b). Commons scholarship finds that day-to-day monitoring of the resource by the users is one of the most important factors in successful common-pool resource governance (Ostrom, 2010a). For IPD, the users are monitored through a metric known as Planned Percent Complete (PPC). At each weekly meeting, the team will “make commitments about the work to be completed each day” (Thomsen et al., 2009, p. 26). Commitments are tracked from request through completion. Each party reports on its ability to meet the schedule commitments made the previous week (Kenig et al., 2010). The PPC measures the percentage of items promised last week, that were actually completed as promised (Thomsen et al., 2009). These actions are intentionally conducted in a public meeting, called the “big room,” so that the other peer appropriators are present and can act as monitors. Local monitoring by the team departs from the common practice of appointing external cost and scheduling consultants to monitor the resources. While such consultants are often selected because they can act as neutral third parties, they lack accountability to the project because they do not share in the project risk/reward pool. Instead, the self-imposed monitoring system of IPD emphasizes to users the importance of accountability by making and keeping commitments.

If project participants violate the operational rules, they need to be assessed graduated sanctions (design principle 5) by other appropriators. These sanctions depend on the seriousness and context of the offense. In IPD projects, the weekly public reporting of PPC described above acts as an early stage of social sanctioning (Kenig et al., 2010). PPC scores are aggregated by subteam, firm, or individual and tracked from week to week to highlight which users are acting in a trusting and reliable manner. Low PPC scores can be used as a proxy; a low score means a stakeholder is not acting reliably on promised tasks. Sanctions can then increase due to continuous non-conformance or underperformance during project duration, leading to the removal of individual participants and/or firms if necessary (Cheng et al., 2016).

IPD participants can establish conflict resolution mechanisms (design principle 6) to allow rapid access to low-cost local arenas to resolve conflicts. In stark contrast to classical project delivery models, IPD projects have developed liability waivers that aim to eliminate or strictly limit the ability of the parties to sue (Sive, 2009). For example, Ashcraft (2011) outlines a project decision-making protocol, which is included in the IPD agreement. IPD projects craft conflict resolution mechanisms that include clear dispute resolution strategies intended to avoid costly litigation proceedings. Furthermore, these conflict resolution mechanisms also exhibit a recognition of the rights of the project participants to organize and make collective decisions (design principle 7), even including procedures for the project team to contest a directive from the project sponsor.

Table 2. Continued

| Design Principle (Ostrom, 2015) | Description (Cox et al., 2010; Ostrom, 2015) | Example Practice(s) From IPD |
|---------------------------------|-----------------------------------------------|-------------------------------|
| 8. Nested enterprises           | Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises. | Nested management levels (SMT, PMT, and functional teams): Governance activities of IPD projects are organized into multiple layers of hierarchy using a nested enterprise design. |

Continued
Finally, the appropriation, prevision, monitoring, enforcement, conflict resolution, and governance activities of IPD projects can be organized into multiple layers of hierarchy using a nested enterprise design (design principle 8). Large and complex IPD projects often have multiple nested management levels, including a senior management team (SMT) to represent the executive leadership, a cross-functional project management team (PMT) to coordinate project management activities, and functional teams that handle the direct work execution and organization (Ashcraft, 2011; Laurent & Leicht, 2019).

**Discussion**

IPD is a form of collaborative project delivery model designed to share the project resource pool, project decision-making rights, and the project outcome among multiple firms. This article suggests that resources in such a project scenario should no longer be understood using standard economic models of a market or a hierarchy (Ostrom, 2010a, 2010b). Instead, the project should be conceptualized as a common-pool resource scenario. Therefore, the self-organized governance structures of these projects can be theoretically informed by Ostrom’s design principles—a viable non-market strategy (Dorobantu et al., 2017) used to look beyond market transactions to enable exchanges that would otherwise yield high transaction costs of coordination (Dorobantu et al., 2017; Williamson, 1979). By reconceptualizing the nature of project resources and the way project managers create governance structures, this theoretical connection can help orient future project management scholarship on collaborative project delivery models in three ways.

First, this conceptualization provides further justification as for when and why the agile and decentralized governance structures used in collaborative project delivery models are more effective than the centralized and hierarchical governance structures found in classical project delivery models. In tragedy-of-the-commons literature, “proponents of centralized control want an external government agency to decide the specific herding strategy that the central authority considers best for the situation: The central authority will decide who can use the meadow, when they can use it, and how many animals can be grazed” (Ostrom, 2015, p. 9). Notably, scholars find that centralized, top-down governance is not the only way to manage the commons; local governance structures can be more effective than top-down control depending on their fit with local context (Acharya, 2005). This aligns with project management scholarship that argues project managers of the future should not rely on command-and-control tactics to centralize decision-making (Levitt, 2011). For example, in collaborative project delivery models, the project sponsor or leading contractor firm is no longer the central authority with final say on resource appropriation. As projects embrace decentralized and agile management practices, the common-pool resource design principles might offer theoretical guidance.

Second, this conceptualization can theoretically inform and extend the practice-based approach often used to conceptualize and study collaborative project delivery models (Bygbole et al., 2014; Cheng et al., 2016; Hall et al., 2018). We suggest that the success of IPD to date occurs because many IPD practices already align with the principles suggested by Ostrom. Using this theoretical lens, scholars can now theorize the design of new sets of practices that likewise meet the design principles. This can allow IPD to evolve or inform the design of entirely new collaborative project delivery models. Future work also can examine unsuccessful projects (Ballard et al., 2015) to understand if certain design principles were not present and how this might impact project success. This can help scholars uncover variables that might “increase the initial likelihood of self-organization, enhance the capabilities of individuals to continue self-organized efforts over time, or exceed the capacity of self-organization to solve common-pool resource problems without external assistance of some form” (Ostrom, 2015, p. 29).

Third, this conceptualization can extend emerging work on managing projects through the lens of pluralism. Recent scholarship has placed the challenge of pluralism at the root of organizing complex sociotechnical projects (Gil & Pinto, 2018). However, this past scholarship emphasizes that pluralistic settings occur primarily during strategic planning (Gil & Pinto, 2017, 2018) or design stages (Gil & Baldwin, 2014) of the project. Once this strategic decision-making and design are completed, parties often use traditional project delivery models and enter into dyadic contracts. An organizational hierarchy is formed among the project firms. The pluralistic dynamics of the project might not completely fade away, but the contractual hierarchy enforces the distribution of project resources. By contrast, collaborative project delivery models that use multi-party contracts offer a scenario where pooled resources and pluralism exist throughout the entire duration of the project. Resource systems are established during the project shaping, resources are allocated during project design, and resources are withdrawn during project production. Throughout each of these stages, project managers must designate boundaries around the pooled resources and must align parties to maintain a healthy resource system that will last until the completion of the project. To the knowledge of the authors, no work to date has applied this theoretical lens of common-pool resource scenarios to the governance of projects throughout a project’s duration. In particular, no work has used this theoretical lens for the production phase when the actual appropriation of the project resources take place.

**Conclusion**

Drawing inspiration from commons scholars, this article offers a new theoretical conceptualization for collaborative project delivery models based on the governance principles of common-pool resource scenarios. Using the example of IPD, we first conceptualize how the characteristics of pooled project resources, shared decision-making rights, and shared risk and reward structures align with the characteristics of common-pool resource scenarios. The article describes IPD in the
context of such a common-pool resource scenario, theorizing a new understanding of the IPD project resource system, resource units, appropriators, providers, and producers. In the second half of the article, we argue that the governance of collaborative project delivery models (e.g., IPD) can be conceptualized and informed by design principles found to be successful for the governance of common-pool resource scenarios. We provide definitions for the project commons, including the tragedy of the commons and Ostrom’s eight design principles found to effectively craft local governance structures. The article offers a brief overview of how existing IPD practices might already align with each of these eight design principles.

The article discusses how the proposed conceptualization can move forward our theoretical understanding of collaborative project delivery models. The proposed theoretical conceptualization can explain why the agile and decentralized governance structures used in collaborative project delivery models appear to be more effective than the centralized and hierarchical governance structures found in classical project delivery models. It also can theoretically inform and extend the practice-based approach often used to conceptualize and study collaborative project delivery models and can extend emerging work on managing projects through the lens of pluralism.

**Limitations and Future Research**

The intent of this article is to act as a theoretical starting point, but some limitations should be noted. The context is grounded in project management for the construction industry. Many examples come from the governance of IPD, which can be specific to the context of North America. Future work should test if the conceptualization holds in other settings of multiparty projects. The propositions made here about the specific practices and how they engender compliance with the common-pool resource design principles are nascent. They should be further explored and tested in the context of IPD and should be reformulated for the practices of other collaborative project delivery models. Furthermore, the common-pool resource design principles were originally developed for renewable resources that can be sustained over an indefinite period of time. By design, the construction project is a finite endeavor. Although the length of many multiparty contracts can be considered long-enduring (e.g., design and construction often take from four to ten years), the resource system is continuously and intentionally depleted, including the closure of the resource system at the completion of the project. This important point is not addressed here, and future studies should seek to understand how it might impact or shape this theoretical perspective.

Applying a common-pool resource governance framework to collaborative project delivery models might open new opportunities for future research. Scholars have suggested that collaborative project delivery models require a “new integrated project manager” (Seed, 2014, p. 1) that can span technical boundaries, educate project teams continuously, and balance short- and long-term goals using a systems view (Sakhrani et al., 2017). Yet questions remain; for example, to which objective should this new project manager be managing? We suggest the goal of this new project manager could be the stewardship (Davis et al., 1997) of the project resource pool to enable healthy withdrawals for the benefit of multiple stakeholders. Future scholarship can then explicitly study how managers can successfully organize nested project structures, design effective collective choice arrangements, or monitor healthy resource withdrawal in the pluralistic context of complex project environments. Such research may help develop a more theoretically rich “ontology for describing project organizations and work methods” (Levitt, 2011, p. 209) of the collaborative project delivery model while complimenting the ongoing practice-oriented scholarship (Bygballe et al., 2014; Hall et al., 2018). The emphasis on organizing around the health of the project resources, and not only information exchange, can spur research to reintegrate production scholarship with project organization studies (Koskela, 2017). Future project managers—with theoretical understanding of Ostrom’s design principles—can then improve or develop new best practices to integrate into “project organizations that will best meet the demands of the full gamut of twenty-first-century projects” (Levitt, 2011, p. 210).

Next, this conceptualization offers an opportunity for future research to synthesize multiple streams of research regarding multiparty contracts. There is an extraordinary amount of in-depth literature regarding collaborative project delivery models. In IPD scholarship alone there are numerous examples of comparative case studies (Ballard et al., 2015; Cheng et al., 2012, 2016; Cohen, 2010; Denerolle, 2013); management strategies (Fischer et al., 2017); impact on desirable project characteristics, such as trust, innovation, and supply chain collaboration (Hall et al., 2018; Lavikka et al., 2015; Pishdad-Bozorgi & Beliveau, 2016; Zhang et al., 2020); quantifications of IPD project outcomes compared to other types of project delivery methods (El Asmar et al., 2013, 2016; Franz et al., 2017; Mesa et al., 2016); and theorizations of ideal IPD profit pool distributions using cooperative game theory (Du et al., 2019; Teng et al., 2019). As Ostrom noted in her own scholarship on common-pool resource scenarios, such literature holds rich accounts and models developed by field researchers who have invested years of effort to obtain detailed information about the strategies adopted by appropriators (Ostrom, 2015). Currently, collaborative project delivery model scholarship departs from various methodological and epistemological perspectives and is scattered across various technical journals, management journals, and industry case studies. Future research might be successful to synthesize the findings from this literature using the design principles for common-pool resource governance.

Finally, the theoretical conceptualization presented here can act as a starting framework to tie together diverse accounts of collaborative project delivery models. This article provides some specific examples from the IPD context, but future work can be extended to other multiparty contracts such as project alliancing, project partnering, and public–private partnerships. Through a common-pool resource scenario lens, it might be possible to address unanswered questions in interfirm project governance. For example, future case synthesis might further
unpack how rules-in-use for steering and monitoring activities are created and enforced among appropriators (Callistus & Clinton, 2018; von Danwitz, 2018). Future field work can answer questions about interfirm conflict resolution (von Danwitz, 2018) by studying how graduated sanctions—the design principle that seems least noted in IPD frameworks—are enforced in practice. The theoretical conceptualization opens new questions, including: How do project managers decide who has access to the resource pool? What resources should be available to all? Which should not? How do graduated sanctions work on project teams? What makes an effective monitoring system for the project?

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**Author Biographies**

**Daniel M. Hall**, PhD is an assistant professor of Innovative and Industrial Construction at the Institute of Construction and Infrastructure Management at ETH Zurich, Switzerland. He received his PhD in civil and environmental engineering from Stanford University, Palo Alto, California, USA. His work seeks to enhance innovation in the built environment by adopting new process innovations to improve productivity, new forms of project governance for complex projects, and new organizational models for industrialized construction. He can be contacted at hall@ibi.baug.ethz.ch

**Marcella M. Bonanomi**, PhD is a research fellow at Polis Lombardia, Milan, Italy, a research institute in support of Lombardy region’s policy-making. Previously she was a research associate and lecturer in Building Information Modeling at the Chair of Innovative and Industrial Construction at ETH Zurich, Switzerland. She received her PhD in architecture, built environment, and construction engineering from Politecnico di Milano. Her work lies at the intersection of management, social sciences, and engineering. Specifically, her studies aim at facilitating new forms of processes and organization (at both the firm and project levels) for and due to the digital transformation of the built environment. She can be contacted at marcella.bonanomi.bds@edu.polis.lombardia.it