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## Identifying Project Management Practices for the Multi-Party Construction Commons

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# **IDENTIFYING PROJECT MANAGEMENT PRACTICES FOR THE MULTI-PARTY CONSTRUCTION COMMONS**

## **ABSTRACT**

This paper presents project management practices implemented by the stakeholders involved in collaborative projects using multi-party construction arrangements (MPCAs) in order to manage their common-pool resources (CPRs). To accomplish this, first, definitions, concepts related to, and implications of MPCAs and CPR scenarios are defined as the research point of departure. Second, the design principles for the governance of CPRs are outlined through the lens of the shared resources of construction projects using MPCAs. Based on this, a content analysis of 27 MPCA case studies employing different multi-party contracting approaches in diverse geographical locations is performed. The output of this data collection phase is a qualitative database of project management practices categorized to CPR design principles and implemented across MPCA case studies. Lastly, a discussion about the implications of the research findings is proposed structuring it in terms of project organization's strategy, structure, people, processes, and rewards in order to provide multiple lenses of interpretation to the project management practices identified.

## **KEYWORDS**

Multi-Party Construction Arrangements, Common-Pool Resources, Collaborative Projects, Project Management Practices, Relational Contracting.

## **INTRODUCTION**

Due to increasing concern about sustainability and productivity issues, there is a demand for the construction industry to boost innovation in the entire value chain (e.g., Noktehdan et al., 2015). Furthermore, the recent development and adoption of digital technologies and processes, such as Building Information Modeling (BIM) creates a demand for more integrated processes, information, and organization. Clients' requests for complex, bespoke designs and sustainable buildings are increasing too. These demands together result in a need for more integration and collaboration between project parties, starting from the early phases of the building process. However, this is often very difficult to achieve by using traditional procurement methods, such as the Design-Bid-Build (DBB) method. Traditional legal frameworks, in fact, provide a context that is more conducive to sequential processes and fragmented supply chains. Within such contracting frameworks, projects are typically managed as temporary multi-organization settings fragmenting the work between many stakeholders (Hall, 2017). These stakeholders act as autonomous units focusing on their own interests and incentives (Park and Ofori, 2006). In most cases, conflict and disputes, rather than collaboration and coordination, characterize project stakeholders' relationships (Lahdenperä, 2012).

This is not the case in the emerging innovative delivery models for construction projects, such as Integrated Project Delivery (IPD) and Project Alliancing (PA) (Lahdenperä, 2012). These Multi-Party Construction Arrangements (MPCAs), in fact,

seek to enable collaborative partnerships and work mechanisms based on trust. These new procurement methods support project stakeholders in working according to a risk-and-reward sharing principle and therefore boost performance-based process management. Furthermore, the project resources (budget and schedule) are available for use by all signatory parties. Recent scholarship theorizes that these characteristics of MPCAs align in principle to the characteristics of Common Pool Resource (CPR) scenarios (Hall, 2017).

To extend the theory of MPCAs as CPR scenarios, there is a need for further scholarship to understand how MPCAs are managed in practice. This paper attempts to do so by specifically looking at project management practices implemented in MPCAs and exploring their alignment with the accepted design principles for the governance of CPR scenarios. To do this, we build upon the design principles of CPR scenarios' governance (Ostrom, 2015) and the theoretical alignment of these to the project delivery process of MPCAs, as proposed by Hall (2017). We perform a content analysis of 27 MPCA case studies to understand which PM practices consistently emerge in MPCA case literature. The result is a qualitative database of project management practices that are more often being implemented across collaborative projects. Furthermore, this study aims to expand the theoretical construction management argument of MPCAs as CPR scenarios by not only understanding the management practices actually implemented in MPCA projects but also identifying their potential impact on projects' outcomes and success.

## **TRADITIONAL CONSTRUCTION ARRANGEMENTS**

Many studies show that the construction industry suffers from inefficiencies, schedule delays and therefore cost overruns (Arditi et al., 2017, Odeh and Battaineh, 2002, Suprpto et al., 2016, Zaghoul and Hartman, 2003). Zaghoul and Hartman (2003) argue that the confrontational approach, which characterizes traditional contractual agreements, such as the DBB method, often leads to total project cost increase and negatively affects the relationships between contracting parties. Accordingly, Lahdenperä (2012) points out that the disintegration of the construction process and the project parties' adversarial behavior are typical conditions when using traditional construction arrangements. Additionally, Sakal (2005) finds that most traditional arrangements do not embrace change and instead try to specify every possible contingency and assign liability in case these changes occur. This governance approach is conducive to adversarial relationships between project parties, who mostly focus on protecting their own interests and profits rather than maximizing the project performance through collaboration. Matthews and Howell (2005) outline that this traditional approach to construction arrangements often leads to one or more of the following four systemic problems on construction projects:

1. Good ideas for the project's execution are held back as each competing contractor keeps these to themselves to gain a competitive advantage during the bidding process;
2. Limited cooperation and innovation are caused by establishing a rigid framework of the scope of services, battery limits and terms and conditions in traditional construction agreements;
3. There is an inability to coordinate due to the lack of meaningful efforts to link the various planning systems of the different subcontractors;

4. Each stakeholder cares for performance optimization of its own project scope, disregarding possible higher-level solutions.

## **MULTI-PARTY CONSTRUCTION ARRANGEMENTS**

Given the importance of project parties' closer integration, improved collaboration, and joint risk management for process performance improvement and project value increase, innovative methods of project delivery are emerging (Miller et al., 2000). These new forms of project delivery are typically referred to as relational or multi-party construction arrangements (MPCAs). MPCAs seek to enable collaborative partnerships rather than adversarial relationships between project parties, therefore boosting work mechanisms based on trust and confidence (Colledge, 2005). Such contracting frameworks create opportunities for joint project management systems by binding designers and contractors together with project owners through means of aligned goals and risk-and-reward sharing mechanisms (Lahdenperä, 2012).

Due to the nature of MPCAs, some of the project resources, which are individually owned in traditional construction arrangements, are shared and managed collectively in many of these collaborative projects. These shared resources can include the overall budget and time schedule, the contingency, the stakeholders' profit, incentive and at-risk pools (Hall, 2017), or even the physical space available for construction activities and the required office space for staff co-location. All these resources are pooled and available from the very start of the project's execution.

MPCAs have been found to significantly improve collaboration, cooperation, and productivity and result in better cost, schedule and sustainability performance for construction projects (El Asmar et al. 2013, 2016; Cheng et al. 2016; Mesa et al. 2016; Mollaoglu-Korkmaz et al. 2013). They are being successfully applied on projects worldwide with three project delivery models most recognized and widespread on construction projects: Project Partnering (PP), Project Alliancing (PA) and Integrated Project Delivery (IPD). This paper focuses specifically on the latter two forms of project delivery models.

## **PROJECT ALLIANCING**

Project Alliancing, as defined by Lahdenperä (2011), is a multi-party construction arrangement, which aims at integrating operations goals of the project's key stakeholders, based on three fundamental principles:

1. A joint agreement to define the shared responsibility for the project's design and construction, including the tasks traditionally performed by the owner;
2. A joint organization and management structure comprised of personnel from all the partner organizations and the owner. The decision-making and resource management is done jointly;
3. Risk sharing between the alliancing partners throughout the entire project development process, regardless of the causes. Rewards are based on the overall project implementation and not on individual performance.

Based on these PA principles, project parties sign a multi-party contract, rather than several bilateral contracts, and agree on a project target cost with possible negotiations to determine pain-gain share arrangement tied to project performance (Lahdenperä, 2011). The application of this delivery model aims at encouraging the

project's stakeholders to work as an integrated team by tying each of their commercial objectives to the actual outcome of the project. This leads to an arrangement that effectively constructs a single seamless organization where all decisions made consider what is best for the overall project's performance and not individual party's objectives and budgets (Sakal, 2005).

The National Alliance Contracting Guidelines developed by the Australian Department of Infrastructure and Regional Development (2015) provide a framework for practice guidance to public sector agencies. The Australian public sector, in fact, successfully and widely employs this PA model to develop high visibility complex projects (Sakal, 2005). Through these Guidelines, the Australian agency adds some characteristics, to the ones mentioned above, as key features for successful PA, namely: commitment to avoid disputes, culture of not faulting and blaming and of good faith and integrity, complete transparency by the means of an 'open books' documentation, finances and reporting.

### **INTEGRATED PROJECT DELIVERY**

The American Institute of Architecture (2007) defines IPD as a "project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste and maximize efficiency through all phases of design, fabrication and construction."

IPD projects present a high degree of collaboration between the members of the owner-designer-contractor triangle, commencing at early design and continuing until the project handover (AIA, 2005). Additionally, IPD projects operate according to shared risk-and-reward mechanisms and apply both fiscal transparency and release of liability (Cheng et al., 2016). In general, this multi-party construction arrangement provides projects with a contractual environment and motivation for collaboration by the means of shared risks, early contractor involvement, stakeholders' equality, project-first thinking, limitation of liability and trust mechanisms like open-book transparent finances and shared understanding of goals, values and business objectives (Cheng et al., 2016).

Early applications of IPD governed project stakeholders' relationships by the means of two agreements (Matthews and Howell, 2005):

1. The Prime Contract as a standard two-way agreement that binds the client with the IPD team, establishing commercial terms and scope, schedule and project cost;
2. The Team Member Agreement, which bounds all the primary team members together, accepting full responsibility for the Prime Contract's terms and conditions, and sharing profits and costs in accordance with an agreed formula.

These arrangements enable to set up a partnership model where project goals are aligned and therefore none of the involved parties are held to individual budget constraints (Matthews and Howell, 2005).

Later IPD projects started being managed through multi-party arrangements with shared risk-and-reward stakes, aimed at aligning stakeholders' economic interests. This was accomplished with three-way, integrated arrangements binding together owners, architects, and contractors within one contract (Hall and Scott, 2019).

## MPCA PROJECT GOVERNANCE AS COMMON POOL RESOURCE SCENARIOS

Ostrom (1990) define common-pool resources as “natural or man-made resource systems that are sufficiently large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use.” CPR systems are stock variables that are capable, under favorable conditions, of producing a maximum quantity of a flow variable without harming the stock or the resource system itself. Ostrom (1990) studies several cases of CPR scenarios worldwide and finds alternative governance models. Specifically, she proposes to set up governance structures that local actors or appropriators create themselves by applying eight design principles (Ostrom, 1990). A later study by Cox et al. (2010) proposes to expand these eight principles to eleven, by dividing and further specifying some aspects of principles one, two and four. For being successful, these principles must be adjusted to the CPR’s system structure, the attributes of the community, e.g. size and heterogeneity, and the type of government regime the users operate in (Blomquist et al., 1991; Blomquist et al., 1994; Cox et al., 2010).

Hall (2017) finds MPCAs to share similarities with CPR systems (see Table 1). Shared project resources in MPCAs are subject to the same overuse and free-riding problems, governance scenarios, and solutions that are applicable to CPRs. To draw this comparison of shared project resources of MPCAs to CPR scenarios, Hall (2017) names this issue the “Tragedy of the project”. Appropriators overcrowd the same physical space, i.e. construction sites, thus leading to schedule delays. Additionally, free-riders often act in a self-interested way and appropriate resource units without contributing to maintaining or improving the overall project’s management system.

Hall (2017) explains that Ostrom’s design principles offer a balanced approach between the organization of the agreement partners (e.g. boundaries of the users, monitoring of the users) and the management of the resources (e.g. boundaries of the resources, monitoring of the resources). In addition, CPR scenarios are implicitly organized around the resources, like the common project budget, and decisions are promoted to enforce the health of this system for the benefit of all. Through this, there is potential for improved coordination between organization and production to manage the resource system health. However, it is important to note that the principles for the governance of CPR scenarios are developed for renewable resources that can be sustained over an indefinite time if properly governed. This is a contradiction in the case of construction projects that are temporal settings in which the resource systems are continuously and intentionally depleted (Hall, 2017).

Table 1: List of design principles for MPCA project governance as CPR scenarios

CPR Principle	Description (from both the CPR and MPCA’s perspective)
<b>1A</b> <b>User boundaries</b>	CPR: Boundaries between legitimate users and non-users must be clearly defined. MPCA: Key project parties should be included as a resource system’s appropriators. They can appropriate resource units by claiming to budget or schedule resources or sell a stake by subcontracting to third parties (Hall, 2017).
<b>1B</b> <b>Resource boundaries</b>	CPR: Boundaries define the system and separate it from the larger environment. MPCA: Costs and fees, how they are funded, and what can be charged to the project or not, must be clearly defined (Ashcraft, 2010). To do this, a validation study can help by estimating the cost and pooled profit (Darrington & Lichtig,
<b>2A</b>	CPR: Appropriation provision rules are congruent with local conditions.

<b>CPR Principle</b>	<b>Description (from both the CPR and MPCA's perspective)</b>
<b>Congruence with local conditions</b>	MPCA: Congruence with local conditions, such as availability of labor, material and/or other resources (Hall, 2017) can be achieved by incorporating knowledgeable stakeholders early into the process (Perlberg, 2009).
<b>2B Appropriation and provision</b>	CPR: Users' benefits, as defined by appropriation rules, are proportional to the number of inputs required (labor/material/money), as determined by provision MPCA: Participants' benefits and risks must be consistent to their cost structure, the timeframe of involvement and/or influence on the project outcome (Cheng et al., 2016) by setting pain-gain share and weighting arrangements.
<b>3 Collective-choices</b>	CPR: Individuals affected by operational rules can participate in modifying them. MPCA: Users should participate in project management (PM) and have the right to vote on the decisions that impact their work and/or expertise (Hall, 2017).
<b>4A Monitoring users</b>	CPR: Monitoring the users and their appropriation and provision levels. MPCA: Monitoring the users should ensure their accountability, performance, and reliability (Thomsen et al., 2010). This task must be performed with transparency, also by using tracking tools (e.g. Last Planner System) (Hall, 2017).
<b>4B Monitoring resources</b>	CPR: Monitoring the condition of the resources. MPCA: The monitoring of the resources must be done by using a transparent system, such as Target Value Design (TVD). This system must reliably reflect the project's status, costs committed and predicted, and provide feedback to the project team to identify potential problems and develop remediation plans
<b>5 Graduated sanctions</b>	CPR: Appropriators who violate rules are likely to be assessed graduated MPCA: If users are underperforming/not conforming to the agreement, the PM team can apply social/financial sanctions (Ostrom, 1990). The transparency of the monitoring can be considered as a low social sanctioning (Hall, 2017). In serious cases, the underperforming party can be replaced (Ashcraft, 2011).
<b>6 Conflict-resolution</b>	CPR: Appropriators have access to low-cost local arenas to resolve conflicts. MPCA: Conflict resolution mechanisms should avoid arbitration/litigation processes. The joint resolution starts within the interested parties and escalates to PM committee, senior representatives or external advisors (Thomsen et al., 2010).
<b>7 Minimal recognition of rights to organize</b>	CPR: Appropriators' rights to devise their own institutions are not challenged by external governmental authorities. MPCA: Senior management should not challenge decisions made by consensus, if not part of a conflict resolution process (Hall, 2017). Target budgeting or consultants' selection process are jointly performed (Ashcraft, 2010).
<b>8 Nested enterprises</b>	CPR: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises. MPCA: Functional teams must be designed and managed as a unit. On a higher level, a cross-functional team coordinates broader activities such as procurement, cost management and scheduling, and functional teams' interfaces (Ashcraft, 2011). Some projects present a higher level, which is the executive leadership (Hall, 2017).

## RESEARCH APPROACH

If there is theoretical alignment between the design principles of CPR scenarios' governance (Ostrom 1990; Cox et al., 2010) and the governance of MPCAs (Hall, 2017), how are principles such as making boundaries, monitoring users, or imposing sanctions carried out in MPCA practice? Is it possible to understand the PM practices of MPCA projects and categorize them to CPR design principles? And if so, can we identify which categories of CPR are most often addressed by the PM practices found

in MPCA case studies? Finally, can we identify categories of PM practices commonly present in MPCA projects with successful outcomes?

To do this, we perform a content analysis of international MPCA case studies. Most of these case studies are successful, but we also analyze less successful cases (e.g. Ballard et al., 2015). The objective of the content analysis is to identify the project management practices that are more often used to manage common project resources in cases of MPCAs and to understand better their alignment with the design principles of CPR scenarios' governance.

## DATA COLLECTION

To collect this data, we first conduct a broad review of MPCA case studies. We queried scholarly academic databases and search engines such as Scopus and Google Scholar. From initial searches, we identified case studies described by an adequate level of detail and with a broad range of project management topics covered. Based on this, 27 case studies are selected. Specifically, the selected case studies consist of 11 PA projects and 16 IPD projects, including four "IPDish" examples (see Table 2).

Table 2: Summary of project case studies reviewed

Source	Case Location	Year(s) of Completion	Project Delivery Type	Case ID
Amaral Fernandes et al., 2018	Finland	2018	Project Alliancing	1
Jefferies et al., 2014	Australia	N/A	Project Alliancing	2
Rowlinson and Cheung, 2005	Australia	N/A	Project Alliancing	3
National Academies of Sciences, Engineering, and Medicine, 2015	Australia (1), Netherlands (1) and New Zealand (2)	2004 to 2010	Project Alliancing (3) & "Alliancing Type" (1)	4 to 7
Hauck et al., 2004	Australia	2000	Project Alliancing	8
Laan et al., 2011	Netherlands	2010	Project Alliancing	9
Barlow, 2000	United Kingdom	1997	Project Alliancing	10
Department of Infrastructure and Transport, 2010	Australia	2011	Project Alliancing	11
Ballard et al., 2015	USA	2014	Integrated Project Delivery	12
Cheng et al., 2016	USA (8) and Canada (1)	2013 to 2016	Integrated Project Delivery (8) and "IPDish" (1)	13 to 21
AIA and AGC, 2010	USA	2007 to 2009	Integrated Project Delivery (3) and "IPDish" (3)	22 to 27

Data about the selected case studies are studied through content analysis methodology (Krippendorff 2004). This began with identifying seven project characteristics to outline the basic information to identify and classify the project reviewed. This included:

1. Project delivery type;
2. Construction arrangement type;
3. Number of project participants in the signatory pool;
4. Number of participants in the risk/reward pool;



5. Completion year;
6. Project type;
7. Country of execution of the construction project.

Next, the researchers identified project management practices described in each case study. Building upon the definition of project management by the Standards Committee of the Project Management Institute (2017), a project management practice can be defined as the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.

To further analyze the collected data, a qualitative evaluation and interpretation process of the information provided by the project case studies is performed. For this task, a scoring system is employed. This approach consists of assigning a score according to either three levels of implementation for the project management practices or success for the project outcomes. Cases, where the particular data point is not available or is not explicitly addressed by the case study, are noted with the nomenclature “n/a” for not available. This scoring system is explained as it follows:

- Score 2: Full and successful implementation;
- Score 1: Partial, problematic or somewhat contradictory implementation;
- Score 0: Explicit failure to implement or avoidance of the practice;
- Score “n/a”: Information not available.

Finally, a discussion about the research findings is proposed and framed according to the five main components of organization design theory as proposed by Galbraith (2016): strategy, structure, people, processes, and rewards. The framing of the findings of this study under the overarching theory of organizational design aims at providing additional context and lenses of interpretation to the project management practices identified and to future research directions.

## **FINDINGS**

In total, forty project management practices are identified from the content analysis of the 27 selected case studies (see Table 3). In addition, we identify four project outcomes described in the case studies: the stated success of the project, budget compliance, schedule compliance, and contractor profit. All together we identify 809 data points regarding PM practices or project outcomes from the content analysis.

The forty project management practices next are grouped and aligned to the design principles of CPR scenario governance (see Table 3). This categorization builds upon the guidelines and practices proposed by Hall (2018). Some PM practices can be categorized in complementary or multiple categories of design principles.

Table 3: Project management practices grouped by CPRs design principles

<b>CPR Design Principle</b>	<b>Project Management Practices in MPCA projects</b>
<b>1A</b> <b>User boundaries</b>	MPCA Request For Qualification (RFQ) and/or For Price (RFP) Interview and/or Choosing By Advantages (CBA) Long-Term Relationships
<b>1B</b> <b>Resource boundaries</b>	Validation Study Clearly Established Goals Adequate Contingency
<b>2A</b> <b>Congruence with local conditions</b>	Experienced Partners Local Partners Integrated Design Early Contractor Involvement Training
<b>2B</b> <b>Appropriation and provision</b>	Same Signatory/Risk Pool Participants Weighted Participation
<b>3</b> <b>Collective-choices</b>	Joint Decision-Making Process Efficient Process Team Alignment Co-location
<b>4A</b> <b>Monitoring users</b>	Monitoring Transparency/Open-Book Culture Key Performance Indicators (KPIs)/Dashboard Surveys Last Planner System (LPS) + Planned Percentage Completed (PPC)
<b>4B</b> <b>Monitoring resources</b>	Monitoring Transparency/Open-Book Culture KPIs / Dashboard Target Cost Estimate (TCE)/Target Value Design (TVD) Lean Tools Building Information Modeling (BIM)
<b>5</b> <b>Graduated sanctions</b>	In-Project Long-Term
<b>6</b> <b>Conflict-resolution mechanisms</b>	Conflict resolution process Joint Liability Liability Waivers Change Management
<b>7</b> <b>Minimal rights recognition to organize</b>	No Prevalence of Owner No External Interference
<b>8</b> <b>Nested enterprises</b>	Tiers of Management Trade Groups Scope Trades

#### **DATA AVAILABILITY ACROSS PRACTICES**

We assessed the data available for each project management practice. For each of the project management practices, we assessed the percentage of cases where enough data was available to determine the status of the practice (e.g. if it was possible to assess the practice with a score of 2, 1, or 0). For each practice, cases scored as n/a would reduce the data availability percentage. Out of the forty project management practices reviewed, eight have a complete dataset (100% data availability) and five have more than 90% of the information (see Table 4).

From the metrics of data availability, we can determine which CPR design principles are consistently reported or not reported by MPCA project case studies. Practices categorized as principles 1A, 1B, 2A, 2B, 3, 4A, 4B, and 7 (see Table 4) are the most consistently reported. Practices categorized as principles 4A, 5, 7 and 8 are the least consistently reported.

Table 4: Project management practices with data availability of more than 90%

Design Principle	Project Management Practice	Data Availability
1A	MPCA	100%
1B	Validation Study	93%
1B	Clearly Established Goals	100%
2A	Experienced Partners	96%
2A	Early Contractor Involvement	100%
2B	Same Signatory/Risk Pool Participants	100%
3	Joint Decision-Making Process	100%
3	Team Alignment	100%
4A	Monitoring	100%
4A	Transparency/Open-Book Culture	93%
4B	Monitoring	100%
4B	Transparency/Open-Book Culture	93%
7	No Prevalence of Owner	96%

Table 5: Project management practice with data availability of less than 40%

Design Principle	Project Management Practices	Data Availability
4A	Surveys	19%
4A	LPS + PPC	37%
5	Long-Term Sanctions	7%
7	No External Interference	22%
8	Scope Trades	37%

### IMPLEMENTATION SCORES

Using the scoring system described in the methodology, we analyzed which practices and design principles were described as successfully implemented by the case studies. In this case, we require a data availability of more than 66% to ensure that the scores represent a significant segment of the cases. The following tables present the five highest and lowest average scores for the practices. The highest average implementation scores (see Table 6) are present for CPR design principles related to the monitoring of the users and resources (design principles 4A and 4B) and the project organization (6 and 8). The lowest average implementation scores (see Table 7) are present for CPR design principles related to the inclusion of experienced project partners (design principle 2A), having a weighted participation mechanism for the risk sharing (2B), or limiting the influence of the owner over the project (7) seems to be complex practices to implement.

Table 6: Top-5 average scores by PM practices

Design Principle	PM Practice	Data Availability	Average Score
4A	Monitoring	100%	1,93
4A/4B	KPIs / Dashboard	67%	1,89
6	Conflict resolution process	81%	1,95
8	Tiers of Management	70%	2,00
8	Trade Groups	81%	1,91

Table 7: Bottom-5 average scores by PM practices

Design Principle	PM Practice	Data Availability	Average Score
1B	Validation Study	93%	1,44
2A	Experienced Partners	96%	1,27
2B	Same Signatory/Risk Pool Participants	100%	1,30
2B	Weighted Participation	74%	0,80
7	No Prevalence of Owner	96%	1,31

#### SUMMARY OF PRACTICES BY CPR PRINCIPLES

The total average of PM practices by CPR category is aggregated in terms of data availability and average implementation score (see Table 8). For each design principle, a “principal” practice (the one with most relevance) was chosen and the score of that principal one averaged with the average score of the remaining ones.

In terms of highest scores, design principles 4A, 4B, 6, and 8 are all above an average score of 1,80. This score indicates a successful implementation of these principles. On the other side, low scores point out some problem areas already highlighted in the analysis of the PM practices. Particularly, design principles 1B and 2B respectively reflect the low implementation of validation studies and use of weighted compensation mechanisms for the participants, while design principle 7 is unsuccessful due to the frequent tendency of the owner to have a higher influence on decision-making and management than the other project partners. Finally, the design principle 5, alias sanctions to project participants and/or partners, is the practice with the least amount of data available.

Table 8: Data availability and average score by CPR design principles

Design Principles of CPR Scenarios' Governance	Data Availability	Average Score
1A Clearly defined boundaries for the user	100%	1,78
1B Clearly defined boundaries for the resources	100%	1,37
2A Congruence with local conditions	100%	1,56
2B Congruence between appropriation and provision rules	100%	1,26
3 Collective choice arrangements	100%	1,74
4A Monitoring the users	100%	1,85
4B Monitoring the resources	100%	1,81
5 Graduated sanctions	52%	1,64
6 Conflict resolution mechanisms	93%	1,84
7 Minimal recognition of rights to organize	96%	1,31
8 Nested enterprises	85%	1,96

To conclude, a qualitative comparison between IPD and PA projects is performed to identify similarities and differences between these two delivery methods in terms of project management practices more or least reported (see Table 11).

Table 11 – Comparison between PM practices for PA and IPD projects (in bold practices with more than 30% of a difference in figures)

Design Principle	Project Management Practices	PA		IPD	
		Data Availability	Average Score	Data Availability	Average Score
1A	MPCA	100%	1,82	100%	1,75
1A	RFQ and/or RFP	64%	2,00	63%	2,00
1A	Interview and/or CBA	64%	2,00	56%	1,78
<b>1A</b>	<b>Long-Term Relationships</b>	<b>36%</b>	<b>1,50</b>	<b>75%</b>	<b>1,92</b>
1B	Validation Study	82%	1,67	100%	1,31
1B	Clearly Established Goals	100%	2,00	100%	1,38
<b>1B</b>	<b>Adequate Contingency</b>	<b>9%</b>	<b>1,00</b>	<b>81%</b>	<b>1,23</b>
2A	Experienced Partners	91%	1,40	100%	1,19
2A	Local Partners	55%	1,67	44%	1,71
2A	Integrated Design	82%	2,00	75%	1,50
2A	Early Contractor Involvement	100%	2,00	100%	1,75
2A	Training	45%	2,00	63%	1,90
2B	Same Signatory/Risk Pool Participants	100%	2,00	100%	0,81
2B	Weighted Participation	64%	0,71	81%	0,85
3	Joint Decision-Making Process	100%	1,73	100%	1,88
3	Efficient Process	64%	1,71	69%	1,45
3	Team Alignment	100%	1,82	100%	1,75
<b>3</b>	<b>Co-location</b>	<b>18%</b>	<b>2,00</b>	<b>56%</b>	<b>0,78</b>
4A	Monitoring	100%	2,00	100%	1,88
4A	Transparency/Open-Book Culture	82%	1,89	100%	1,88
4A	KPIs / Dashboard	91%	2,00	50%	1,75
4A	Surveys	18%	2,00	19%	2,00
<b>4A</b>	<b>LPS + PPC</b>	<b>0%</b>	<b>N/A</b>	<b>63%</b>	<b>1,90</b>
4B	Monitoring	100%	2,00	100%	1,69
4B	Transparency/Open-Book Culture	82%	1,89	100%	1,75
<b>4B</b>	<b>KPIs / Dashboard</b>	<b>91%</b>	<b>2,00</b>	<b>50%</b>	<b>1,75</b>
<b>4B</b>	<b>TCE/TVD</b>	<b>18%</b>	<b>2,00</b>	<b>56%</b>	<b>1,56</b>
<b>4B</b>	<b>Lean Tools</b>	<b>0%</b>	<b>N/A</b>	<b>75%</b>	<b>1,50</b>
<b>4B</b>	<b>BIM</b>	<b>0%</b>	<b>N/A</b>	<b>94%</b>	<b>1,33</b>
5	In-Project	45%	1,80	56%	1,56
5	Long-Term	0%	N/A	13%	2,00
6	Conflict resolution process	91%	1,90	75%	2,00
<b>6</b>	<b>Joint Liability</b>	<b>100%</b>	<b>2,00</b>	<b>31%</b>	<b>0,80</b>
<b>6</b>	<b>Liability Waivers</b>	<b>9%</b>	<b>2,00</b>	<b>88%</b>	<b>1,07</b>
<b>6</b>	<b>Change Management</b>	<b>9%</b>	<b>2,00</b>	<b>69%</b>	<b>1,45</b>
7	No Prevalence of Owner	91%	1,40	100%	1,25
7	No External Interference	27%	0,67	19%	0,00
8	Tiers of Management	64%	2,00	75%	2,00
8	Trade Groups	82%	2,00	81%	1,85
<b>8</b>	<b>Scope Trades</b>	<b>18%</b>	<b>2,00</b>	<b>50%</b>	<b>1,75</b>

In terms of data availability, some project management practices have important differences in figures (more than 30%). The practices more often reported in IPD rather than PA case studies are “Long-Term Relationships”, “Adequate Contingency”, “Co-location”, “TCE/TVD”, “Liability Waivers”, “Change Management” and “Scope Trades”. On the contrary, the practices of “KPIs/Dashboard” and “Joint Liability” are more prominently addressed in Project Alliancing case studies. Additionally, the PA case studies do not totally address the use of project management tools that do come up on IPD, such as “Last Planner System”, “Lean Tools” and “BIM”.

Lastly, in the case of the items “Joint Liability” and “Liability Waivers”, the differences in data availability shows how the practices vary between the project delivery methods, with PA favoring the “Joint Liability” and IPD the “Liability Waivers”, as explained before. Furthermore, the application of long-term sanctions on project partners is not addressed by PA cases and barely reported in the IPD ones.

## **DISCUSSION**

The content analysis of the selected MPCA case studies provides insights about their project’s organization, particularly in terms of management practices implemented and design principles for CPR scenarios’ governance most often addressed.

Given the alignment between the design principles of CPR scenarios’ governance and the project management practices of MPCAs, the researchers propose to couple these two research fields with a third lens of interpretation, that is organizational design theory, in order to address additional aspects of MPCAs that are not fully covered by the design principles for CPR scenarios’ governance.

The research findings’ discussion is therefore categorized to the five main components of organizational design as proposed by Galbraith (2016). According to his model, organizational key components fall into five categories:

1. Strategy, which determines the direction of the organization;
2. Structure, which determines the location of decision-making power;
3. Processes, which establish the flow of information and information technologies;
4. Rewards, which influence the motivation of people to perform and address organizational goals;
5. People, which influence and define employees’ mindsets and skills.

Given these definitions of the organizational design theory’s components, each project management practices and project outcomes defined from the case study review is attributed to one or more components of this framework, to attempt to align these concepts.

## **STRATEGY**

Based on the results of the case study review, the most important decision to be made by project owners and planners seems to be the choice of an MPCA as a project delivery method. Nevertheless, this choice might be challenging if the project’s work environment is not adequate and/or ready for delivery model innovation yet. This viewpoint is explained by Cheng et al. (2016): “In retrospect, a lesson learned is that the market context can reduce interest in IPD. If there is an abundance of

conventional delivery opportunities, IPD, as a new process, can appear riskier to trade partners.”

Additionally, the use of MPCAs by public agencies in infrastructure projects might be limited by the local legislation, as it happened in the case 5 of this study (National Academies of Sciences, Engineering, and Medicine, 2015) where a workaround had to be used to allow an Alliance-Type project delivery. This results in an interest in MPCAs that is limited to just some owners’ categories and only in some countries, like IPD projects with healthcare providers in the USA and Canada (Ballard et al., 2015; Cheng et al., 2016; AIA and AGC, 2010) and PA projects with public agencies in Australia, the UK, New Zealand and Finland (Lahdenperä, 2011; Amaral Fernandes et al., 2018; Department of Infrastructure and Transport, 2010).

## **STRUCTURE**

Regarding the topic of organizational structure, several interesting points can be made on how MPCAs are implemented and could benefit the project outcomes, based on this study’s findings.

Most of the MPCA case studies reviewed have successfully built project’s organization based on the CPR design principles of “Collective choice arrangements”, “Conflict resolution mechanisms”, and “Nested enterprises”. Both the high data availability and average scores of some of the related project management practices demonstrate this successful implementation. For example, the practices of introducing several levels of management and the formation of trade groups between specialized partners and contractors are some of the collaboration aspects that project teams seem to have taken advantage the most. These practices also have a positive impact in the alignment of team members towards common goals, in the building of trust and decreasing of conflicts (Nyström, 2005).

Regarding the design principle “Minimal recognition of rights to organize” instead, MPCA projects are mostly not following what the governance of CPR scenarios suggests (Hall, 2017, Ostrom, 1990 and Cox et al., 2010). This misalignment can be explained by one of the fundamental differences between common pool resources and shared MPCA projects resources, which is the temporary nature of the latter ones (Hall, 2017). The temporary setting of construction projects, in fact, determines a work environment in which basically just one project party has a long-term interest in the project’s success, that is the owner, while all the others have less incentive to maintain a sustainable resource usage until the end of the project’s execution. Therefore, from this perspective, it might be even better to have a ‘smart’ owner who takes over the leadership and engages project partners into achieving the established goals (Cheng et al., 2016). However, the present study finds this owners’ leadership to be problematic in at least three of the MPCA projects reviewed due to the owners’ tendency to change significantly the design and scope of the works throughout project execution.

## **PEOPLE**

Given the importance of incorporating the right partners, selection process and stakeholder management should be major focus points to consider when planning and executing MPCA projects.

However, from the collected data, a majority of projects (63%) still rely on traditional price and/or qualifications competition. Nevertheless, a bit over half the projects incorporate an interview and/or choosing by advantage (CBA) process, therefore complementing or even replacing the traditional selection methods. These latter practices are in line with the need to move away from traditional procurement methods, that focus heavily on lowering prices and ultimately generating the adversarial behavior between parties (Thomsen et al., 2010), for achieving the goals of collaboration, partnership, and trust.

The design principles “Clearly defined boundaries for the user” and “Monitoring the users” both concur to the successful outcomes of the projects reviewed, further reflecting the importance of the partners involved in MPCA projects.

Finally, some other aspects of the projects’ human resources management, including team culture, leadership, transparency, and trust, are not directly translatable into specific project management practices or addressed by CPR design principles. Nevertheless, these factors are reported as fundamental components of the achieved success in some of the MPCA case studies analyzed (Cheng et al., 2016).

## **PROCESSES**

Out of the vertical processes, which are used to allocate resources through planning and budgeting (Galbraith, 2016), the MPCA practice of performing validation studies presents average scores lower than expected. In addition, another vertical process, that is the “Adequate Contingency” for the project, is reported in many case studies, 13 IPD projects in particular, as a problematic point. This could be a consequence of project organizations continuing to establish project budgets based on the planners’ estimations and the subsequent contractors’ quotations, instead of doing a thorough validation study of the project’s cost collectively with the MPCA partners. This is a missed opportunity to achieve estimates that are more accurate and to increase partners’ commitment (Cheng et al., 2016).

In the case of horizontal processes, which are related to the practical project activities (Galbraith, 2016), the monitoring of users and resources is successfully implemented in most of the MPCA case studies and evaluated positively with high average scores. KPIs and/or dashboards are mostly used for monitoring of resources and users, with approximately two-thirds of MPCA case studies implementing them and very few instances of problems reported. On the other side, more recent project management practices such as the use of Lean Tools, Last Planner System, Target Value Design and BIM are often implemented in the IPD projects reviewed, while barely being mentioned in most of the PA case studies.

## **REWARDS**

The purpose of reward systems is to align the goals of project partners with the goals of the project’s organization (Galbraith, 2016). In this sense, there is a margin of improvement in the profit and risk sharing mechanisms implemented in the MPCA case studies analyzed. As highlighted before, in fact, the PM practices categorized to the design principle 2B “Congruence between appropriation and provision rules” are in the lower end of scores. This is due to not considering important aspects, such as the scope, timeframe and/or impact of different types of partners on the project outcomes, and therefore leading to some cases of dissatisfaction.



Cheng et al. (2016) propose possible solutions by including differentiation between partners with a fee-based cost structure or early pay-outs based on performance metrics for architects and/or engineers whose scope of works is practically finished long before the project's final delivery. Additionally, the creation of long-term partnerships can also help to increase project partners' satisfaction and interest to continue participating in MPCA projects, through lessons learned, increased efficiencies and the prospect of continued business over time (Leufkens and Noorderhaven, 2011).

Finally, the design principle 5 "Graduated sanctions", according to which project partners who violate operational rules are likely to be assessed graduated sanctions (Cox et al., 2010), is the category with the least amount of data. Most MPCA case studies do not even mention the need and/or existence of penalties, and in the instances where this principle is mentioned, it results only in cases of removal of specific individuals or statements to consider current performance as a factor for the selection process of future projects. This seems to confirm the suggestion by Hall (2018) that peer pressure based on the transparency of the financial and progress monitoring and a clear understanding of the resulting metrics by the users involved are very good mechanisms to sanction subpar performance and increase partners engagement.

## CONCLUSIONS

The management of multi-party construction commons theoretically aligns with the governance of common pool resource scenarios. This turns into a need to understand how the design principles of CPR scenarios' governance are carried out in MPCA practice and to identify project management practices commonly present in MPCA projects with successful outcomes. To do this, we performed a content analysis of international MPCA case studies. In this way, project management practices that are more often used to manage common project resources in cases of MPCAs were identified, categorized and analyzed to better understand their alignment with the design principles of CPR scenarios' governance.

Firstly, the data collected confirm the implementation, or at least consideration, by the majority of project organizations of the more significant management practices of MPCAs, like early contractor involvement, joint decision-making, team alignment, and transparent monitoring of participants and resources. In terms of higher scores, the monitoring of resources and project participants, the conflict resolution process, and the project organization through different management levels and functional teams or trade groups are the most successful practices implemented on the projects reviewed. This indicates that the priorities are on correctly organizing the project, performing a thorough project control and monitoring, and on solving any conflicts as efficiently as possible.

In the lower end of scores, the mechanisms on how to reward project participants perform poorly, mostly due to not considering the scope, timeframe and/or impact of different types of partners and contractors on the final outcome. This led to some cases of dissatisfaction in projects, especially among architects, which consider their impact and involvement much higher than their percentage of the overall costs. Other low scores of these practices might reflect some of the difficulties that project organizations face when implementing MPCA projects, such as incorporating

experienced partners, decreasing the owner's prevalence in the decision-making and developing full validation studies together with at least the major project partners.

Regarding the design principles for the governance of CPR scenarios, in most cases, all the principles are addressed, at least partially. Specifically, the organization of the project into "Nested enterprises" (design principle 8), the monitoring of users and resources (4A and 4B) and the introduction of effective conflict resolution mechanisms (6) have been observed as being most successful. On the lower end of the score scale, some of the observations made before with the project management practices appear again, with projects having less success in general with "Clearly defining boundaries for the resources" (2B), the "Congruence between appropriation and provision rules" (2B) and providing the project partners with "Minimal recognition of rights to organize" (7).

## **LIMITATIONS**

The MPCA case studies analyzed vary considerably in terms of topics covered, as well as for the consistency and depth with which these topics are studied in each instance. It is important to note that even though certain data might be unavailable or not mentioned in a case study, it does not mean that the project did not implement these practices in a successful way. These possible scenarios might have led to some omissions and/or inaccurate assumptions or scoring in the study database. Data collection and analysis, therefore, rely heavily on qualitative evaluation and interpretation of the project case studies' information.

Another issue arising from the case study review is the potential bias present in the published project cases. This could be caused by the higher appeal that successful projects have, especially if a publication's goal is to promote a certain practice, and the possible reluctance of project stakeholders of an unsuccessful project to share their insight. This bias can be partially explained through the concepts of Confirmation and Social Desirability biases:

- **Confirmation Bias:** Connotes the seeking or interpreting of evidence in ways that are partial to existing beliefs, expectations or a hypothesis in hand (Nickerson, 1998).
- **Social Desirability Bias:** Occurs when a respondent provides an answer that is more socially acceptable than the true attitude or behavior. This leads to underreporting of socially undesirable behavior and over-reporting of socially desirable behavior (Kaminska and Foulsham, 2013).

## **FUTURE RESEARCH STEPS**

As a closing remark, some suggestions for further lines of research are proposed to build upon this study's findings and gain further insight into the project management practices of MPCA projects and the governance of their shared resources as CPR scenarios.

Firstly, it would be interesting to analyze and compare the project management practices employed in traditional contracts, to see if these vary by type of project, which ones are addressed in successful and unsuccessful projects, and if some of these variations in practices, processes and/or tools might benefit or hurt MPCA projects. For example, people behaviors can be simulated by using game theory and agent-based modeling in order to understand how project participants differently

interact according to traditional project management (as-is state), BIM project management (transition state), and collaborative multi-party project management (to-be state).

Additionally, the scope of this study could be restricted to a certain subset of project management practices and design principles. This could possibly allow the inclusion of more MPCA case studies and provide more insights into some particular aspects. For example, the focus can be put on the ‘People’ domain in cross-analysis with the CPR principle number 1A, namely “Clearly defined boundaries for the user”. Data can be collected by distributing network questionnaires to project participants and performing social network analysis. The purpose of this analysis would be to understand how relationships and ‘boundaries’ between people change, as project needs evolve, new participants are added or excluded from the project, and process phases advance. This can also help to understand how the working context should be set and evolve throughout the different phases of the process in order to facilitate team integration and collaboration.

Finally, the performance of one or more detailed MPCA case studies would allow to complement this study’s findings and obtain more detailed information on which means and methods could be useful for the organization, which ones make more sense to project partners and how these contributed to project’s outcomes.

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