INVESTIGATING FACTORS LEADING TO IPD PROJECT SUCCESS IN CANADA

Final Report
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EXECUTIVE SUMMARY

Integrated Project Delivery (IPD) is an increasingly popular relational and collaborative approach to project delivery that focuses on maximizing project outcomes and generating value for an asset owner and its end-users. Initially developed to increase reliability and predictability of project outcomes and to maximize value generation, IPD has been applied to hundreds of projects across North America and internationally. While being predominantly adopted in the United States, over 60 Canadian IPD projects have been initiated, mainly in the provinces of Alberta and Ontario, with some exceptions.

Main reasons for adopting IPD include dissatisfaction with traditional project delivery modes as they have been shown to repeatedly fail to deliver value to owners and end-users (Collins & Parrish, 2014). Indeed, past research has demonstrated significant improvements in the overall project delivery process from a cost, schedule, and quality perspective Field (Ibrahim et al., 2020) and a human and relational perspective (Choi et al., 2019). Most research findings point toward IPD leading to better projects and, ultimately, better-built assets (Ling et al., 2020).

Implementing IPD, however, is not without its lot of challenges. For instance, lack of awareness, precedent, and education, consistently rank among the most significant barriers to IPD (Kent & Becerik-Gerber, 2010). Moreover, IPD implies fundamental changes in how projects are structured, procured, designed, and delivered. This change in the ways of doing things requires significant amounts of effort by the entire project supply chain to, in essence, redesign their work (Abdirad & Dossick, 2019). Therefore, there is a need to capture, document, and provide more examples and lessons learned of IPD in practice, essentially broadening the body of knowledge, to help the industry adopt and implement IPD, especially in Canada.

The research presented in this report aimed to document three cases of IPD implementation in Canada to understand how and why IPD was implemented, if it was successful, and the reasons that led to this success or lack thereof. The case studies presented in this project are among the first documented cases of IPD implementation in the Canadian context. The research project replicated the methodology used to develop the 2016 report titled: "Motivation and Means: How and Why IPD and Lean Lead to Success," produced by a joint research team under the direction of Professor Renee Cheng at the University of Minnesota and commissioned by the Integrated Project Delivery Alliance (IPDA) and the Lean Construction Institute (LCI) (Cheng & Johnson, 2016). The aim was to further the body of knowledge on IPD using a consistent set of indicators (also known as markers).

The report is structured around the markers developed initially for the Motivation and Means report. They have been restructured slightly. Overall, the three projects demonstrated high levels of performance across all indicators. As

such, they were consistently delivered on time and within budget. Moreover, several additional items, termed Wishlist items, were delivered on all three projects. Finally, all three projects paid out their full ICL, meaning that all project signatories received their full profit. From a scheduling perspective, all three projects were delivered within the targeted timeframes, with projects being delivered ahead of schedule while facing challenging situations that could significantly disrupt project timelines. Finally, according to project participants, all three projects were successful in delivering high value and quality to the owners and end-users.

In coming back to the original research questions of how and why IPD can lead to project success, the three case studies are consistent in their application of the core components of IPD as defined through the categories developed in this report and their markers. In this sense, following the decision to move ahead with IPD, all three cases framed the project appropriately through the use of the contract and its provisions, choose the right team members through a value-based and inclusive RFQ/RFP process, set a conducive project context through clear decision structures and by involving key resources and facilitators, executed the work in an effective and efficient manner by implementing appropriate tools, methods and technologies, and maintained excellence throughout the project by ensuring team alignment, cohesion and a favorable culture. As mentioned, this allowed the project teams to reap the benefits of IPD, not only in terms of cost, time, and quality, but also in terms of having fun and building lasting business relationships.

The three case studies are only an example, albeit telling, of the potential of IPD in Canada, as acknowledged by many in the Canadian built asset industry, as a significantly improved way forward over traditional project delivery. One thing to note, is that all three projects were publicly funded. They generated value for their communities and taxpayers in a context and in an industry that has traditionally not been overly successful in doing so. This research project emphasized that IPD should become a more widely used and adopted project delivery approach for public bodies in Canada. Challenges remain, though, to make this happen. As such, more research is needed to support IPD's progression in Canada. These are discussed below.

FUTURE RESEARCH

This study highlighted how IPD can contribute to project success and provided detailed accounts of the processes used to implement it. While this in-depth analysis demonstrated how the various components of the IPD system work together to create a highly conducive environment for project success, it also served to denote and identify certain aspects that can still be optimized to further improve implementation of IPD within the Canadian built asset industry. As such suggested future research areas include, among others:

- **IPD adoption and implementation process:** Perform in-depth investigations of the overall IPD adoption and implementation process through longitudinal case-studies to provide more detailed accounts and further understanding for the various mechanisms to be deployed to support this process.
- **IPD in publicly funded projects:** Investigate regulatory and procurement barriers that hinder the use of IPD in publicly funded projects across Canada.

- **IPD in privately funded projects:** Challenges faced in privately funded projects.

- **Contract development and implementation process**: Evaluate the implementation of different forms of agreement, including the CCDC 30, and to what extents these agreements meet expectations and what challenges are faced in their development.

- **Target Value**: Perform a broad, cross-case analysis of TVD implementation to uncover the challenges, document best practices, highlight avenues for improvement and develop innovative solutions, tools and practices, to facilitate its implementation.

- **Ensuring team alignment throughout the project:** Developing strategies to enable and support alignment of project team members throughout the project, including site personnel and external contract parties.

- **Collaborative BIM implementation for IPD**: Investigate approaches to maximise the benefits of BIM through structured practices in the context of IPD, using industry standards such as ISO 19650 and others.

- **Procurement practices**: Identifying approaches to procure integrated teams in the most effective way.

RESEARCH BACKGROUND

The current report builds upon a former fundamental publication supported by IPDA and published in 2016 (Motivations and Means), in which 10 different IPD case studies from the United States and Canada were developed and presented.

The authors in the Motivations and Means report highlight that their major finding was a striking uniformity of success for all the studied IPD projects, regardless of their type, scope, geographic location, or previous experience of their teams with IPD and Lean practices. This finding was supported by their rigorous analysis of the case study projects including using 24 specific markers of project success that they categorized in seven categories.

The second major finding introduced in the Motivations and Means report was the complementary strength of implementing IPD and Lean practices together to support the project success. In other words, the authors found out that although IPD as a contractual framework can create the necessary shared risk/reward structures, fiscal transparency, and release of liability for project success, Lean Construction measures play a significant role in reliably being able to meet project schedule and cost, as well as the owner's goals for quality. They also identified a direct relationship between teams with a high degree of Lean practices and the most positive collaboration outcomes, which emphasizes the necessity of considering Lean practices, while adopting an IPD delivery model. Additionally, they emphasized that collaborative measures such as building information modeling (BIM), co-location, and pull planning could be essential for a project if done well.

The authors also highlighted that these two terms, IPD and Lean, often are mentioned together when having discussions with practitioners and even noticed that they would sometimes use these terms interchangeably but the underlying finding by the authors in this regard was that most practitioners, especially owners, regardless of their prior experience with regards to project delivery models, believed that IPD facilitated the implementation of Lean practices. They also mention that while IPD is essential to create mechanisms for trust, and "motivation" for collaboration, Lean practices can provide the "means", by which the team can effectively collaborate (hence the name of the report: Motivations and Means).

Furthermore, the authors of the Motivations and Means report argued that, contrary to the common industry perception, the occurrence of collaboration and high-performing project teams can be actively fostered by introducing IPD contracts and Lean practices to a project. They paid extra attention to the team-owner relationship and the engagement of the owners specifically. They noticed that all the owners in their study committed very early to adopting IPD for their projects even before forming their project teams. This early commitment, according to the authors, was a key measure for building and supporting a high-performing collaborative project team and a team culture that respected mutual

trust, project-first spirit, calling out problems, and collectively working on solutions. This special team culture, they argue, was crucial and effective in making sense of the owners' goals and translating them into actions, even in cases when the goals were not completely clear or were changed over the course of the project. They also identified that project teams that could successfully cultivate a positive team culture also tended to be the most invested in planning and communication, and particularly in implementing Lean practices.

The Motivations and Means report also highlights an investment in early planning and team building is another necessary measure for a successful IPD implementation. However, finding the financial resources for early planning, coordination, and fiscal reporting is challenging for many organizations, despite the general notion of advantages in early planning.

Finally, the authors concluded that although project budget and schedule do not necessarily reflect the team performance and whether the project goals were achieved, many project teams still consider them as ultimate metrics for project success. This was even witnessed by the authors among project teams that worked on high-performance buildings yet often defaulted to cost and schedule metrics to measure the project's success.

METHODOLOGY

As previously mentioned, the research methodology adopted for this project replicates the one used to develop the 2016 Motivation and Means report (Cheng & Johnson, 2016), albeit on a smaller scale, with three cases selected to be part of the study. The cases were selected on the following basis:

1. The projects used multi-party contract with three or more signatories
2. The projects were delivered by January 1st, 2021 (they could still be in the warranty period)
3. Were distributed in different regions across Canada
4. Involved Canadian companies to ensure a breadth of representation
5. Represented a diversity of building typology

Data were collected through three mechanisms: (1) interviews with most, if not all, project signatories, (2) project document reviews, and (3) surveys distributed to the project teams. Follow-up e-mails and discussions were held to clarify any ambiguities or misinterpretations of the data. The main findings came from the analysis of the interviews and were complemented and confirmed through the document analysis and the survey.

CATEGORIES AND MARKERS

The original markers were used in this research project to ensure consistency of data collection and analysis and allow cross-analysis with the ten original case studies. Each marker was originally classified into one of six categories: Context, Legal/Commercial, Leadership/Management, Processes/Lean, Alignment/Goals, and Building Outcomes as shown in Table 1.

Table 1 - Original markers and categories (Cheng et al. 2016)

Context				Legal Commercial				Leadership & Management				Processes & Lean				Alignment & Goals			Building Outcomes
At a Glance	Project Description	Project Timeline	Owner Identity & Interface	Choosing IPD & Lean	Team Selection	Developing Contract	Developing Parties	Champions	Decision Structure	On-Board And Off-Board	Clarity of Goals	Resources & Facilitation	Lean	BIM	Workplace	Team Alignment	Collaboration	Team Culture	Profit And Payout	Budget and Schedule	Building Outcomes

After review by the project team, it was deemed that these categories could be refined while eliminating certain inconsistencies (for instance Clarity of Goals under Leadership & Management as opposed to Alignment & Goals). The new categories were developed to be more aligned with the overall IPD process while hinting at the key aspects that support the efficient and effective adoption and implementation of IPD.

The new categories were identified as: Making the case for IPD, Framing the project, Choosing the team, Setting the context, Executing the work, Maintaining excellence, and Reaping the benefits. Table 2 illustrates the relationship between the markers and the new categories. Relationships marked as primary in the table indicate the strongest link between the category and the marker. However, the research team recognized that there were many instances where markers could belong to more than one category. Those relationships are marked as secondary in the table.

Table 2 - Relationship between the markers and the new categories

	Owner context	Choosing IPD	Developing the contact	Clarity of goals	Team selection	Developing parties	Champions	Decision structure	Resources and facilitation	On-board and off-board	Tools and processes	Lean	BIM	Workplace	Team alignment	Collaboration	Team culture	Profit and payout	Budget and schedule	Building outcomes
Making case for IPD	X	X																		
Framing the project		x	X	X				x												
Choosing the team					X	X	X	x	x											
Setting the context				x				X	X	X		x								
Executing the work									x		X	X	X	X	x	x	x			
Maintaining excellence											x	x	x	x	X	X	X			
Reaping the benefits																		X	X	X

X = Primary   x = Secondary

As indicated in Table 2, Making the case for IPD includes the owner's context including its requirements and its motivation for adopting IPD. Framing the project includes how the contract was developed, its type as well as the clarity of the owner's and project goals. Choosing the team includes the team selection process, identify the champions of IPD and clarifying roles and responsibilities. Setting the context includes the decision-making structure that was developed, any specific resources or facilitation that was involved as well as the processes used for bringing team members on board and for their removal. Executing the work includes the team's implementation tools and processes, their use of BIM and Lean tools and their effectiveness as well as the workplace environment, including co-location and Big Rooms. Maintaining excellence includes aspects relating to team culture, their alignment around goals and the ways that the teams defined, understood, and eventually implemented measures to achieve these goals as well as the team's ability to collaborate. Finally, Reaping the benefits provides information on profit and the payout of the risk/reward pool and describes how the teams achieved budget, schedule, and other project goals as well as overall project outcomes.

INTERVIEWS

The interviews were conducted online over a 6-month period with the project signatories on each of the cases. Most interviews were conducted with a group of representatives from each organization. Some interviews were conducted with a group of representatives from various firms representing one specific Project Implementation Team (PIT). The choice to combine interviewees was based on the number of interviews to be conducted in the allotted time frame. The research team was aware that doing so could alter certain behaviours or responses and considered this when analysing the data. The research team looked for hesitations or nuancing and prefacing of responses as indications of this change in behaviour. After analysis, little to no variation was noticed between interviews with single organizations or with multiple organizations.

The same interview questions that were used in the Motivations and Means research project were used for this project. Two interview scripts were used: one for the owner organizations and one for the project team members. The interview topic areas were realigned to the new categories as described above and included a section on respondent profile and experience, where the team member's experience with IPD and Lean as well as general experience in the construction sector were discussed. Regarding *Making the case for IPD*, motivations that lead the owner organization to pursue IPD, their aspirations and how it came about were discussed. For *Framing the project,* the development of the contract, and how the contracting terms and processes impacted team culture and performance were considered. With regards to *Choosing the team*, the team members were asked to describe team member selection and championing of IPD. For *Setting the context*, joint decision-making was discussed as were the on-boarding and off-boarding process. Regarding Executing the work, the implementation of tools and processes, including Lean processes and BIM tools as well as notable general workplace organizational strategies were considered. For *Maintaining excellence*, how the teams maintained alignment and collaborated as well as how they measured success on the project were discussed. Finally, for *Reaping the benefits*, the teams were asked about project outcomes from the perspective of both project and building performance.

Table 3 indicates the number of interviewees per discipline and per case study. All interviews were transcribed and coded in NVIVO. Deductive coding was used, with codes aligned to the categories and markers identified and defined above.

Table 3 – Number of interviewees per discipline and per case study

	Barrie Simcoe Emergency Services Campus	Canada Games Aquatic Centre	Thelma Chalifoux/Soraya Hafez Schools
Owner	2	2	2
Architect	3	2	2
Engineer	8	4	2
General Contractor	4	1	1
Specialty Contractor	3	3	2
Facilitator	1	1	0
Other	0	0	0

DOCUMENTS

All project teams were asked to provide the documents listed below. These documents were analysed as a source of primary data pertaining to project information. They were also used to validate and clarify certain interpretations made from the interview analysis, thus providing grounds for triangulation of data sources, and thereby improving the validity and reliability of the results. The documents were prioritized to enable the project teams to focus on providing the documents that would be the most important without overburdening them.

- Commercial and legal
  - Request for proposal (RFP)
  - Request for qualifications (RFQ) and criteria for selection
- IPD agreement and contract exhibits, such as risk/ reward distribution, milestone payouts
  - Budget and other financial documents
  - Validation report
- Project management
  - Project schedule
  - RFI log, Change Order log or other communication log
  - Risk registries
- Decision making
  - Protocols for decisions
  - Sample documents related to major decisions by the core team
  - Sample communication of decisions to the larger team
  - Documentation of goals

- Project meetings
    - Protocols for meetings
    - Meeting schedules and agendas
    - Sample meeting minutes
- Lean
    - Samples of A3s and, pull plans
    - Samples of customized tools, screen shots
    - Protocols on how tools were used, including dashboards
- BIM
    - Execution plan
    - Sample snap shots of models
    - Relevant BIM software (BIM platform, clash detection, etc.)
- Workplace Environment
    - Plans and photographs of shared workspaces
    - Photographs of interactive tools
    - Office floor plan with seating chart (if collocated)
- Project personnel
    - Organizational Chart
    - Project directories
    - Personnel lists
    - On-boarding protocols

SURVEY

To supplement the detailed interview data and document analysis, project participants were a survey. The survey was largely modelled on that of the Motivation and Means research project but was revised to include additional questions and reword certain ones.

A series of project- and respondent-demographic questions were first asked to position the respondent. These included questions around familiarity of the respondent with their team members and with the various principles, processes and tools implemented in the project. Several questions were then asked relating to the team formation, commercial and legal consideration, and the effectiveness of how they were addressed. A section looking into the success of specific project team activities, owner engagement, and the management practices was included. Team culture, examined through the lens of collaboration, decision-making, and goal alignment was investigated. The project execution section looked at the level of Lean- and BIM-tool use in the project and asked respondents to compare use to previous experience. Specific measures of project effectiveness were included in the survey including communication, accountability, transparency, and trust, as well as outcomes, like effective decision-making, commitment and improvement, and goal alignment with the owner and across the team. Perceptions on project outcomes were surveyed also, including cost, schedule, energy performance, and

sustainability and compared to respondents' past experiences. Finally, participants were asked whether they would choose to use IPD in the future or recommend it to others. Table 4 indicates the type and number of survey respondents per case study.

Table 4 - Type and number of survey respondents per case study

	Barrie Simcoe Emergency Services Campus	Canada Games Aquatic Centre	Thelma Chalifoux/Soraya Hafez Schools
Owner	7	2	1
Architect	1	2	1
Engineer	2	5	3
General Contractor	0	3	1
Specialty Contractor	2	1	5
Total	12	13	11

RELIABILITY AND VALIDITY OF RESULTS

The reliability and validity of results were ensured through several means. For instance, an advisory committee was set up to help with case study identification and project oversight. During the data collection process, interviews were conducted with two or three researchers present to ensure consistency in the interview process. Field notes were taken during all interviews and shared among the research team. Coding was performed by one researcher and validated with another member of the research team. Findings were triangulated using the three data sources to ensure their validity. Each case study write-up was shared with the project team to ensure the interpretations were valid and represented what happened. Finally, the report was reviewed by the advisory committee, who acted as a peer review.

CASE STUDY DESCRIPTIONS

BARRIE-SIMCOE EMERGENCY SERVICES CAMPUS

The Barrie-Simcoe Emergency Services Campus (BSESC) was a collaborative effort between the City of Barrie, the principal owner, and the County of Simcoe, the co-owner. The project concept was to bring together the Barrie Police Service, the Barrie Fire and Emergency Services, and Simcoe County Paramedic Services on a shared campus in a mutually beneficial collaboration structure. This was highlighted in the validation report: "The Barrie-Simcoe Emergency Services Campus will leverage both capital and operational efficiencies through a partnership that will foster innovative, collaborative, and sustainable values to support community growth, safety, care, and satisfaction. The campus concept provides a centralized platform from which our first responders can develop and implement programs that best meet the current and future needs of the community." As such, each partner would have access to more efficient and enhanced facilities via shared spaces and staff amenities than what would be practicable or economical in separate standalone buildings.

The project's vision was to establish a centralized platform from which the first responders could design and administer programs that would be most responsive to the community's present and future needs. The modern facilities created in this project were intended to improve efficiency among first responders while achieving savings both upfront and during operations.

CANADA GAMES AQUATIC CENTER

The Canada Game Aquatic Center (CGAC) was the first signed and completed Integrated Project Delivery (IPD) agreement in British Columbia. The project consisted of renovating and upgrading the City's main indoor pool, located at 910 McGill Road in Kamloops, British Columbia. The facility was originally constructed circa 1992 for the 1993 Canada Summer Games and is now described as the busiest site within the municipal boundaries, with more than 2,000 users per day.

Over its 26 years of service, the building was maintained, but no upgrades or improvements were made. The existing building envelope, as well as the mechanical and electrical systems, showed signs of fatigue and were nearing or beyond the end of their expected service life. In addition, the CGAC is responsible for a significant portion of Kamloops's greenhouse gas (GHG) emissions.

Therefore, the project's main objectives were to upgrade the facility, increase overall building durability with an innovative envelope and mechanical solutions, reduce energy use, and reduce greenhouse gas (GHG) emissions.

THELMA CHALIFOUX AND SORAYA HAFEZ SCHOOLS

This project consisted of building two schools commissioned by the Edmonton Public School Board: Thelma Chalifoux School and Soraya Hafez School (TCSH). The owner wished to anchor the school in 21st century learning and design principles. Thus, the team needed to develop a program and floor plan for the school that utilized the areas allocated by the provincial grant agreement to reflect a 21st century education approach.

The Thelma Chalifoux School project was designed to accommodate 900 new junior high students while the Soraya Hafez School was similar but smaller in size, aiming for a capacity of 650 students. The two building projects were grouped into a single IPD project and team, even though they were two separate IPD contracts. Therefore, in this document, the TCSH project refers to the construction projects for the two schools, Thelma Chalifoux School and Soraya Hafez School.

COMPARATIVE ANALYSIS

While not providing enough evidence for a generalization of findings, the three case studies performed in the context of this research project did allow for comparative analysis to identify trends and characteristics of IPD projects and how these characteristics impacted project performance and outcomes. The results of this analysis are presented across the six main categories developed for this research.

MAKING THE CASE FOR IPD

All three owners had to convince the decision-making within their respective organizations: They had to *Make the case for IPD*. As such, this category of markers involves the reasons and motivations that led the owner organization to choose IPD. Project characteristics, prior dissatisfaction with traditional delivery method outcomes, and recognition of the potential benefits of IPD were identified as major elements that played a leading role in the choice across the three cases.

All three projects had distinct qualities that lend themselves to IPD as an optimal delivery mode. The CGAC project was a renovation project with a high level of uncertainty that necessitated an intensive early investigation by the entire team. The TCSH's project consisted of two schools that were to be aligned with the concept of 21st-century learning. The BSESC project was the first experience for the two owners in a joint capital project involving three different end-users. All three projects had high aspirational goals for their respective building.

The owners' previous experience with traditional delivery models was another motivator that led them to seek an alternative path. In all three cases, the owners expressed dissatisfaction with the outcomes from prior projects. They were frustrated with recurring challenges in their projects, such as the number of change orders, which led to cost overruns, the adversarial culture, and schedule delays.

The recognition of the potential advantages of IPD was the third aspect that influenced the owners' choice to proceed. Industry conferences, feedback from peers and research were the primary sources of information for owners to understand the potential and the benefits of IPD for their projects.

COMPARATIVE ANALYSIS

FRAMING THE PROJECT

Once the decision to go with IPD was made, all three owner organizations had structure and frame the project. This was done using contracts and by setting the goals that were to be attained. In all three projects, the Hanson Bridgett IPD agreement, a contract initially developed in the United States, was employed by the owners. All the cases mentioned problems with American references in the contract that did not correlate to the Canadian context. To deal with these issues, all three projects held contract workshops. This also helped the teams deal with their lack of familiarity and ensured a consistent level of knowledge across the project signatories.

One point of divergence between the three cases was the liability waiver. While the CGAC and BSESC projects had a liability waiver clause, the TCSH project elected to remove this waiver. The team on that project were largely dissatisfied with the removal of the liability waiver as they considered it incompatible with IPD principles. However, they acknowledged that it was the only option to overcome the governmental barrier that disallowed the contract in its original form. Figure 1 indicates the survey respondents overall rating of the clarity of the contract in all three case studies, on a scale from 1 to 5, 1 being totally unclear and 5 being very clear.
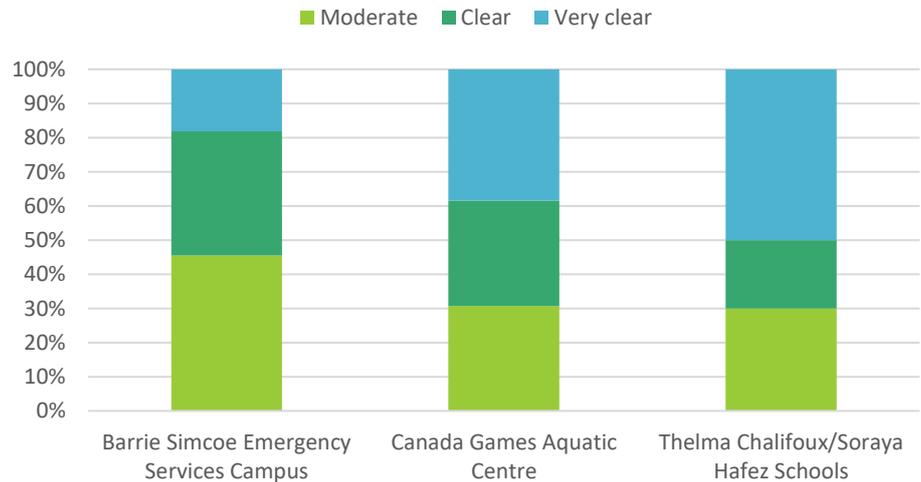
Figure 1 – Overall rating of clarity of the contract

Regarding the project's goals, all three projects displayed a high level of clarity around the owner's goals (Figure 2) and how they were communicated (Figure 3). The three teams also mentioned that the goal setting process was relatively transparent. In certain cases, however, the owner's mentioned that their requirements were mismanaged and difficulties in tracking them were reported.

Figure 2 - Clarity of owner's goals

Figure 3 – Communication of owner's goal

COMPARATIVE ANALYSIS

CHOOSING THE TEAM

Choosing the right team was consistently pointed to as one of, if not the, most important aspect in all three case studies. This category of markers therefore relates to how the teams were selected and how IPD was championed on the projects.

In terms of team selection, the three projects adopted different approaches. The CGAC project's owner used a waterfall hiring strategy. They began by deciding on the general contractor and the architect. Once the team was formed, they jointly decided who else should be a part of the team and began assessing their RFP submissions and picking the remaining partners. On the other side, a modest variation to this strategy was seen in the TCSH project, where a hybrid waterfall method was used. Six key actors were divided into three groups as part of the procedure. The general contractor was paired with the architect, the electrical engineer with the electrical contractor, and the mechanical engineer with the mechanical contractor. After choosing those six members, the team jointly determined who else they would add to the team. In contrast, the BSESC project has taken a completely different strategy. The applicants were asked to submit their proposals in clusters. At least one Ontario-licensed architect, a contractor who will carry out the project's construction, and mechanical and electrical engineering professionals must be part of the applicants' teams. After the project was granted, the chosen team and the owner determined which sub-trades to add to the team since they were not included in the initial RFP proposal. The owner's purpose with this strategy was to save time since they anticipated a lengthy public procurement procedure.

Figure 4 illustrates the survey respondents' perception regarding the effectiveness of the team formation process. All three cases were seen as effective in this regard, with CGAC and TCSH being seen as very effective.

Figure 4 – Effectiveness of team formation

Championing of IPD was largely attributed to the owners in all three cases, with the general contractor being credited with championing IPD in certain cases also. As noticeable in Figure 5, the BSESC project didn't have a clear champion whereas CGAC and TCSH team members indicated that championing of IPD was more significant. Figure 5 illustrates the survey perception of the contribution of IPD champion to the project's success

Figure 5 – Contribution of IPD champion to the project's success

COMPARATIVE ANALYSIS

SETTING THE CONTEXT

Having framed the project properly and chosen the right team, the project teams were then tasked to setting a conducive context to ensure the project's performance. In setting the context, all three project teams implemented a clear decision-making structure that involved the project implementation teams (PIT), the project management teams (PMT) and the senior management teams (SMT). Across the three cases, this structure was quite well respected, and decisions were largely made at the PIT and PMT levels; rarely did the SMTs have to cast a deciding vote in the three projects. In general, as shown in Figure 6, decisions were seen as being made collaboratively to a high degree. The sizes of the PMTs varied among the three projects, and concerns arose about the inefficiencies associated with having too large PMTs, which made their regular meetings costly and ineffective, particularly in the TCSH and BSESC projects. In the BSESC, the decisions were made to reduce the number of PMT members and focus on core signatories during a later phase of the project. While in the instance of TCSH, the project was committed to maintaining PMT meetings with the presence of the entire team since they saw it as a critical component of the project's success. However, alternative strategies were employed to make those meetings shorter and more efficient, such as encouraging more PITs to assemble around specialized issues that needed the participation of just the concerned parties.
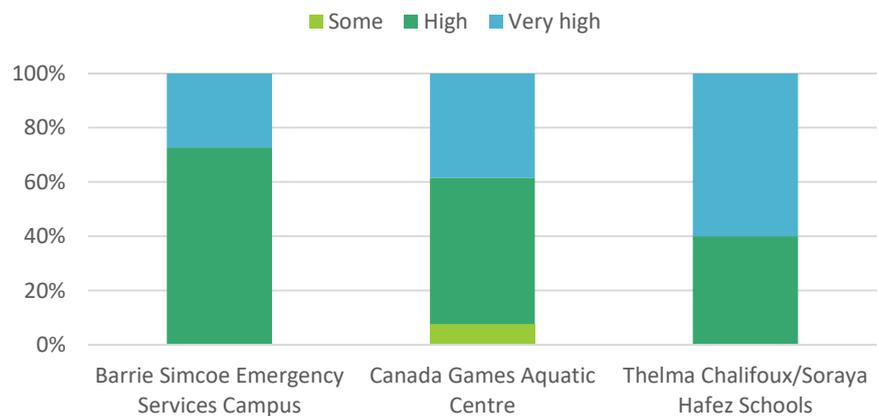

Figure 6 – Level of collaborative decision making on the project

Another aspect in setting the right context is the availability of dedicated resources and facilitation for IPD, to coach and train the project team members among other things. Indeed, IPD has a considerable learning curve as it implies new ways of working and involves several concepts and tools that are unfamiliar to a large portion of industry stakeholders. As is shown in Figure 7, the perceived effectiveness of this coaching and training varied across the three cases, with the CGAC project being seen as the most effective followed by the TCSH project. Within the three case studies, three distinct techniques for facilitating IPD were identified. The first approach, as in CGAC, was for the owner to hire an

independent third-party facilitator. The second approach, as in the TCSH project, was to include the facilitating entity as a team member and a signatory in the IPD agreement. While the BCESC project did not include a dedicated entity for facilitation. Instead, one of the team members with extensive IPD expertise, in this instance the general contractor, was tasked with assisting the IPD process.
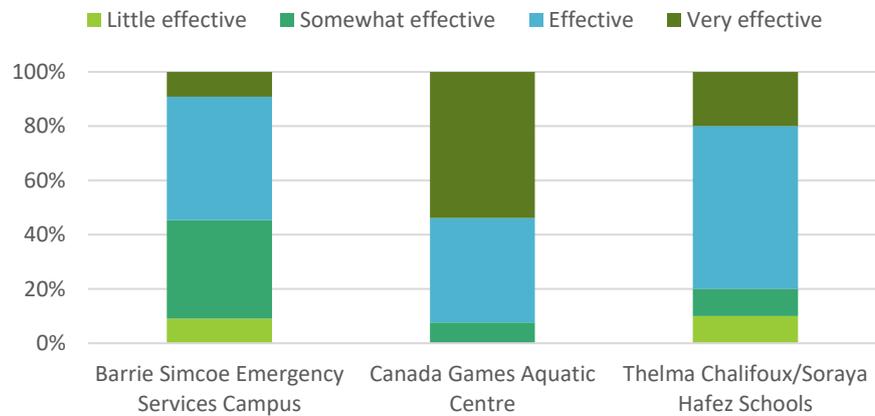

Figure 7 - Effectiveness of coaching and training for IPD

Finally, the On Boarding & Off Boarding process is critical in setting a conducive context for the project. Figure 8 illustrates that, while seen as effective or somewhat effective across all three cases, the on-boarding process could have been improved. This was supported through the interviews where it was mentioned consistently in all three cases that, while initial on-boarding was effective, it became less so as the project progressed, especially at the construction phase, where not all subcontractors were on-boarded to the same extent. The on-boarding process served to recall project values and goals, train individuals on IPD and to perform some team building.


*Figure 8 - Effectiveness of the onboarding process*

COMPARATIVE ANALYSIS

EXECUTING THE WORK

Over the course of the project, the project teams executed the work using several tools and processes and operated within a physical and digital environment. As previously stated, IPD was originally developed to enable Lean design and construction. As such, all three projects implemented various lean tools and methods to enable the team to meet the goals identified by the owners and the project teams. Examples of Lean methods and tools used consistently across the three cases include the Last Planner System®, Target Value Delivery, A3, retrospectives and plus/deltas, etc. Figure 9 illustrates the perceived overall effectiveness of lean implementation across the three cases.
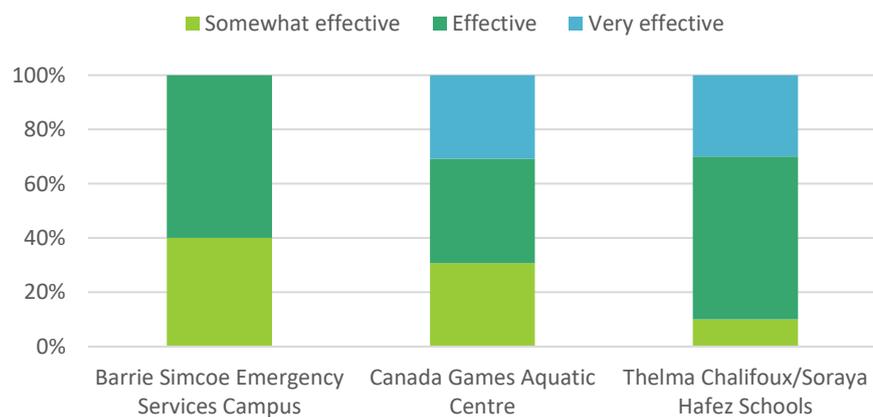
Figure 9 - Effectiveness of Lean implementation

BIM was also used on all three projects although to varying degrees. All three projects did not have specific information requirements and BIM deliverables specified by the owners. Indeed, none of the three owners had yet implanted BIM for the operations and maintenance, therefore no specific asset information requirements were formulated. It was therefore left up to the team to define the scope of BIM implementation in all three projects. Examples of BIM use were given in all three projects, namely, to support detailed coordination and field use, but advanced BIM uses, such as for prefabrication, for simulations and analysis and planning and cost estimating, were more limited. Figure 10 indicates the overall perception of project participants relating to the extent of BIM use on all three projects.

■ High - extensively used and customized (i.e. all project information developed and communicated through the models)

■ Medium - used frequently with most of the known capacity of the tool/process (i.e. project information developed and communicated jointly through the models and through 2D documents)

■ Low – used but not extensively and with only some of the power of the tool / process (i.e. project information developed and communicated principally through 2D documents)
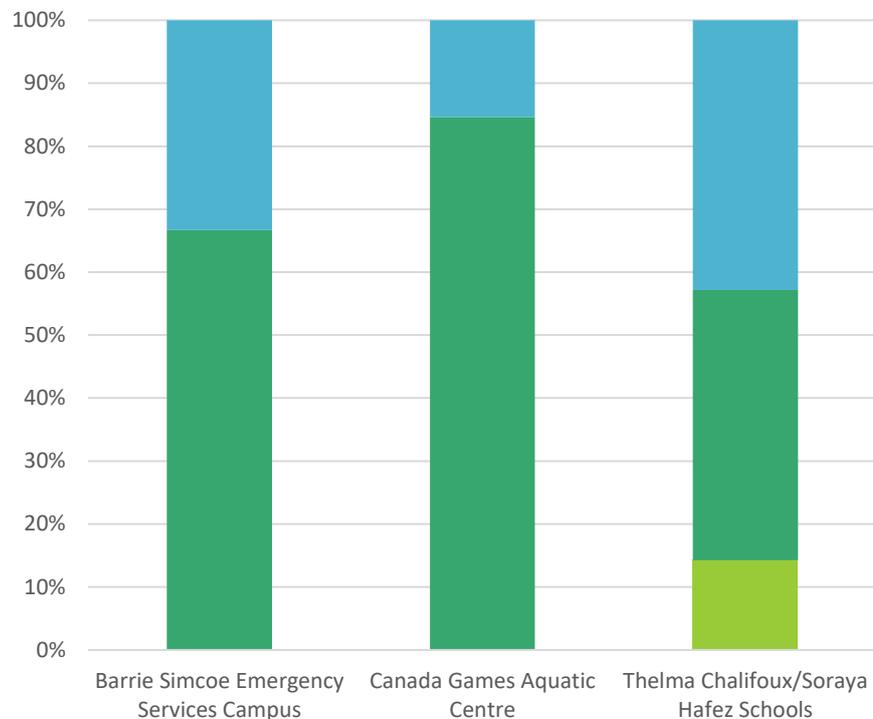
Figure 10 – Extent of BIM implementation in the project

Lastly, the physical and digital work environment plays a significant role in ensuring the project's success. Colocation and the implementation of big room, physical or virtual, is key to setting a conducive work environment. Across the three projects, the work environment was seen as being conducive to support collaboration and teamwork (Figure 11). Of the three projects studied, only CGAC was constrained to move to a virtual workspace due to the COVID-19 pandemic. The effectiveness of the virtual big rooms and work environment were discussed and seen to be effective for the most part. The BSESC project was disrupted but was in the process of being handed over when the pandemic hit. Both TCSH schools were operational prior to the pandemic. With regards to colocation, all three projects did collocate to varying degrees and all three implemented a Big Room, albeit in different configurations. The big room sessions in the CGAC project were conducted for two days every other week. Since many team members were from out of town, it was thought more convenient to travel in for two days biweekly rather than one day each week. In the TCSH, big room meetings were held one full day per week initially, then half a day per week as the intensity lessened in the late stages of the design phase, while big room meetings were held twice a week throughout the duration of the BSESC project.

Figure 11 - Conduciveness of work environment

COMPARATIVE ANALYSIS

MAINTAINING EXCELLENCE

Finally, while challenging, maintaining excellence throughout the project to ensure a consistently high degree of performance is one of the benefits of IPD, due to the various mechanisms in place that enables project teams to do so. The potential for high degrees of alignment and integration between project team members, namely through the various PITs and PMTs that characterize the collaborative decision-making structure, is very high. Across the three projects, the teams were integrated to varying degrees, yet all were determined to be considerably above what is observed on traditional projects. As is shown in Figure 12, all three projects demonstrated a relatively high perceived level of integration.
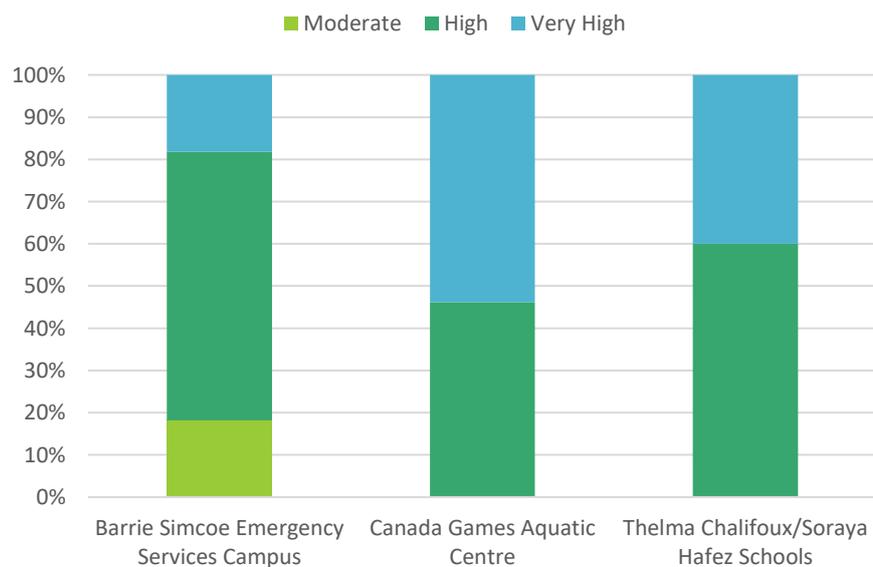
Figure 12 – Overall rating of team integration on the project

Issues did arise with accountability in the decision-making process and in anticipating the impact of these decisions on various projects variables and outcomes. For instance, in one case, challenges in properly forecasting costs led to situations where funds, that would otherwise be included in the ICL, had to be spent on project items that were missed during the validation process. Project team members in this case felt that the participants that had made the mistakes, weren't held accountable for them. However, fiscal transparency in all three cases was extremely high, with full access provided systematically to all PMT members.

Maintaining excellence through the project also involved fostering high levels of collaboration amongst project teams members: these were deemed high on all three projects. As an example, the levels of collaboration between owner, designers, and builders, for scope development in each project, as is shown in

Figure 13, were perceived as very high for the most part across the three cases. The effectiveness of this collaboration was equally deemed to be high as demonstrated through the project outcomes presented in the next section.
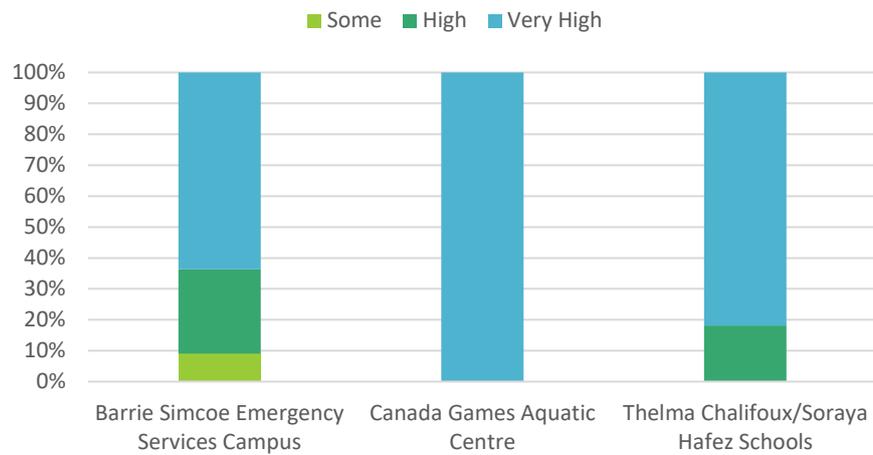
Figure 13 – Level of collaboration between owner, designers, and builders, for scope development

Another indicator supporting the degree of excellence maintained throughout the project is attributable to team culture, which is closely tied to collaboration. As is shown in Figure 14, overall ratings of team culture on all three projects were very good to excellent. While highly subjective, the notion of team culture was embodied through examples such as making the big room area a no-title zone as done in the BSESC, which was meant to encourage contributions by all. The same notion can be noticed in the sustained efforts made in the TCSH project to engage the onsite teams and align them with the project goals and values. In the CGAC project, the team mentioned many team building activities that were conducted both within and outside of the project's boundaries, which successfully enabled them to build stronger relationships and trust among team members. Indeed, some team members credited the collaborative culture created as the main factor that enabled them to collaborate effectively and thus contributed to the project's success.

Figure 14 – Overall rating of team culture on the project

COMPARATIVE ANALYSIS

REAPING THE BENEFITS

At the onset of each project, the owners all had certain expectations regarding the benefits that could be accrued by the improved project context and the efficient use of tools and methods that have characterized IPD projects and been reported in the past. Overall, all three projects did deliver on the expected benefits of IPD. For instance, in all three cases, the owner's expectations were largely met and even exceeded in certain regards (Figure 15). Indeed, in the CGAC and in the TCSH projects, all Wishlist items were granted whereas some of them were granted in BSESC. Moreover, quality of design was generally seen as excellent or very high in all three projects, with some room for improvement in BSESC and CGAC to a lesser extent (Figure 16). Lastly, the overall rating of respect of project scope was seen as excellent or very high in both TCSH and CGAC projects whereas it was seen a generally very high in the BSESC project (Figure 17). Issues pertaining to tracking of scope and decisions throughout the validation process in the latter project led to this more mitigated performance regarding project scope.

Figure 15 – Overall rating of meeting of expectations

Figure 16 – Overall rating of design quality
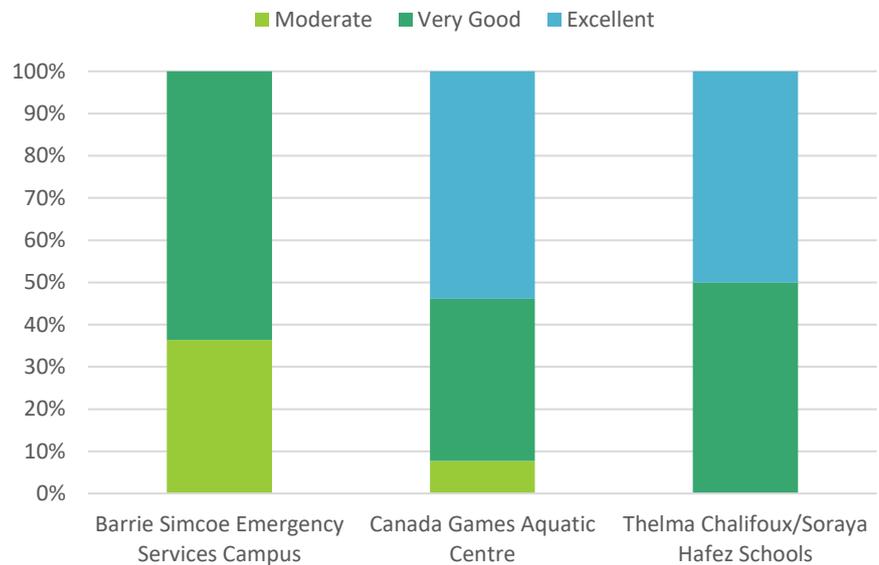
Figure 17 – Overall rating of respect of project scope

Looking at time-based indicators, all three projects were delivered on-time or even ahead of schedule in the case of TCSH. Both overall speed of design (Figure 18) and speed of construction (Figure 19) were rated as either very high or excellent. All three projects faced schedule challenges and overcame them with considerable ease. Project participants largely attributed this to IPD and indicated that these challenges would have been significantly harder to overcome with traditional project delivery modes. Be it a change in municipal regulation or a strike (BSESC), working within an operating building and then having a global pandemic hit (CGAC) or delivering two schools aligned with 21-st century learning concept within the context of an accredited government program (TCSH), all projects tracked positively in terms of schedule performance. The capacity of the teams to resolve these significant issues and "pivot" rapidly in a collaborative manner were seen as the prime reason for this performance.

Figure 18 – Overall speed of design
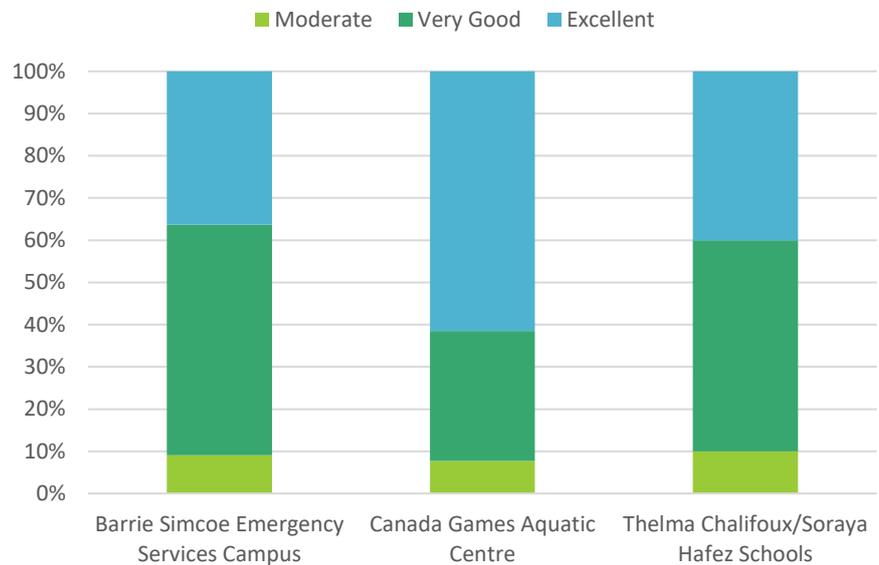
Figure 19 – Overall speed of construction

Regarding fiscal and cost-based indicators, first and foremost, all three projects paid out their full ICL, which also implies that they were on budget. As is shown in Figure 20, both CGAC and TCSH were considered to have respected the owners' fiscal goals either completely or to a high degree, whereas BSESC was considered to have respected the owner's fiscal goal mostly to a high degree. While full cost transparency was observed across all three projects, maintaining costs up to date, tracking and management them were seen as challenging due to the significant and sustained efforts that this took on the part of all project parties. Several dedicated meetings at the PMT level had to be regularly held in the three cases to ensure this tracking and management. Cost forecasting was generally well performed at the contractor and sub-contractor levels concerning materials and time on-site. However, forecasting and tracking effort in the design phase, across the different project stakeholders, including designers and project managers, was identified as a challenge. Indeed, it was mentioned quite consistently, that design teams faced challenges in properly forecasting their efforts as did the sub-contractors in their design assist roles. Other issues arose

around validation and verification of project costs. Project respondents consistently pointed to the presence of a third—party cost consultant as an added value item to ensure items were budgeted and tracked appropriately and that rates were charged out consistently. While there was general trust in the budget numbers, having this third-party certifying body would have helped according to many project participants across the three cases. None of the projects had such a third-party cost consultant involved.
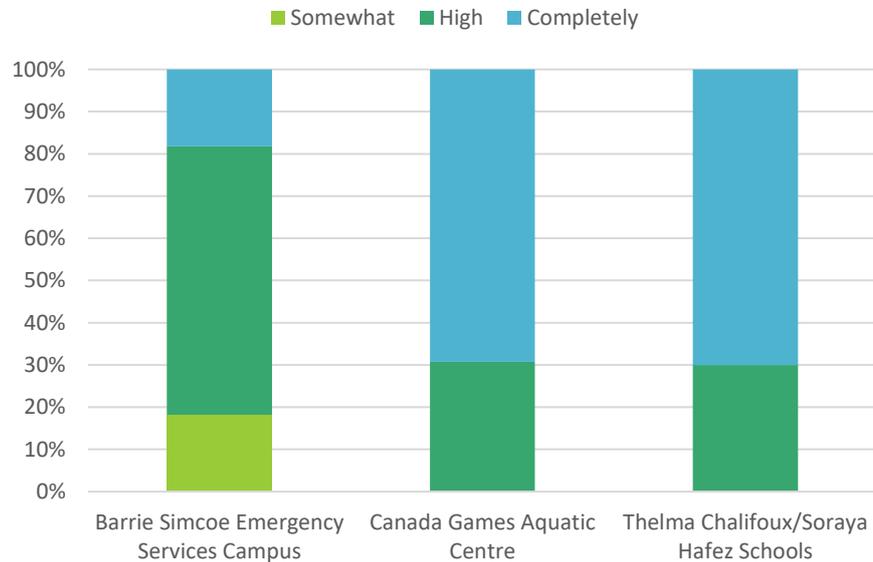
Figure 20 – Respect of the owner's fiscal goals

Finally, beyond the traditional indicators of project performance relating to time, cost and quality, the project teams were all asked about their perception of the project atmosphere itself. As previously discussed, the team culture was seen as quite good on all three projects, which lead to a more transparent and collaborative process. This is confirmed in Figure 21 which indicates that the overall experience of the project teams members was very high, some even indicating that it was the best project of their career. Across the board, survey respondents indicated in a very large proportion that they would be very likely to want to work on an IPD project again, following their experience on their respective project.

Figure 21 – Overall rating of project experience

Figure 22 – Likelihood of wanting to work on an IPD project again

BARRIE-SIMCOE EMERGENCY SERVICES CAMPUS

Project Description

PROJECT	Barrie-Simcoe Emergency Services Campus
LOCATION	Barrier, ON
BUILDING TYPE	Emergency Services
PROJECT TYPE	New Construction
CONTRACT	Custom
OWNER	City of Barrie and County of Simcoe
ARCHITECT	Lett Architects and AECOM
CONTRACTOR	Gillam Group and Chandos
PROJECT START	September 2016
COMPLETION	January 2020

Project Images

Project Delivery Experience

	None	1-3	3+ Projects
IPD	64%	36%	
LEAN	36%	55%	9%
BIM	27%	45%	27%
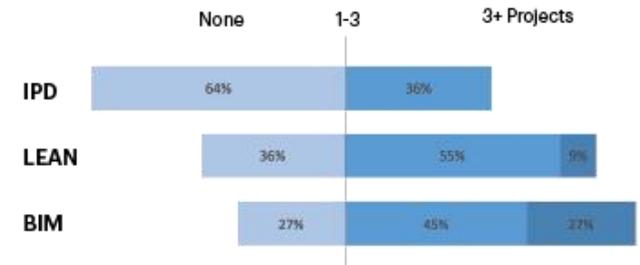
PROJECT PARTICIPANTS SURVEYED: 11

Most of the team members were new to IPD and few members some IPD experience. Majority of team members had some experience in Lean, with remaining having either no previous experience or substantial experience. A significant majority of the team members had BIM experience prior to starting the project.

Building Size   190,000 sq. ft.

Budget $85,799,954

Schedule   10 months design   28 months contruction

MAKING A CASE FOR IPD

OWNER CONTEXT

The Barrie-Simcoe Emergency Services Campus (BSESC) was a collaborative effort between the City of Barrie and the County of Simcoe, co-owners, with a 75% and 25% interest respectively. The project concept was to bring together the Barrie Police Service, the Barrie Fire and Emergency Services, and Simcoe County Paramedic Services on a shared campus in a mutually beneficial collaboration structure. This was highlighted in the validation report: "The Barrie-Simcoe Emergency Services Campus will leverage both capital and operational efficiencies through a partnership that will foster innovative, collaborative, and sustainable values to support community growth, safety, care, and satisfaction. The campus concept provides a centralized platform from which our first responders can develop and implement programs that best meet the current and future needs of the community." As such, each partner would have access to more efficient and enhanced facilities via shared spaces and staff amenities than what would be practicable or economical in separate standalone buildings.

The project's vision was to establish a centralized platform from which the first responders could design and administer programs that would be most responsive to the community's present and future needs. The modern facilities created in this project were intended to improve efficiency among first responders while achieving savings both upfront and during operations.

MAKING A CASE FOR IPD

CHOOSING IPD & LEAN

The key considerations that prompted the owners of BSESC to embrace IPD were the project's characteristics, past unsatisfactory experiences with traditional project delivery systems, and education on the benefits of IPD through conferences and communications.

Project characteristics: The project owners were looking for a delivery strategy through which they could successfully manage the expectations from the three separate end-user and two owner organizations. This project was both owners' first experience working on a joint capital project of this size with another party. As a result, they needed to consider how to best collaborate to attain the value for which this partnership was developed. The multi-stakeholder facility, in addition to the owners' tight budgets and it being a high-profile project in the public eye, were other major factors that led to choosing IPD.

Previous experience with traditional delivery models: The owners voiced dissatisfaction with current industry practices. They were seeking innovative approaches to create value, reduce adversarial behaviour, and boost confidence in project outcomes. According to one of the owners, their existing procurement approach was inefficient and failed to provide the best value for projects mainly due to the lowest bidder approach. This approach often ended with projects running over budget due to frequent change orders and unexpected costs due to errors and omissions. As the owner stated, "Low bid pricing is not the way to go to move forward to strong North American designs, civic design, and excellence."

Recognizing the potential benefits of IPD: Parameters such as delivering projects on or under budget, on or ahead of schedule, and owners expressing high satisfaction with the overall value delivered were very appealing for the owners and played a key role in adopting IPD. The idea of IPD came about in several ways, with one of the members involved having previous experience with IPD and a group of staff members who attended an IPD conference where they met many IPD experts and learned about successful IPD projects and the possible challenges, which played a significant role in establishing trust in this approach within their organization.

Key takeaways:

- The project involved two owners and three end-users. This made it a challenge to incorporate each party's benefit and maximize the value they accrued through the project.

FRAMING THE PROJECT

DEVELOPING THE CONTRACT

Drafting the contract: The contract drafting process in BSESC was reported as a lengthy exercise, with the project being in the construction phase before the final version of the contract was eventually signed. The AIA IPD agreement was included in the RFP documents so that the team members were aware of what they were signing up for. However, owing to a lack of comfort in the contact form because of several challenges encountered, such as an issue with insurance, the team decided to shift gears and adopt the Hanson Bridgett IPD agreement. This switch, along with a few other factors, all contributed to the contract's lengthy development process. In 2016, this was one of the first IPD projects in Ontario. There was, therefore, a lack of data, proven contract forms, and industry familiarity with the system. As mentioned, the Hanson Bridgett IPD agreement was chosen for the project. To work on the contract specifics, a contract-working PIT was created. The process involved the legal departments and lawyers from the team member organizations, and an expert from the legal company that drafted the contract was brought in to clarify some of the details to the team and assist in reaching a consensus. Indeed, developing and negotiating the contract was a complex process that led to some frustration, as described by one of the team members "Getting a contract that was suitable to all parties took an awful long time, and I would say it took longer than it should have."

The owner perspective: The owners found developing the contract for this project to be challenging. They made sure that a joining agreement was signed during validation and then proceeded with the joining agreement into construction as negotiations and signing of the multi-party agreement were extensive. The liability waiver was another part of the contract that the owner found challenging. They acknowledged that as a public owner, they would never feel comfortable releasing liability. However, understanding IPD and the importance of releasing liability between project teams was a key facet that makes the entire system coherent and viable, made them agree to the waiver.

Contract's form: No Canadian IPD contract form existed at the time of choosing a contract type or template. Therefore, the owners chose to include the AIA IPD agreement in the RFP documents, and then the team jointly decided to use another standard American contract framework, the Hanson Bridgett IPD agreement. As was the case with the other two projects in this study, the members of BSESC had some difficulty with American references in the contract that did not correspond to the Canadian context.

Concern was also raised by a few team members around accountability of signatory parties and how it was handled in the contract. While the accountability is not exclusive to the Hanson Bridgett IPD agreement, in the eyes of many of the project participants, the agreement did not handle the notion well. The main concern was related to how to hold team members accountable for their cost estimates and their performance. Many wondered what the

situation would be if a member, who estimated their work at a certain amount during the validation phase, later came back to the project team and asked for a greater amount. This would of course affect the entire team. While a certain number of costing and management processes were used to mitigate this, namely target value delivery and monthly financial checks, there were still questions around holding individual team members accountable for certain cost items that were perhaps missed or poorly evaluated, and situations where additional costs were allowed when those amounts would otherwise have gone into the profit pool. As stated by one of the team members, "You must have integrity and trust in your partners right. Because this model will not work if you have one part of your team that's accountable, and the other part of your team that just doesn't care about it." The concerned parties did not consider the profit risk pool as enough of a guarantee for such an event. Despite this, many team members did not express these concerns.

Key takeaways:

- Procedures underlying the development of the contract were drawn out due to team members' lack of familiarity with the type of project and omission to include the contract form in the RFP documents.

- Concern arose relating to how to hold team members accountable for their cost estimates and performance in the light of IPD agreement.

FRAMING THE PROJECT

CLARITY OF THE GOALS

Developing the goals: The team defined two types of goals in the early phases of the project. The first type, the soft goals which represent the project values, included: safety, community satisfaction and engagement, sustainability and longevity, collaboration and relationships, efficiency, and innovation, learning and growth, fit for purpose and user satisfaction, and aesthetics. The team gave favorable feedback on those values, which served as project success indicators and as a guide for the decision-making process. On the other hand, the team had difficulty defining the project's hard goals, particularly the project budget, which went through several rounds of attempts before being set and approved.

Due to the owner's original budget being less than programmatical need, the RFP specifically stated that the team's responsibility was to assist in developing the overall project budget. However, allowable costs were a struggle throughout, and the cost estimating faced some challenges to include the owners' requirements and meet the allowable cost. Eventually, the joint efforts in the validation phase were the key to overcoming these challenges and setting the project forward.

Communicating the goals: In BSESC, two motivations were given for communicating the project goals were mentioned. The first was to provide team members with the necessary information on the end-users' needs, which required additional attention in this case because the project featured three distinct end-users who would share the space. This was accomplished by involving the end users in the process from the start in the validation phase. The second motivation was to engage individuals on site and inform them about the project's objectives. Various team members thought the project did a good job of incorporating people in the field by including site supervisors in some meetings and planning sessions. Others, on the other hand, argued that the culture of teamwork fostered in the big room did not make it to the site as anticipated.

Clarity and management of the owner's requirements: As previously stated, the owners' general requirements were adequate for the team to develop the design to the point where they could estimate the budget and be confident about it. Except for a few instances where the team was confused by the various end-user requirements, the team thought the project owners handled this part well and adequately addressed the three end-user organizations' requirements with the least possible disturbance.

However, during the validation phase of the BSESC project, certain issues were expressed related to recording the agreed-upon requirements and scope. According to the owner, ensuring that all requirements were clearly conveyed and recorded was difficult for this project team. Because of this, some items were overlooked in the validation report, particularly in the latter phases of the project. The owners concluded that a more rigorous documentation process was

required to adequately convey and record owner requirements and project decisions, while also being considered as Lean as possible.

Key takeaways:

- A more rigorous documentation process was required to adequately convey and record owner requirements and project decisions, while also considering as Lean a process as possible.

CHOOSING THE TEAM

TEAM SELECTION

RFP Strategy: The BSESC project used an approach in which applicants were invited to submit their proposals as a group. According to the RFP documents, the team should include at least one Ontario-licensed architect, a contractor who will carry out the project's construction, and mechanical and electrical engineering professionals. The owner's goal with this strategy was to save time because they were anticipating an extensive and time-consuming public procurement process. However, the owner stated that they would consider ways to improve the current strategy in a way that could put them in a better position to select the team in accordance with the regulation and timeframe usually allotted for such a procedure by public bodies.

Many of the team members, on the other hand, were aligned with this procurement strategy. They believe that IPD is meant to be done as a team and that there is no assurance that the selected parties would cooperate and work together as desired in case other strategies were followed, such as the waterfall strategy. As was mentioned by a project participant, "You are putting people together and asking them to work together. IPD, to me, is very much a team approach. So, I would always say IPD should start as a team, right at the beginning."

RFP process: Once on-board, the project's main parties, which were led by the two contractors who partnered as the project's general contractor and were described by many team members as the project's main player, began working with the owner to hire the remaining sub-trades who were not part of the RFP. One of the team members pointed to a critical part of the procedure. According to them, the screening procedure should focus on the sub-trades' ability to work together rather than only with the general contractor, especially since this method could combine two parties with a history of dispute into one multi-party contract.

Evaluation criteria: Like the other two cases in this study, the evaluation criteria comprised a review of the RFP documents as well as an interview with the participants during the process. The interviews included many participants, with 10 to 12 people from each side in attendance. The owners sought to validate the collaborative abilities of the interviewees, such as past projects they had worked on together and expertise with collaborative contract.

Key takeaways:

- The main motivation for requesting the teams to submit their proposals as a group was to avoid a lengthy public procurement procedure while ensuring the best fit for the project.

CHOOSING THE TEAM

DEVELOPING THE PARTIES

Nature of the Roles: Throughout the RFP process, the joint venture general contractor played a leading role in developing the team. A key consideration was the prospective team member's contribution to the project's cost and schedule in the decision to bring them on board. This was the case for both the pre-RFP stage, during which the general contractor led the search for the right team to jointly submit the RFP proposal, and the post-RFP stage, during which the whole team, including the owner, evaluated the remaining sub-trades to join the team.

Simultaneously, the architects on the project regarded their job as "fundamentally different" compared to traditional project delivery systems. Their view of their position in IPD projects was more that of a facilitator. Rather than being the sole party responsible for developing ideas and solutions in traditional projects, their role in IPD projects shifted to involving all teams in the discussion and utilizing their diverse expertise to describe the solutions they would ultimately develop to best meet the project's objectives. A respondent from the architectural team stated that, "I think the role now is a bit more of a collaborative facilitator in a way. You need to anticipate what the needs are and the questions and then tailor the discussions around the information you need to do the job you need to do. You need to try to pull in all the input from everybody in the room as needed, so it's very fundamentally different for an architect in an IPD environment."

Regarding the nature of the roles in the BSESC project, some team members raised concerns about the extent of the roles that can be assigned to the sub-trade partners. Concerns were raised about the capacity of smaller subs to shoulder the administrative burden where the participation as a signatory member came with a high level of commitment to the project and required involvement in many budgetary and administrative tasks. According to one of the team members, "We had some trades on site who had never even done a budget in their entire career, and they were expected to work with these huge forecast papers that were dependent on someone who knew how Excel works. And that was very difficult for a lot of people who didn't have a number kind of background." Therefore, the level of their involvement and nature of their responsibilities must be considered to determine their ability and willingness to participate upfront.

Owner involvement: Owner involvement was higher compared to traditional projects. One of the project's owners used the term "tenfold" to describe their engagement in this project in comparison to their previous endeavors. However, the same owner concluded that this was not a drawback of IPD, given their improved capacity to influence processes and manage costs and the risk mitigation opportunities internally. "Your involvement as an owner is probably

tenfold to what you would typically manage in contracts elsewhere. And it is not a negative piece, you have to understand your resourcing."

Forming joint ventures: One of the owners likened the BSESC project to that of a "dynamic family." On the owner side, the project team consisted of two owners and three distinct end users, while the team consisted of 13 members, including two architects who shared the architect's role in the project and a joint venture of two contractors who handled the position of the general contractor. The contractor joint venture was formed to combine one partner's IPD knowledge and understanding with the other partner's local presence and market expertise.

Key takeaways:

- The owner's involvement in IPD projects is higher but it also increased their ability to influence processes internally, and better control the cost and the chances to mitigate risks.

- Joint ventures can provide a mechanism for contractors and architects with limited IPD experience to work with more knowledgeable firms, which enables knowledge transfer and helps to build industry capacity for these types of projects.

CHOOSING THE TEAM

CHAMPIONS

In the interviews conducted with the BSESC project team, the owners were given the most credit for championing IPD over the course of the project. The owners believed that their role in the project was to, in their words, "continually lift the team, lift the spirits." One of the general contractor joint venture partners was also a champion of IPD. Having had IPD experience, they were able to leverage that knowledge to serve the team by providing support and guidance throughout the various project stages.

However, the project did reveal a lack of IPD championing practices across different aspects of the project, as evidenced by several scenarios reported by various members. One of these scenarios was some disappointment expressed by one of the owners of the way the project records and risk register were managed. There were also instances reported by the project team, including lack of facilitation or shortcomings during onboarding and training; concerns about the roles assigned in the big room and whether they considered differences in team capabilities and capacity; and concerns raised by some team members about the team's accountability for project forecasts and budgets. The absence of ongoing advocacy for the IPD approach to address these issues caused that they remained unresolved and continued through the end of the project. This may have been partly caused by a lack of confidence in the IPD strategy, which may have been caused by the fact that many team members, including the owners, were new to the approach at the time.

Key takeaways:

- Lack of clear championing and facilitation of IPD can lead to issues in fully benefitting from its advantages.

SETTING THE CONTEXT

DECISION STRUCTURE

The BSESC team members were unanimous in their appreciation for the collaborative aspect of the project's decision-making process, which reflected the project's joint management and included all team members. The team used the project values and objectives established earlier in the project as parameters in the decision matrix tool, which assisted them in making choices that were in the project's best interest. As was mentioned by a project participant, "We did a relatively good job of establishing values, and then inserting the values, and using the values to make large decisions and to ensure that the team was adhering to our values throughout the project."

The owners shared the view of the other team members that the decision matrix tool was very helpful in facilitating and managing the project's decision-making process. On the other hand, the owners believed that the way decisions were documented ought to be revisited. They considered that the decision matrix missed contextual information and details that contributed to the decision. Indeed, one of the owner's representatives stated, "I really liked the decision matrix; I thought it was a fantastic tool. I have never seen one before. And when we used them, they were great. The challenge was that they would disappear after that. And then, eight months later, when we were trying to figure out why we did that. Why did we make that decision? The decision matrix did not have all of the particulars that had been involved in the discussion to get there."

At the PIT level: The decision-making process for the project was characterized by a bottom-up decision structure where most of the decisions were initiated by the PITs. The project established PITs for all the major disciplines, where matters are initially explored and then often submitted to the PMT for final decisions.

At the PMT level: Most of the project decisions were initiated in the PITs and the final decisions were usually made in the PMT, which took the lead in managing all the important aspects of the project. The project contract required team members to have representatives in the PMT. This resulted in a large PMT of 14 team members in addition to the owners. The team members, including the owners, all noted having encountered challenges throughout the decision-making process for the BSESC project because of the large number of PMT participants. The team believed that the decision-making process in the IPD project should benefit from collaboration and the participation of all relevant stakeholders at the table to be efficient and timely. However, in this case, the scenario was somewhat different. In several instances, the large number of PMT members was seen as an obstacle, prolonging the decision-making process. Additionally, the project discovered that it is costly to continuously hold such large meetings. For instance, a project participant indicated, "We could not afford to pay for everyone to attend the meetings." Therefore, as the construction phase progressed, the project team devised a new arrangement and chose to keep meetings to a small number of participants, as reported by

one of the owners: "I would say, a year into construction, we are just so large, as a PMT decided that we needed to skinny out and that we had one trade representative representing all the trades and we had one consultant representing the consultants and everyone got the same information. They (the rest of the team) were still cc'd on everything."

At SMT level: The SMT's (or PET, project executive team, as it was called in this project) involvement was barely noticed due to the efficiency in handling most of the project decisions at the PMT level. The team was aware that the SMT was available should the PMT not be able to reach a conclusion. However, most of the time, project challenges were resolved satisfactorily in the PMT with little interference from the SMT. The project made sure to keep the SMT informed and aware of the project status through a monthly update and direct contact when needed. However, the team members interviewed believed that they should learn how to engage the SMT better. "If you're not doing that (engaging the SMT) and when you need to engage the SMT because things are going wrong, they have no idea what's going on in the project. It either they can't make a good decision, or a fair decision because they don't know the history."

Key takeaways:

- The decisions were made collaboratively in the BSESC and reflected the project's joint management.

- Although the decision matrix was seen as an effective tool, the team reported that they should have documented contextual information and details that contributed to the decision.

- The large number of PMT participants was seen as an obstacle, prolonging, and straining the decision-making process.

SETTING THE CONTEXT

RESOURCES & FACILITATION

The BSESC project did not engage the services of a specialized firm to act as an IPD facilitator. Rather, the function of the facilitator was allocated to one of the general contractor's joint venture partners who had prior expertise with IPD. While it was recognized by the project team that the partner chosen to act as facilitator did so diligently, it was mentioned that this effort was intermittent and not consistent throughout the project. This was recognized by the partner in question, who said, "We had an IPD coach, but they were very thinned out, because we had several projects throughout Canada, that we were working on at the same time. So it was, it was a bit difficult." As a result, both the team and the owner were on the same page about missing an opportunity by not choosing to hire a third-party IPD facilitator who could have been always accessible on-site to provide constant support and guidance to the team.

At the owner level: At the time we interviewed the project owners, one is in the process of other IPD projects, so their conclusions regarding the facilitation roles were motivated by a different approach that utilized an independent IPD facilitator to provide support throughout the project. As mentioned by one of the owners: "I think it was such a value that gives the ability to onboard and to educate, in addition to setting the PMT up, setting the processes up, and getting everyone to get the tools they need, as well as lifting the team throughout the project when they need the cheerleading and the support."

At the team level: Although the team expressed a preference for a full-time facilitator to assist them throughout the project's different stages, particularly in the big room that involved many people, they also valued the assistance and support they received from their partner who assumed the IPD facilitating role. This assistance was mainly guidance about the IPD procedures and expertise they shared from prior experience. "It would have been way better if we would've had a coach there all the time because the big room had 50 to 80 people in it all the time. So, you could pretty much imagine how difficult it was trying to get everybody on the same page."

Key takeaways:

- The facilitation roles in BSESC were assigned to one of the team members who have experience with IPD.

- The team appreciated the value of the facilitation given. However, it was intermittent and inconsistent throughout the project.

SETTING THE CONTEXT

ONBOARDING & OFFBOARDING

Onboarding was performed during the first weeks of the big room. The team collocated two days a week during which dedicated sessions were held for the different onboarding activities. The onboarding was led by the general contractor joint venture partners who took the roles of facilitation. Throughout the interviews with team members, there was a firm view of the onboarding process, which revealed several shortcomings. As the general contractor stated, "I do not think we did the best job of onboarding like it was very, sort of superficial. I do not think we realized the value of it. I mean, later in the project we did."

Leveling the knowledge about IPD: Because most of the team was unfamiliar with the IPD approach, one of the key goals of the onboarding process was to educate them about IPD and its procedures, which was accomplished over the first few sessions in the big room. On the other hand, the owner considered that the team should have been educated better about the administrative burden and time commitment necessary to the overall process, "They [team members] were not told they were going to need all this back-office support; they were not told how much time was going to be required of their key players like we had pretty high up people in this project, we had principals and owners. Now eventually, they were delegated to the next person down."

Team building: A variety of activities were conducted in and around the big room, all of which contributed to the BSESC project's team culture and cohesiveness. Some of those events required the team to collaborate on a single game, while others were more social in nature, such as group lunches, celebrating accomplishments, and hosting a sports tournament off-site. As mentioned by a project participant: "You need to spend so much time during pre-validation and early validation, investing in getting to know people to build the trust and collaboration that you would need to close off a project successfully." These exercises lasted throughout the course of the project and were not restricted to onboarding sessions. Additionally, several of the team members traveled from various locations to Barrie for the two-day big room, which enabled them to develop greater bonds with one another. As one of the team members described it, "I think many of us were traveling to Barrie from Toronto or other parts, so a lot of us would stay over. And I think we built a really, like good group of friends really, and you do not get that in most projects, because you are at a meeting for an hour, and you are gone again. So, I think we built really good strong relationships outside of the work environment."

Training: The training was offered as part of the project's onboarding process over the first several weeks. The training centered on the tools and techniques that the team were to utilize throughout the project, such as the lean concept, decision matrix, and risk register, and it was incorporated in numerous group exercises. However, as indicated by many team members, the training for the

BSESC project was brief and light. They characterized the training as "ground level" and "basic training".

Defining the project values: The project's values were defined collaboratively in the big room early on. The team deemed this section of the onboarding process to be the most effective since the values were clearly articulated and recorded in the validation report.

Offboarding: In a few cases, the project team had to offboard certain team members. In each of the reported situations, the decision was made to replace the individual with another employee of the same organization. The primary grounds for offboarding were that the individuals in question were unable to meet their obligations consistently or showed a lack of alignment with the team culture and spirit. When this occurred, the PMT considered the matter further and then submitted a recommendation to the SMT for consideration.

Key takeaways:

- The time spent onboarding was seen as an investment in getting team members to know each other better to create the trust and collaboration required to effectively complete the project.

- Team building activities held outside the project's direct setting were noticed as an effective way for the team to form stronger bonds with one another.

EXECUTING THE WORK

TOOLS & PROCESSES

Management tools: According to the team interviewed, the decision matrix and dashboards were the management tools used on the project. The decision matrix was widely applied during validation and throughout the project to assess the impact of a proposed decision on the overall project. Additionally, the dashboard served as a visual tool for keeping everyone informed of key statistics. On the other hand, a few tools were missed from the project, and the team subsequently determined that they would have been quite valuable. One of the owners believed they should have documented and tracked meeting minutes and the decision matrix for the project, which is something they will revisit in future projects since several tools can assist in this.

Digital tools: The project team made no mention of alternative communication technologies or efforts to replace or even limit the use of email. Still, many team members remarked that the dashboards were efficiently used in the big room, in addition to the field team's widespread usage of tablets on-site to access the BIM model, as detailed further.

EXECUTING THE WORK

LEAN

Implementation of Lean: The BSESC project made efforts to adopt lean concepts and employ its tools and strategies to benefit the project. The most visible and effective aspects of implementing lean on the project related to the team's use of pull planning and target value design. Lean was also incorporated to identify methods to improve efficiency and decrease waste in processes, as one of the project architects indicated, "I just think the whole approach is how can we be more efficient, both in time, money, materials, and effort."

The BSESC project's primary lean tools were pull planning, last planner, plus/delta, and using target value design. Many team members who were using pull planning for the first time deemed it to be very successful. Several of them indicated that they would continue to use pull planning in future projects. The team implemented pull planning sessions to engage site supervisors, who were asked on many occasions to collaborate on derivative, a six-week look ahead from the pull plan. The team discovered that pull planning aided them in comprehending the owners' expectations for final targets and important milestones, and that it was qualitatively different from the traditional planning tools they were previously using. As expressed by one of the owners, "I love that pull planning; it was amazing. I obviously have a Microsoft Project schedule that is kind of blah when the pull plans are on the wall; it is a whole different thing, fascinating, and helpful. That is something I would repeat now. I have got a desire to repeat that virtually (due to the pandemic) in the project that I am working on right now." In addition, plus/delta was used effectively at the end of each meeting to obtain immediate feedback and assess ways for improvement.

In addition, target value design was seen as a practical strategy that the team used to adjust the design to meet the budget constraints after the first validation was rejected. As one of the project's architects described the situation, "We did the initial estimate that obviously was high, because it was full of assumptions and allowances. And every PIT had a budget. So, the architecture PIT had a budget and sort of mechanical, and we would work through target value design to figure out where we could reduce costs."

On the other hand, the extent of the lean application was seen to be limited. The team considered that the project did not use lean to its greatest potential, which is seen as a missed opportunity, even more so given the high level of collaboration achieved within the team, which could have benefitted from this even more. As one of the engineering team put it, "It just never happened. So, that would be one disappointment I had was that we just could not get that going. Because I think there is an opportunity there." Some team members attributed this missed opportunity to an inadequate understanding and application, which reflected in some misapplication attempts throughout the project. As stated by one of the project's subtrade members, "Having a crane sit there at $15,000 a week is not doing anybody any justice. Yeah, but they called

it equipment sharing. And it had to be there waiting for the time when somebody needed it. I am back to just having the right people that understand the right things in the right place. And I think that is what this project was missing."

IPD and Lean: The team recognized that one of the most significant advantages of IPD was its ability to facilitate and foster the adoption of lean principles and tools. Although the team recognized the benefits of lean even with the limited extent to which they applied it in the project, they did not believe that the project truly relied on lean as an indispensable part of its success. In other words, many of the team members interviewed believed that lean tools and processes could have been implemented more extensively, as one of the project participants stated, "I still think it is a great idea. One of the things you hear about an IPD and first learn is that this (applying Lean) is one of the advantages. But no one could get it implemented, and I do not know why."

Key takeaways:

- The team's usage of pull planning and target value design was the most apparent and successful component of adopting lean on the project.

- The extent of the lean application was determined to be limited. That was viewed as a missed opportunity by the team, especially given the high level of collaboration achieved within the team.

EXECUTING THE WORK

BIM

Degree of Usage: The BSESC project made significant advances toward using BIM, an experience that was favorably rated by the project team. The validation phase of the project did not use BIM; nevertheless, it was used in the design phase for the implementation drawings and construction phase. The project used a live model that was updated weekly and made available to the whole team. All reviews and comments on the drawings were made on the model. Additionally, the project attempted to go paperless from the project designs, which was partly accomplished by installing Revit stations throughout the construction site equipped with tablets that enable access to the model. "I think we use the power of the BIM model better than lots of projects. We had iPads on-site that all the trades used, and it was not 2D drawings. They were working live from the model. I mean, it was a model that every Friday got updated." As a result, the project guaranteed that implementation teams had access to the project's trusted source of information and prevented several issues associated with the various drawing versions that often occur in traditional projects. As noted by the project architect, "Once I saw the impact that a well-organized BIM project does, I just basically mandated everything we do now, from this point onwards is BIM."

Barriers: Although the project owners and most of the team deemed the use of BIM in the BSESC project to be successful, several barriers were identified, which hindered its full deployment. The owners believed that enforcing a strong BIM policy would potentially result in a more robust application of BIM, more engagement, and the closure of a perceived gap in their internal departments regarding the application and use of BIM. As expressed by one of the owners, "I believe that the benefit of that was nice, but the true benefit of BIM, I think, is the latter portion of it, the operational continuity of using it and whether the city has been able to do that, I am not sure." Additionally, cost, and insufficient resources were cited as the main barriers to narrowing the gap observed by the other owner of the project in their departments.

The second set of barriers involved the project's team and technology. The team mentioned that it was not simple to transition to paperless drawings and utilize tablets to view the model to guarantee the team had the most up-to-date data. A significant mind shift was required, and the resistance they encountered from some teams on-site was a serious barrier. Furthermore, the team experienced a significant issue in obtaining a stable and adequate internet connection for the project, particularly during the early phases of construction, which restricted on-site access to the model.

Benefits of BIM: Numerous benefits were observed because of the project's use of BIM. To begin, it enabled collaborative design and drawing review between designers and trade partners, allowing them to identify clashes in both the finished product and the implementation drawings. One of the team members

said, "I think this is where IPD really scores well, when you are reviewing a BIM model, and you have the major trades with you." Second, prefabrication was a great benefit facilitated by the project's usage of BIM. "The Revit model that we use, we handed over to the contractor, and they built a fabrication model from our design model." The third benefit was the ability BIM provided to the team to keep everyone on the same page by allowing access to the most up-to-date project information and track changes immediately. The general contractor described this as one of the biggest wins the project achieved. As the general contractor representative stated, "It's huge benefit. I think one of the largest things that we did on this particular job." The respondent further mentioned, "Now you can see where the drawing changes; it is immediate, you do not have to refer for drawings, you can question things, and it goes out immediately and get an answer back. So, I think getting everybody on the same page is way easier because the access to the information was not restricted."

IPD and BIM: The project team perceived IPD as an enabler for the proper use of BIM. Integration to the process and the collaboration among the team, both ensured through the IPD approach, was reflected on how the BIM was used in the project.

> **Key takeaways:**
>
> - To make sure all the team had access to a verified and updated source of information, the project installed Revit stations across the construction site equipped with a tablet that allowed access to the model and limits the use of paper-based drawing.

EXECUTING THE WORK

WORKPLACE

Big room benefits: For the duration of the BSESC project, big room meetings took place twice a week. Communication and information flowed freely, facilitated by the team's near-constant availability. The engineering teams viewed the opportunity to work in the same area as their trades partners as extremely beneficial since it enabled them to address several challenges efficiently. As one team member explained, "Involving the trades in those meetings was, I would say, invaluable. We probably solved an awful lot of things in the big room before we got on site." As for the project owners, they believed that collocation was a necessary approach for establishing trust. One stated, "I would say collocating is huge in establishing trust. And, honestly, we have two projects virtually right now and one of the biggest concerns we have, and takeaways is how do you build trust virtually?"

Big room space: After a brief time of holding the big room meetings in a leased office located off-site, the team relocated their big room meetings to the project's permanent location. Several trailers were utilized to construct a large space enough to house the whole team. The room was an open area, yet it was adaptable to hold as many PIT meetings as required. The room's walls were utilized to display the pull plans and their derivatives. The team chose to make the big room a "no-title" place to foster a sense of teamwork and encourage open communication. "One of the things that I think works really well is, I mean, straight away, we told everybody, leave your titles at the door, we are all the same. From day one, we are all the same; we all count. And it is a big room. So, it is a safe place, you know, you can say anything you want, obviously, nothing offensive or personal, but you could say anything you want, and you would not be judged negatively on it."

Big room concerns: Despite their generally favorable experience with the big room, team members noted some shortcomings with its implementation. The first issue was how to keep track of the discussions, decisions, and tasks that occurred in it. The project owner and architect both noted multiple instances when the team struggled in the latter stages of the project to trace back to a topic or problem, they had addressed earlier in the project due to insufficient documentation. One of the project's trades partners recognized the critical need for record-keeping to avoid misunderstandings between what was said in the room with the entire team and what was discussed outside the room amongst specific team members. "There were a lot of conversations happening outside of the meeting that just became real in the meeting. So, I really think that bringing in someone neutral right at the beginning just keeps the rest of the process honest."

Another point of concern was the level of commitment needed by the team to maintain their presence in the big room and the expense associated with hosting such a large team. "It is a tremendous amount of time, there is a tremendous

value, but it is a lot of time. So, you need to make these decisions, who is going to be involved for how long when in the validation and carry those costs, because we all know, we are measured against our budgets." The last issue of debate was the large number of individuals in the big room, which made it difficult to get everyone on the same page and successfully lead the discussions. Additionally, this made the big room an inappropriate location for concentration, and many team members perceived the big room space to be more beneficial for problem-solving. "It is not a place where I could sit down, go head down, and focus on design. It was a big room with 40 people; there was chatter and everything as expected. It was great for solving problems."

> **Key takeaways:**
>
> - Proper record-keeping was deemed critical for holding a successful and productive big room and avoiding misunderstandings down the line about what was discussed in and out of the room owing to the high degree of overlap between the teams.

MAINTAINING EXCELLENCE

TEAM ALIGNMENT

Along with sharing risk and profit, the team collaboratively established the project's goals and values, which served as the cornerstones for aligning the project team throughout the project. As was mentioned by a project participant: "We did develop the project values as a group together, which I think when you do it that way, you know there is better ownership and understanding of those values." These values were examined on a regular basis to assess the project's position in relation to them, and corrective action was taken, as necessary, to get the project back on track. "Generally, every couple of weeks, we would do a values alignment exercise. So, we would just pick a value, and then we would ask the team how we are doing so we would rate ourselves."

The efforts made to preserve the project values and the priority they placed on those values successfully brought the team together and kept them on track. "So that one thing was done really well, I think, values assessments continued right until the building was occupied, and it was a good process if there was something that was a strong Delta coming out, those people were assigned to find a solution or fix it if they could." Many of the team members interviewed thought that developing and maintaining the project values throughout the project was critical to making correct and informed choices. "I think we did a relatively good job of establishing values, and then inserting the values and using the values to make big decisions. And to ensure that the team was adhering to our values throughout the project."

Key takeaways:

- Shared profit and risk and jointly developed project goals and values were the foundations for team alignment during the project.

MAINTAINING EXCELLENCE

COLLABORATION

Throughout the BSESC project, when a positive aspect was highlighted, it was often related to the quality of the project collaborations. Once again, IPD demonstrated its immediate and considerable influence on collaboration and team culture. The team members were unanimous in their assessment that the project involved a high level of collaboration, which directly led to its success. Many of the benefits and the impact of IPD on collaboration are discussed within the Big Room setting, including information sharing and communication. However, other indicators of collaboration were highlighted by the project participants and are discussed below.

Accountability: The sense of accountability among the team members was largely established because of the collaborative efforts to achieve the project's goals and the transparency that governed the project's accounting management, where the invoices and numbers of each party were accessible to everyone on the project. The team members mentioned an unspoken rule that anytime a team member fell short of a goal, they must get up and address the whole team. However, some of the team members expressed concern about the accountability element of IPD, stating that without joint efforts and a feeling of accountability on the part of the whole team, success would be very difficult to attain. Some of the team members emphasized this point and stated that accountability is still an open question and that it is possible that more procedures could be implemented to address this problem and incentivize others to ensure accountability. "That's the point, how do you address accountability? Everybody is equal and the same, so you prepare these budgets, and a partner says [X item] is a million dollars and that's it. Then at the end of the day, it's 2 million. So, you start to put things in place, like maybe you must do a pre-validation, which is becoming more popular, getting a third party to check it out."

Problem-solving: The team's capacity to overcome several difficulties that arose over the course of the project was one of the most telling indicators of the high level of collaboration achieved. Many problems arose, namely two labor strikes, dealing with a major municipal regulation change concerning an offsetting phosphorus policy, and rising material prices, which are described in detail in the schedule and budget section, were mitigated, and the collaborative efforts were able to keep the project on track.

Fiscal transparency: The team members described the project as very transparent. The project's accounting was open book, and any member of the team could access and question the numbers at any given time. According to the general contractor, "So everybody's invoice was all placed in an accessible file. So, every organization could look at everybody else's invoices, and then we sat down once a month as a team and went through the forecast collectively together. And then we summarize it, and a synopsis was created, and it was sent

out to everybody every single month." The team acknowledged this degree of openness, with several believing that the transparency they witnessed in the project was unprecedented in their past experiences with traditional approaches. "I have never seen that kind of transparency on a design-build, as you still operate in little silos in this mode."

Improved process efficiency: A key factor in the project's increased efficiency was the team's capacity to work together and be always available. The team members noted that IPD removed several barriers and saved time that is generally used for administrative communication and protocols in conventional projects. As the general contractor affirmed, "But for me to have a question about an anchor bolt or design connection, for example, and I can literally just walk across the room and ask three people how this works, and then it is resolved within 15 seconds is way better than just sending all this correspondence."

> **Key takeaways:**
>
> - The project demonstrated clear collaborative behavior and outcomes, such as transparency, fluid communication and seamless information sharing.
>
> - A certain lack of accountability relating to decisions around budget and spending did cause issues with certain team members.

MAINTAINING EXCELLENCE

TEAM CULTURE

The BSESC project team members were consistent in their assessment of the culture and spirit that prevailed in the project's work environment. The project's stated goal of establishing and maintaining a culture distinct from that represented by traditional projects was obvious. They spent substantial time creating the team's values and relationships, in addition to implementing additional steps such as removing titles in the big room. One respondent said, "It does not matter if you are like a tradesperson, if it is the first day on your job, you are just coming out of school or if you have 30 years of experience, if you cannot leave your resume your title in your head at the door, then you are not fit for this big room. Because that is never going to impact the project positively, and it is not going to align with the success of the project." In addition, the owner realized that their own behaviour and actions had a significant impact on whether the desired culture was fostered. As a result, they strived to set an example for others to follow. One stated, "I think from the Owners Group; if we do not exhibit the behavior that we want others to champion and exhibit, your behavior will become the behavior of the team."

The team's relationships were regarded as collaborative, honest, and transparent. Notably, several team members concluded that such characteristics countered the traditionally adversarial relationships found in traditional projects. For instance, as was mentioned by one of the engineering team representatives, "I love the collaboration aspect of it. Because it is always us against them, you know, it is me against architects, and then it is me against the contractor. I have been at it for 20 years, and I am sort of tired of being the bad guy because it is always too big, too heavy. So, I thrive in a collaborative environment for sure."

Furthermore, the true partnership that united the team members was another highlight of the project's culture. "So, working with a contractor was like a dream, like collaboratively, right? Because normally we are on opposite ends. And well, you know, things can happen as projects go into construction. So, I love the idea of IPD and collaboration." The team's entire experience in the project reflected that atmosphere, which was considered as the model that should be followed. "That is the beauty of the IPD. Right, that is the intended model, right, is to have a collaborative hands-on all-in-one room making decisions type of environment with the BSESC. It was a fantastic experience that way."

Key takeaways:

- One of the BSESC's distinguishing decisions was to make the big room a no-titles place, which was a clear statement from the start of the project's desire to establish a distinct culture in the project.

REAPING THE BENEFITS

PROFIT & PAYOUT

The BSESC project was financially successful. The project demonstrated that the team met its incentive compensation layer (ICL) in full and earned additional incentives because of the savings produced. The owner also received their share of the savings, which were used to execute several Wishlist items. Nevertheless, they had expected and hoped to achieve all their Wishlist items, but this was not accomplished.

Payments were made in two parts. Monthly payments for chargeable costs and milestone payments for the ICL. The ICL was paid out in six stages. Team members reviewed and agreed upon the milestones as part of the contract negotiations. These six milestones included the building permit submission, superstructure completion, envelope sealed, building 75% completion, substantial performance, and project closeout. In both cases, the invoices were reviewed and approved by the PMT prior to being payable by the owner.

Additionally, one of the owners highlighted a critical advantage they obtained from the project's payout management. They said that since the payment on this project was more predictable, it enabled them to manage their cash flow much more effectively and realize financial savings for their organization. Indeed, they mentioned: "We could be better investors with the city's money if we had a better understanding and control of forecasting, S curves, monthly spending, things like that, and it was a huge success on that part for the city, and that was a major win." Instead of acquiring the whole budget for the building upfront, they knew exactly when they needed the money, which resulted in significant savings: "It was in the millions of savings, and so that is huge. Just financial savings to understand when you need to borrow the money and how long you can invest it. And then our construction loans were very successfully managed."

Key takeaways for BSESC project:

- Completed on budget

- Achieved savings in the risk register and granted some items of the Wishlist.

- 100% of the ICL was achieved.

REAPING THE BENEFITS

BUDGET & SCHEDULE

Schedule: The BSESC project was finished very close to the original schedule, despite several obstacles that, under a normal project delivery process, could potentially have caused significant delays. "I think the building went really well. I cannot believe they built it in the timeframe they did, because it should have taken ten months longer." What was remarkable was the project's ability to adapt to these obstacles and the team's concerted efforts to recover and meet the project's timeline.

The first difficulty occurred during project validation when the team faced challenges in attaining the maximum allowable cost by the owner, which caused a few modifications and revisions before it was approved by the authorities. Many team members estimated that this procedure added at least three months to the project's duration, while others estimated that it added up to four months when accounting for the forced redesign effort.

The second significant issue was two strikes by workers in two of the project's trades. The first lasted a few weeks, while the second lasted three months. Trade partners were impacted, and many parts of the project were paralyzed. The occurrences not only resulted in an immediate delay, but also the possibility of protracted delays due to the work sequence disruption and paralysis of some critical activities. "The other thing was when we ran into, well we ran into a strike of mechanical, electrical, and mechanical plumber strike. That had a huge impact on our major trade for mechanical. And that was just that shut everything down, and we lost a whole bunch of time. And of course, that was terrible." The project team dealt with this unexpected occurrence by prioritizing other areas of the project that were unaffected, planning how to include the on-hold activities once the team returned to the site, and prefabricating certain components to compensate for the time lost.

The third concern arose during the construction phase, regarding a change in a municipal regulation concerning offsetting phosphorus runoffs and stormwater treatment. In this respect, the team's original understanding of the new policy was that it did not apply to the project. However, this was shown to be inaccurate, causing a significant disruption to the site plan application and forcing several design adjustments, requiring the joint efforts of the whole team to overcome this challenge. According to the owner, "I can honestly say, if we had not been in an IPD project, the project would have stopped, and it would have taken a year to get back on track, if not more." The solution involved a large changing of stormwater management ponds, along with a lot of the civil engineering works to support what was required.

The final issue regarded the COVID-19 pandemic and had only a minor impact since it occurred after the project's main activities. The lockdowns that resulted

disrupted the project's testing and commissioning activities at the end, which were another challenge the project had to overcome.

Budget: Managing the BSESC project's budget was challenging for the entire team. While the project was completed very close to original schedule and on budget, several of Wishlist items were not granted.

First issue: The importance of acknowledging a project's allowable costs.

The budget's initial difficulty stemmed from the challenge to meet the owner's allowable cost. This resulted in several budget changes before the project was approved and constituted a stumbling start in terms of budgeting. As mentioned by one of the project team members: "So, they were clear at the onset about what the requirements were, but it was unclear how we were going to distill what they had asked for into what they physically could afford."

Second issue: How to establish trust in the budget numbers?

The owner considered that an independent cost consultant should have been employed to assist with budgeting and establish confidence in the project numbers. The idea of hiring a third-party cost consultant was not suggested by the owner alone. Other team members had come to the same conclusion. They considered that having a dedicated person and a dedicated accounting system would have significantly helped in this endeavor. "It took us about six months to get the same platform for everybody to use. And I think we finally did land on something, but it was very difficult. And I have to say personally, it probably took me two weeks, every month, to go through all the financials to report out." Likewise, one of the trades partners believed that a specialized person might be valuable to some of the team members who were having problems creating project forecasts. "We had trades on site who had never even done a budget in their entire career. You know, and they were expected to work with these huge forecast papers that were dependent on someone who knew how Excel works."

Third issue: Risk register and Wishlist items

The risk registers and the Wishlist items were other debate points in the project. The project was unable to grant several of the Wishlist items defined during the validation phase. According to one of the owners, the main reason for this was the way the risk register was administered. They considered that the team was too conservative in its risk management and lacked the confidence in the data necessary to grant the items at the "last responsible moment", particularly those that arrived early in the project. The same owner voiced dissatisfaction with this outcome, believing that the "last responsible moment" they identified for the Wishlist item could have been better managed.

On the other hand, the general contractor cited the high risk involved with granting several Wishlist items that emerged early in the project as the primary barrier to being more flexible in this area. "A lot of the owner Wishlist items were a bit dicey. Because they were told they could make those decisions early on, and when you get into it, you cannot, like we are doing a job right now and the orders going, why can I not do this? And this is because we do not know. We still had high risk."

Fourth issue: Rates and general expenses

Several concerns were raised by the owner and other team members that the IPD agreement should include more details and definitions of billable rates. Several team members observed that the absence of standard roles in this area resulted in many undesirable scenarios about disparities in the costs being charged to the project.

REAPING THE BENEFITS

BUILDING OUTCOMES

This project had two owners who shared a different project percentage. While both owners agreed that the project was a success, their assessment of how successful it was varied somewhat. One of the owner's representatives was pleased with the building they received and their involvement in the project. They commended the project team for overcoming several obstacles and successfully completing the project on schedule. Additionally, they expressed satisfaction with the degree of control IPD provided over their cash flow, which resulted in significant savings. They also acknowledged the qualitative characteristics that set this project apart from their past experiences.

The other owner's representative agreed with the first owner that the project was a success and that they had gotten all they desired in the building. However, the representative indicated that the owner they represented did not make any meaningful financial savings. They concluded that a more rigorous approach to budgeting, such as hiring a cost consultant, would have resulted in better financial results. Furthermore, they realized that IPD was a great experience that exposed them to new ideas and strategies that they would use in non-IPD projects in the future. In addition, they admired the culture that framed the team's interactions, saying, "A lot of the people I worked with I would absolutely work with again 100%, I would have any of those major trades, I would hire them in a second." Finally, when asked to evaluate their satisfaction, they said, "I always do this on a scale of one to 10, how happy I was with the IPD project, I would say a seven." This rating was given by one of the owner's due to the issues surrounding the tracking and management of owner requirements and items within the scope that were seemingly "dropped" over the course of the project.

The team members were all in agreement that this project was a success. 100% of the ICL was paid and the team worked well together to complete the project on schedule. These were two major accomplishments for the team. "Well, we got 100% of our ICL, which was good, and we overcame some difficult things, some challenging schedule things. So, we are very happy about that." As a bonus, the project's team members enjoyed working together in a way that was significantly different from how they did things in the traditional practices. "Would you do it again? And would you work with the same people? A resounding yes. Now, if you think about traditional contracts, how many times have you heard, I will never work with that trade again, I don't want to see that consultant again."

Even those on the team who had some reservations regarding the approach, and which have been outlined in various sections of this study, agreed that the IPD was a positive experience. "I wholeheartedly believe that IPD is one day going to be the standard construction approach in Canada. Excellent. It works, but you just need to get all these little things out."

PROJECT CREDITS

Project team

- Co-Owners: City of Barrie
- Co-Owners: County of Simcoe
- Architect of Concept: Lett Architects Inc.
- Architect of Record: AECOM Canada Ltd.
- Structural Engineer: LEA Consulting Ltd.
- Mechanical Engineer: AECOM Canada Ltd.
- Electrical Engineer: AECOM Canada Ltd.
- General Contractor: Joint venture (Gillam Group Inc. And Chandos Construction)
- Mechanical Contractor: Geo. A. Kelson Limited
- Electrical Contractor: Wallwin Electric Services Ltd.
- Drywall Contractor: Cesaroni Contracting Inc.
- Formwork & Concrete: Alliance Forming Ltd.
- Sprinkler Trade: Vipond Inc.
- Masonry Contractor: Ontario Fox Corp.
- Windows and Glazing Contractor: BMG Glass + Aluminum Inc.

Interviews

- Co-Owners: Jessica Liefl
- Co-Owners: Dawn Hipwell
- Architect of Concept: Michael Gallant
- Architect of Record: Roy Turner
- Structural Engineer: John Ford
- Mechanical Engineer: Julia Sacher
- General Contractor: Scott Hunt
- Electrical Contractor: Tim Southhorn
- Windows and Glazing Contractor: Nadine Gaspar

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# CANADA GAMES AQUATIC CENTER

Project Description

PROJECT	Canada Games Aquatic Center (CGAC)
LOCATION	Kamloops, BC
BUILDING TYPE	Sports & Recreation
PROJECT TYPE	Modernization
CONTRACT	Custom
OWNER	City of Kamloops
ARCHITECT	Group2
CONTRACTOR	Chandos
PROJECT START	March 2019
COMPLETION	December 2020

Project Images

Project Delivery Experience
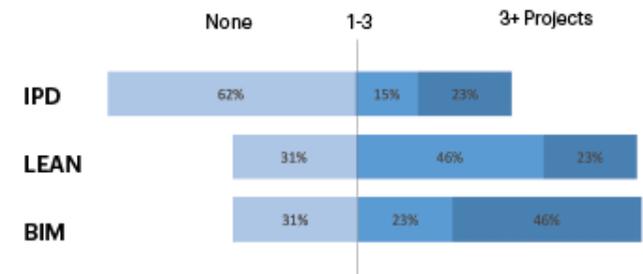
PROJECT PARTICIPANTS SURVEYED: 13

Most of the team members were new to IPD and few members some IPD experience. A majority had some experience in Lean, with remaining having either no previous experience or substantial experience. Approximately half of the team members had BIM experience prior to starting the project.

Building Size   34,000 sq. ft.

Budget $14,142,000

Schedule   7 months design   8 months contruction

MAKING A CASE FOR IPD

OWNER CONTEXT

The Canada Games Aquatic Center (CGAC) was the first signed and completed Integrated Project Delivery (IPD) agreement in British Columbia. The project consisted of renovating and upgrading the City's main indoor pool, located at 910 McGill Road in Kamloops, British Columbia. The facility was originally constructed circa 1992 for the 1993 Canada Summer Games and is now described as the busiest site within the municipal boundaries, with more than 2,000 users per day.

Over its 26 years of service, the building was maintained, but no upgrades or improvements were made. The existing building envelope, as well as the mechanical and electrical systems, showed signs of fatigue and were nearing or beyond the end of their expected service life. In addition, the CGAC is responsible for a significant portion of Kamloops's greenhouse gas (GHG) emissions.

Therefore, the project's main objectives were to upgrade the facility, increase overall building durability with an innovative envelope and mechanical solutions, reduce energy use, and reduce greenhouse gas (GHG) emissions.

MAKING A CASE FOR IPD

CHOOSING IPD & LEAN

Several factors played a role in the decision to adopt IPD for the CGAC project, namely the project characteristics, dissatisfaction with previous project outcomes that used traditional delivery methods, and the potential benefits of IPD.

Project characteristics: IPD can be ideal for owners who have a broad vision for their project. For instance, in this case, the owner had clear goals and needs but not necessarily a clear vision as to the solution on how to fulfill those needs. The project involved the renovation of a facility of a certain age and high occupancy rate. Therefore, the degree of uncertainty and risk that could be encountered were relatively high. Hence, the early involvement of key participants, namely the architect, contractor, engineering firms, and trades that were all part of the IPD approach, was exactly what was needed for this type of project, which involved an intensive period of early investigations to define the needs and design accordingly. "This kind of typology is actually, in my mind, the perfect project for IPD because you can do so much investigation early on."

Previous experience with traditional delivery models: The frustration with the outcomes of the city's previous projects using traditional delivery models, such as design-bid-build, design-build, and construction management, motivated them to try a different approach. Despite the owner believing they had done things according to best practices in past projects, the outcomes did not meet their expectations. Many projects incurred cost overruns and schedule delays. "We had a bunch of bad experiences with some traditional delivery models, despite us doing everything by the book, and everything exactly how we were supposed to do it, and to see things still fail."

Recognizing the potential benefits of IPD: Once the owner recognised the potential advantages of IPD, they attempted to learn more about it by talking with various references who had prior experience with IPD. The consultation focused on various elements of project setup and implementation. In this case, the consultant was a former project director who had successfully completed an IPD project. As a result, he was able to share many key lessons learned with the owner team.

Key takeaways:

- IPD can be very effective for a project that is complex and has a high degree of unknowns.

- IPD can help owners identify the project's key characteristics that will enable them to best fulfill their goals.

FRAMING THE PROJECT

DEVELOPING THE CONTRACT

Drafting the contract: The contract used in the CGAC project was the Hanson Bridgett IPD agreement. The contract negotiation took place during the validation phase, and it was signed right after validation. The owner started the process by including a template of the Hanson Bridgett IPD agreement in the RFP documents. The aim was to make RFP bidders aware of and prepared for the contract's various circumstances prior to submitting their proposals. Team members described the owner's role during the contract negotiation as being neutral. The client listened and helped guide the team through the discussion. Since the team members had different levels of experience with IPD, and for some, it was their first IPD project, the owner brought in an external third party to act as an advisor for the contract negotiation process. This advisor helped to clarify different aspects of the contract and ensured that all parties were on equal footing regarding their knowledge about the contract. During validation, all the team members attended a dedicated session to discuss the different clauses with the owner. At this stage, several important issues were discussed and agreed upon, such as holdbacks and the costs that would be associated with overhead and insurance, and how the organization's privacy would be handled regarding rates and markups.

The owner's perspective: From the owner's perspective, adopting the IPD contract presented several challenges. First, being a municipal government body, its role and responsibilities demanded that it ensure compliance with regulatory and procurement requirements. The owner motioned those joint internal efforts in their organization have contributed to ensuring the compatibility of this new model with the rules and regulations that govern their work. In addition, the project included a liability waiver across all signatories, which was a point of agreement among the team members and the owner, who aimed to guarantee a fair procurement and contract process in such a way as to avoid pushing risk onto the other project parties. The owner believed that a critical advantage of IPD lies in its not focusing on where to distribute the blame, but rather on how to find solutions as a team, benefiting the project. "Construction is complicated, and the blame gets distributed in different ways. To decide upfront that, this is how blame is going to be distributed, was not very IPD."

Contract's form: Respondents had mixed feelings about using a Hanson Bridgett IPD agreement for the project. While some did not have any issues with it, others expressed concerns regarding the rendering of U.S. terms and clauses in such a way as to be applicable for a Canadian project, saying "a Hanson Bridgett contract is really be spoken and specific. Not necessarily all elements are applicable."

Key takeaways:

- Contract workshops led by experts in the field can be helpful in ensuring all project team members have the same understanding of the various clauses in the contract and facilitate the contract negotiation process.

- It is important that the role of the owner be neutral during the process, overseeing the negotiations and ensuring a balanced and fair contract.

- The contract needs to be added to the RFP documents to ensure that bidders have a comprehensive view of the project and know what to expect.

FRAMING THE PROJECT

CLARITY OF THE GOALS

Developing the goals: Two types of goals were set in the CGAC project. Hard goals involved measurable objectives, which were, on time, on budget, safety, and reduction of greenhouse gas emissions and energy consumption. Soft goals were team values and the owner's conditions of satisfaction. Notably, having fun, collaborative culture, knowledge sharing was agreed upon as team values, and sustainability, accessibility, maintained operation during construction, facility revitalization, best utilization of space, and a welcoming place for visitors and users were the owner's conditions of satisfaction.

The process of identifying these goals was done in two stages. First, during the IPD onboarding process, value-setting exercises were conducted, and the team agreed on the team values. Second, during the validation phase the hard goals and the owner's conditions of satisfaction were developed. "I believe that the validation phase creates a better understanding of what their goals are and truly defines them in a way that they might not have known at the beginning for everyone."

Communicating goals: The team members felt that it was deeply important that the project goals be communicated effectively because this delivery system involves very different practices and environments than traditional delivery models. "We need to do better to communicate what we are doing, why we are doing it because it is so much different than what people are used to." The owner highlighted this by emphasizing the importance of explaining their goals and expectations instead of just informing the team about them. The owner understood that effective and transparent communication sets the tone for the entire team and ensures overall alignment with project goals.

On the other hand, some team members felt that they should have done a better job communicating the project's goals and culture to the people on the site. They believe that the site was not fully aligned with the culture created in the big room. However, part of this stems from the COVID-19 pandemic, when the project's big room went virtual just as the construction phase began.

Clarity of the owner's goals: There is a consensus among the team members that the owner's goals were clear from the beginning. However, by nature, it is more difficult to achieve a fully matured vision in terms of scope from the onset for a renovation and upgrade project. The owner was clear about their budget, schedule, and external contributing factors, such as the facility being one of the busiest in the city. However, the owner was unclear as to the limit up to which it would have the city council's approval to move forward. Therefore, to deal with the undetermined scope limits, the team prepared three options for validation, phase one alone, phase one and two together, and phase two alone for an ulterior date, including various scenarios for phases one and two. This made the

process more complex, but it was well managed with a group team effort in the validation phase.

Key takeaways:

- The clarity of the owner's goals in terms of the scope and available budget is crucial to ensuring a fully aligned team.

- Methods to communicate the project's goals and values to the people on site and keep them engaged throughout the project must be determined from an early stage.

- Establishing goals collaboratively was crucial in ensuring the team's commitment and enthusiasm for the project's success.

CHOOSING THE TEAM

TEAM SELECTION

RFP Strategy: Due to past unpleasant experiences involving the low bid tender strategy, the owner of the CGAC switched RFP strategies not only for IPD projects but for all the other project delivery systems. Indeed, they now adopt a "best value" approach in all their RFPs. For the CGAC, this approach helped create a team of people who brought the best value to the project.

As their understanding of the joint management style of IPD was relatively new, the owner did not predetermine the number of poly party members and their disciplines. Instead, their RFP strategy was to first select the architect and the general contractor (GC), and from them, the selection cascaded for the remaining team members. This was done as a collaboration between the owner, architect, and GC, whereby they determined the number of members and which disciplines needed to be partnered and at which moment they needed to be invited to the table. When asked, one of the project team members said, "It is always exciting when you get to be part of actually building that team as well, instead of just simply joining it and away you go." On the team side, not all the applicants had experience with IPD or the RFP process, especially the local trades. This prompted the applicants to proactively form joint ventures with local trades and other national trades with IPD experience.

RFP Process: Once the architect and the general contractor joined the team, they worked with the owner to determine who should be a partner and evaluate the RFP submissions. The hiring process continued with the engineering firms and trades until all the team members were selected. As the process progressed, when a member was selected, they were included in subsequent interviews.

A key feature of the RFP is that it is open for discussion, giving the opportunity to negotiate, question, and clarify any aspect of the proposal. This aspect was greatly appreciated by the team.

Evaluation criteria: The evaluation criteria focused on the team members' readiness and willingness to collaborate. This was highlighted in the RFP documents, in which the percentage dedicated for the fees was 20%, 35% for the proposal, and 45% for team member evaluations. The interviewees were required to demonstrate their ability to collaborate within a team. Previous experience with other alternative project delivery systems such as DB and CM were accepted. The team member's personality and the level of engagement they showed all together served the purpose of forming the best team possible. As stated by one respondent, "We've had them do exercises that are not typical of interviews to allow us as interviewers, to see how they participate as a team doing a difficult exercise, solving puzzles, or engaging in a specific activity."

Key takeaways:

- A waterfall RFP strategy was employed, which was seen as positive and helpful in assembling the right team. The Architect and GC were selected first. Other project team members were selected subsequently, and these participated in selecting the rest of the team.

- The evaluation criteria focused on the team members' readiness and willingness to collaborate and were tested through a series of questions and exercises performed during the evaluation process.

CHOOSING THE TEAM

DEVELOPING THE PARTIES

Nature of the roles: On the CGAC project, the poly party members compared their team to forming a new entity for whom the success and failure of the project depended on the joint efforts of all team members. Project participants found that having team members who had solid IPD experience presented benefits, such as their being of assistance to the rest of the team throughout the process. As one respondent explained, "They helped everybody find their role right away and be effective in the big room."

Owner involvement: The project team unanimously agreed on the importance of "buy-in" and the influence of the owner's degree of participation on the project's success. They found that while IPD involves more effort from the owner than standard project delivery methods, which each new owner should predetermine, it is essential for maintaining a seamless project process. The owner recognized the importance of the efforts invested in IPD projects, which ultimately resulted in less work. The RFP process, for example, necessitated greater work from the owner from the onset. However, they realized that these efforts were worthwhile compared to the consequences of the low bid strategy, which usually resulted in extra work later. "We found the low bid is a lot more work for us and usually results in a lot of issues." The impact of the owner's high level of engagement and the level of commitment they showed towards the project's success was notable as one of the main factors that led to the success of this project.

Forming joint ventures: Several of the team members, particularly the trade partners based in Kamloops that lacked experience in IPD, strategically and proactively formed joint ventures with national trades who had IPD experience. The joint ventures provided the local contractors and their workforce support from the national contractors that had past IPD experience.

> **Key takeaways:**
>
> - The owner's active involvement in the IPD project was one of the main contributing factors to the project's success.
>
> - Framing the project team as a distinct entity and recognition that every member's individual experience enhances the entire team's capabilities was noticed.
>
> - The use of joint ventures for firms that lacked IPD experience was an effective way to accelerate learning and enable active participation in the IPD environment.

CHOOSING THE TEAM

CHAMPIONS

In the CGAC project, IPD championing was an essential precursor to its successful implementation. It was noted that championing had significant effects on team alignment and the commitment level created among the team members toward the project's success. In the CGAC project, some of the championing of IPD was done amidst most of the team members all the way to the owner, but mostly it was done by the general contractor, the architect, and other team members who had had previous IPD experience.

The owner as a champion for IPD: The owner championed IPD in three ways. First, the owner showed throughout the project a strong buy-in for the IPD approach and commitment to making it work. As one respondent noted, "Of everybody that came to the (big) room from the city, nobody came in with doubts (that) this will work, but (rather that) this will be a success, and we are going to make sure it works." Second, the owner understood their new role as a part of the IPD team and acted as a true partner, making everyone feel they were together in the project's success and failure. Third, the owner fully engaged in the process and actively participated in the SMT, PMT, and PITs meetings. They fulfilled their responsibilities and made sure the team had everything it needed to perform its job. "They (The city) had team members that were capable and knew what the community and the municipality needed. So, they were invaluable. I think a huge part of the success of this project was how strong that municipal client team was."

Team members: Other team members who had previous IPD experience were of great help in championing IPD. This indicates that their presence bolstered confidence in this model by showing that if it had worked before, it could work now as well. In addition, they played an important role in facilitating and guiding the team members who did not have prior IPD experience.

Key takeaways:

- Owners are critical champions for successful implementation of IPD, which requires strong "buy-in" for the approach and being a true partner that is fully engaged in the process.

- Team members with previous IPD experience can also help to champion the approach and guide those firms that have limited experience.

SETTING THE CONTEXT

DECISION STRUCTURE

In the CGAC project, the most important thing that made the decision structure work efficiently was setting the project goals and values early in the big room. The goals and values served as parameters with which to assess and justify the decisions made throughout the project. Participants generally described the decision process as open and transparent. A decision started by a discussion in the big room, to voice the team's thoughts, then a vote was held with the project's best interest in mind. "There was a huge degree of transparency. Decisions in terms of technical, team performance and how do we proceed in schedule, those are all collective decisions." Additionally, the criteria utilized for decision-making on the CGAC project were set across the several management levels on the project.

PITs level: Starting from the lowest management level, the PITs could make decisions within their specialty without consulting upper management if the decision had no impact on project costs or schedule. The owner's presence for most PITs helped make decision-making effective.

PMT level: If the decision could have an impact on the project cost, time, or values, then the PITs developed a decision matrix that assessed the impact of the decision on the project and the anticipated benefits. This decision metric would then be escalated to the PMT to decide. The PMT was the heart of the project where most of the decisions were made. In the CGAC project, the PMT meetings were held in every big room session and included representatives from all the teams, making it an effective decision-making stage. Due to the adequate fulfillment of the PMT's role only a few occasions required the involvement of the SMT.

SMT level: Whenever the PMT could not come to a decision, the issue would be escalated to the SMT, which consisted of the senior management of all the team member companies. As per the contract agreement, the SMT was encouraged to make their decision collaboratively. However, if a consensus could not be reached, the majority could decide while taking into consideration the owner's input. In the CGAC project, the SMT met mostly monthly. Nevertheless, the team members described the SMT's role as limited, which was due in part to the effectiveness of the PMT's decision-making. As described by an interviewee, "Meetings were very short, but I think quite effective in also reinforcing the behavior and sort of that executive level in the project." SMT meetings were short and practical to keep the SMT team members informed and aligned with the project to ensure they could effectively intervene whenever required.

Key takeaways:

- Decision matrices are an effective tool to evaluate the pros and cons of a potential decision.

- The goals and values created early in the project served as parameters to guide purposeful decision-making.

- The owner's involvement in the PITs helped make them effective at making decisions.

SETTING THE CONTEXT

RESOURCES & FACILITATION

The facilitation of IPD was ensured at two different levels. At the owner level, the owner educated themselves to prepare for IPD. At the team level, members were provided with the necessary knowledge, tools, and guides to perform their roles in the project through workshops. The owner's approach to project facilitation was to hire a third-party facilitator. They were a neutral third party who was not a signatory to the IPD agreement, and their duty was primarily to give expertise and guidance to the team on the various processes and phases of IPD. Many of the respondents indicated that it was better able to guide the team and provide the required support. As described by one respondent, "I think actually having them (the facilitator) as a neutral third party is a great exercise because they do hold everybody accountable."

At the owner level: In the CGAC project, the owner was well prepared, having informed themselves on IPD and making sure they understood the entire process and set their expectations accordingly. They hired an expert with prior success with IPD to establish IPD within their organization. Together, they developed the strategy to build the IPD team and outline the RFP's.

At the team level: As mentioned above, CGAC hired a third-party facilitator to provide the IPD base knowledge and help guide the team through the process. The role of the facilitator is crucial in smoothing the process and preparing the team for what is to come. A summary list of the facilitator's roles on the CGAC project was provided and is described below:

- Lead the onboarding process and level up the team's knowledge of IPD.

- Introduce the new roles that govern the team's relationships and render them non-adversarial.

- Help the team set the project values.

- Train the team on collaboration and lean tools.

- Outline the project stages and processes and ensure the team members have accurate expectations for what comes next.

- Monitor the alignment of the team with the project's goals.

- Monitor the team culture and maintain project values.

- Help in communicating and embodying the project's spirit to the people on-site, who were not necessarily in the big room.

- Help to ensure financial transparency.

- Help in the administrative tasks, such as onboarding new members, offboarding a team member, big room meetings, to name a few.

Key takeaways:

- The facilitation in CGAC is delivered by a neutral third-party facilitator engaged by the owner. They were not a signatory to the IPD agreement, and their primary responsibility was to provide knowledge and guidance to the team on the different procedures and stages of IPD.

SETTING THE CONTEXT

ONBOARDING & OFFBOARDING

The onboarding process took place over four days of training prior to the validation phase and the big room sessions and was led by a third-party IPD facilitator. A variety of methods were used to deliver the training program, such as team building, lectures, serious games, and open discussions.

Leveling up knowledge about IPD: The CGAC team members' levels of prior IPD experience varied. Some had extensive experience, whereas others were at their first IPD project. Therefore, one of the most critical targets of the onboarding process is to align the team members in terms of their understanding of IPD and their expectations for the process.

Team building: Creating social bonds between the team members was another objective for the onboarding process. A variety of team-building activities were used and were not limited to the big room. It is noteworthy that the project took advantage of having many team members traveling for the two-day big room sessions and stayed overnight in Kamloops. Some of the team members recognized the activities that occurred after-work hours helped to further build team culture and cohesion. They saw them as essential to the project's success and felt they should be implemented in every project.

Training: In addition, the onboarding process contained training on the tools and concepts that were used throughout the project. Training on target value design, pull planning, and lean thinking, to name a few, took place at this early stage of the project. The purpose was to ensure that every member of the project understood the concepts and knew how those tools would be used as a team.

Defining the project values: The project benefited from the entire team's involvement at this early stage in the project, as well as the engagement reached to identify and highlight the values and goals the project team was looking to achieve throughout the project. As mentioned earlier, those jointly developed goals and values were crucial to the team alignment and served as a benchmark to assess the team's success.

Offboarding: None of the team members on the CGAC project went through the offboarding procedure. However, there was considerable dissatisfaction with one of the team members, who looked to be exceedingly busy and was unable to meet expectations and failed to meet the deadlines on different occasions. Rather than pursuing the offboarding process on their own, the team members met with the contentious party at the PMT level to see if there was any way to fix the situation. The situation was finally settled, and the team member fulfilled their tasks until the project was completed.

As a lesson learned, some participants suggested including the on-site superintendents in the training sessions to improve the process. This would

ensure that construction teams are aligned with the values and goals developed in the project's early stage and prevent the drop they felt in the team culture once the construction started, and the new members arrived who had not participated in any of the onboarding process.

Key takeaways:

- Critical aspects of the onboarding process focus on:
    - Introducing the concepts of IPD and lean.

    - Training on tools and techniques that will be used in the project.

    - Setting the project goals and values.

    - Creating social bonds between the team members.

- A continual onboarding process is necessary throughout the project's many stages to ensure that the entire project team, particularly the onsite construction crew, is aligned with the project's aims and values.

EXECUTING THE WORK

TOOLS & PROCESSES

The tools and processes used in the CGAC project can be classified into three categories: Management tools, digital tools, and lean tools. While the use of lean tools will be described in the lean section, this section is dedicated to explaining the management and digital tools used. Mostly, the use of these tools was linked to a positive impact and effectiveness, while negative effects were reported for only a few aspects.

Management tools: The decision matrix and sprint boards were the tools most utilized on the CGAC project. As described earlier in the decision structure section, the decision matrix was used intensively to figure out the impact of any potential decision on the project parameters, cost, budget, and values. On the other hand, sprint boards were a highly appreciated tool used by the team to visually follow up the tasks every week in the big room.

Digital tools: The two key features of the digital tools employed in the project were Slack, as a communication platform, and SharePoint, as a document sharing platform. Even before the pandemic struck, these technologies were extremely beneficial to the project. The pandemic, on the other hand, intensified their usage, to the point that they became critical to project procedures. Then, the platforms Teams and Zoom were added to hold project meetings and big room sessions.

The project materials were hosted on SharePoint, and the forecast sheets were shared. Most of the team appreciated Slack, noting how easy it is to ask a question on Slack and receive a quick response. Many people linked this to the overwhelming difficulty of dealing with a high number of emails, as well as what appears to be a greater inclination and convenience for people to connect via chat rather than email. The success of this communication platform can be observed in the comparatively low number of emails sent and received during the project, as compared to the volume of email they had to deal with in their previous experience. Furthermore, the option to create threads around certain themes or PITs that everyone could view, search for, and participate in was a remarkable feature that made it even more appealing.

However, several team members expressed reservations about using Slack. In the latter stages of the project, the number of members grew to over 100, making it difficult to track and raise concerns about the capacity to secure and control sensitive project information and data.

Key takeaways:

- The use of a communication platform was highly effective and appreciated by team members due to its benefits in reducing the number of emails, promoting quick responses, and having broader attention of the team members.

- The security of project information needs to be considered when selecting a communication platform, particularly when there is a large team of users.

EXECUTING THE WORK

LEAN

The onboarding sessions in the CGAC project provided an opportunity to introduce the project team to Lean principles and tools from the beginning of the project. They tried to highlight the potential benefits, create buy-in among the project participants, and ensure engagement from the entire team. Many team members identified buy-in and team engagement as the cornerstone in the successful implementation of Lean.

The implementation of Lean: In the CGAC project, the project team linked the implementation of Lean mainly to the pull planning tool and the last responsible moment. The team saw an opportunity to capitalize on the collaborative spirit and positive outlook of team members to reduce waste. The project owner described two types of waste: (1) Tangible elements leading to shared savings that could be achieved by the team were items such as, construction materials, shared equipment, shared recycling bins, and (2) intangible elements, such as savings in the cost of dumping and cleaning. Other savings related to project management tasks, such as more efficient meetings facilitated by predetermined meeting agendas and targets and getting the team to work on the shop drawings together rather than separately, which the owner described as one of the most wasteful tasks.

The project team agreed that pull planning assisted them by allowing them to identify the work that was yet to be done and by whom, to keep the work sequence moving and complete the assignment. Pull planning, according to one team member, was a tool that allowed them to track and interact with the consequences of their activities. One limitation was reported regarding pull planning, when the restrictions due to COVID-19 forced the project to shift to virtual mode. Some team members felt that pull planning was a little weak in virtual mode because of the lack of specialized tools to host the process.

In addition, the last responsible moment was used effectively in the project. The project team identified a last responsible moment for all the Wishlist items, which specified when the team could decide to go forward with that item without impacting the project parameters or causing rework.

The team found many benefits from using pull planning and the last responsible moment, which convinced many to continue using these tools within their organization and on other projects, even non-IPD projects. "Some of the companies even said that this is something that they'll carry forward and do on a regular basis, even just for themselves and for their work planning. They found pull planning beneficial."

Key takeaways:

- Lean concepts facilitated waste reduction in several aspects of the project by capitalizing on IPD's collaborative teamwork approach.

- Training was provided to all project team members to familiarize them with Lean tools and processes

- Some project members were so convinced by lean tools and approaches that they have started implementing them in their day-to-day operations across their business and in their other projects.

EXECUTING THE WORK

BIM

Degree of usage: In the CGAC project, the team decided to use BIM for its advanced project design and execution functionalities. The existence of a BIM execution plan and a collaborative model were apparent signs of the intent to make successful use of BIM. However, the use of BIM in the CGAC can be described as limited. Although a collaborative model existed and the team jointly contributed to it, the model was not employed to its fullest extent. Of all the teams, the mechanical teams utilized BIM the most, while the other teams did not report the same usage level.

Barriers: The limited use of BIM was attributed to two main barriers. The first related to the typology of the project. As a renovation project with many isolated work packages, the team realized that modeling every item to a high degree would not be an easy job, and most importantly, it was not evaluated as providing a return on investment. The second barrier was the concerns about the capability of the project team to deal with BIM. This technological barrier was the reason for the project's inability to utilize paperless drawing and instant updates through portable devices distributed on-site, as was seen in the other projects.

Benefits of BIM: The main benefit linked to BIM use was clash detection, whereby the developed model was great to detect issues early in the design phase. The team conducted a VDC session where they reviewed the module together, which led to valuable discussions around the model and different aspects of the project. The ability to accurately pre-order the material required to complete a particular job was another benefit achieved from using the BIM model. A direct example of this was the machinery room. The construction material and fittings were pre-ordered based on the model, which allowed the team to execute it in record time and without issues.

The relationship between IPD and BIM: Although IPD projects provide a collaborative environment and contractual bases to successfully implement BIM, the project team did not see a necessary link between BIM and IPD projects. In other words, the team showed that an IPD project can succeed without BIM. However, BIM could add great value to the project and capitalize on the collaboration created in IPD projects. This observation is like the use of Lean and IPD.

Key takeaways:

- The most beneficial use for BIM reported on the project was clash detection.

- The project typology, technological capability of the trade partners, lack of owner requirements, and cost restrictions were the most important barriers to implementing BIM to its full extent.

EXECUTING THE WORK

WORKPLACE

Big room benefits: The project team in CGAC collocated for two days every other week. Many team members were from out of town. Therefore, it was deemed more convenient to travel in for two days biweekly instead of one day per week. Remarkably, this was one of the main factors that made the big room in CGAC very successful. The project took advantage of having the team for two days in Kamloops to expand the social and team-building activities after work hours. The team described the moments they spent together after the big room sessions as a great time, establishing strong bonds within the team and this reflected positively on their work relationship throughout the project. For some team members, the social interactions and bonds created within and beyond the big room were the highlight of this project and one of its main success factors.

Big room space: Regarding the big room itself, the team described it as one of the most beautiful big rooms they have ever been in with its abundant natural light and views to the outside. The big room was also well-equipped with all the necessary instruments and technical equipment to enhance their experience. The owner's investment in the big room was evidence of their belief that it can enhance performance. One respondent said, "Bring everyone together in the room, and you will be surprised with what you get." Aside from the investment in the big room, the owner's active involvement was witnessed by several PITs on different occasions, when they met to work on topics related to their disciplines.

Big room concerns: This said, it was reported that the management of project records was somewhat deficient. In the CGAC project, each PIT kept its records separately to track the tasks and document the decisions made in the big room. However, some team members said it would have been more efficient if the project had had a project record instead of a PITs record. Thus, this is an issue that may change in their future IPD projects. Another issue with the big room was the level of productivity. Some people could have worked on individual tasks in the big room, but mostly the time was used for higher-level activities. Individual tasks were not the focus as the team believed that working on group activities within the big room was more beneficial, such as design discussions, problem-solving, coordination with other trades, project value checks, updating the project forecast, planning, Lean wins, and tools, and reviewing the financial matters.

Due to the lockdowns, the big room was forced to shift to virtual model. The team started utilizing communication tools like Zoom and Teams widely. Many struggles were reported, mainly because the period in question featured much uncertainty about the overall situation in general. Fortunately, the project benefited from the culture and cohesion created among the project team before

the pandemic. It managed to maintain an acceptable level of communication and coordination.

Key takeaways:

- The big room fostered team cohesion and the unique collaborative culture of the project team.

- The big room sessions were dedicated to design discussions, problem-solving, coordination with other trades, project value checks, updating the project forecast, planning, Lean wins, and tools, and reviewing financial matters.

MAINTAINING EXCELLENCE

TEAM ALIGNMENT

Team alignment is one of the main aspects that was relied upon to increase the chances of project success. It is one of the primary objectives of IPD. Instead of a fragmented project team with disparate aims and motivations, IPD attempts to create an aligned team that shares the same goals and values using a variety of measures, including shared risk and reward, collaborative management, and responsibility waiver, to name a few.

In the CGAC project, team alignment was established in two different stages: the contract and the validation. The contract tied the team members together and gave primacy to the collective goals. The team not only shares risks and rewards, but many see entering an IPD contract as forming a new entity where their individual identities and titles are merged with the group identity. "We now focus our energies, our thoughts, our engagement and our behaviors around that group of people being a team working together, all pulling in the same direction."

One of the main implications for the alignment created by the contract was how the team has dealt with the project's risks. The IPD contract allocated risk in a balanced manner, which instilled a sense of fairness that resulted in dealing with risks collectively. The team showed collective ownership of the risks and collaboratively mitigated them.

The contract ensures the first stage of the alignment related to the team members' financial goals. However, the second stage of securing that the team members are aligned with the project goals was handled during the onboarding and validation stage. In those stages, the team developed the project goals and values, which formed the conditions of satisfaction for the project and served as a benchmark for team alignment. Values alignment exercises were usually performed in the big room sessions, and effort was made to keep those values posted and the team aligned with them.

Key takeaways:

- Team alignment is established in two stages: the contract stage binds the project team together and the validation stage establishes the project goals and values.

MAINTAINING EXCELLENCE

COLLABORATION

IPD is known as a collaborative approach. The team was told the desired level of collaboration at every phase of the project, from the contract through onboarding and big room meetings. One of the primary elements that the project team found to be extremely different from traditional projects was collaboration. During the interviews, the phrase "extremely collaborative" was used repeatedly to describe the project. Clearly, the team realized that this approach was created with one goal in mind: to encourage the team to collaborate more effectively. As collaboration is a critical component of the project's success, it is a goal that should be met on its own.

The high level of collaboration reached in the CGAC project reflected positively on many aspects of the project, such as accountability, problem-solving, fiscal transparency, and process efficiency.

Accountability: The team's level of performance and task accountability was linked to the degree of collaboration reached on the project. It motivated them to fulfill their responsibilities. This could be noticed when the team spoke about the project forecast and how everyone was contributing and checking each other's numbers, which resulted in forcing the team members to be more critical in their review. Even the trade partners reported counting and budgeting for things they did not count in regular jobs, just to be accurate, as they were held accountable by the rest of the team. In addition, the team emphasized accountability for team member performance; at each big room session, the team examined each member's performance to ensure no one went off course.

Problem-solving: The collaborative culture greatly facilitated problem solving in the CGAC project. Having easy access to all parties concerned with less of the traditional barriers, such as formal communication channels, excessive paperwork, bureaucracy dominating the processes, and fragmentation made the project team an effective problem-solving machine. One of the team members described that IPD does not mean mistakes will not be made on the project. However, in the case of a mistake, the team members can own up to it and solve it promptly, benefitting from inputs offered by the entire team, as they are conveniently already fully aware of the project.

Fiscal transparency: Fiscal matters were handled transparently in an open-book accounting approach. Bills, hourly rates, trades invoices, and financial issues were reviewed openly in the big room. All the team members had access to each other's figures and could question and discuss them without barriers. The team in CGAC evaluated the financial aspect of the project as the most transparent process they had ever participated in, saying "(…) CGAC was the most transparent I've seen so far. Some parts of the financial (aspects) was completely open book." To ensure the individuals' privacy, the team applied what they

called a rate table. For this, the rates of the entire staff were averaged for one of the team members and this is what was displayed on the sheets.

More efficient processes: Team collaboration and the willingness to share knowledge and experience was highly appreciated and increased the efficiency of the team's performance. As mentioned by one respondent, "So in this particular team, there was a complete openness and willingness to share and a lot of experience, so it was quite good that way." The project team reported many examples where collaboration and direct and open communication made all the difference in overcoming a problem, mitigating risk, or performing better in a particular task.

Key takeaways:

- Collaboration is the central theme; its implication can be noticed in every part of the project which led to its success.

- The high level of collaboration reached in IPD projects reflected positively on many aspects of the project, such as accountability, problem-solving, fiscal transparency, and having more efficient processes.

MAINTAINING EXCELLENCE

TEAM CULTURE

What is noticed foremost in IPD projects in general and in the CGAC project is the prevailing culture of the project environment. Many team members expressed their dissatisfaction with traditional project delivery techniques, citing adversarial relationships, "going after each other", and "yelling and screaming to get the job done", as an indication of displeasure about the whole experience. In contrast, in the CGAC project, the expressions used by the team to describe their experience were: we had fun, we were looking forward to seeing each other, we trusted each other, we made friends, we felt like a team, the best of my career, and I would prefer to do IPD for the rest of my career. A large part of the credit for this accomplishment is due to the team's culture. "I really think that the social aspect of this project is largely what made it as successful."

Creating a different culture that enhanced the team's abilities and alignment was well handled starting from the early days in the CGAC project. The target culture was defined, and the bases of that culture were established during the onboarding process. In addition, significant investment in time was paid in the big room sessions to create the team culture. Open discussion, encouraging everyone to talk, and holding many team-building activities were some of the strategies used. The owner's efforts to foster this culture, driven by their understanding that this culture is one of the leading indicators of a project's ability to succeed, was key. In addition to leading in this direction in the project, the owner contributed effectively to spreading this culture by encouraging and arranging many social and team-building activities inside and outside the big room.

The positive impact of the right culture can be noticed by tracking the main attributes for the relationships on the project, such as fun, partnership, trust, and a no-blaming non-adversarial culture. Fun was identified as one of the project goals, and the team really intended to make it happen, so each of the team members we met expressed how amazing and fun it was working on this project. In addition, the team reached the point where they trusted each other and acted as true partners, which, again, was one of the fundamental attributes for which the team agreed that without it, they would not attain the same level of success. Indeed, due to all the efforts made and the positive spirits, the team enjoyed a healthy work environment in which there were no adversarial relationships nor blaming culture, which helps to stay focused on the project's goals.

Key takeaways:

- The basis for creating the desired team culture were first established during the onboarding process.

- Fun, partnership, trust, and a no-blame/ non-adversarial culture were some of the main attributes guiding the dynamics of the relationships on the project.

REAPING THE BENEFITS

PROFIT & PAYOUT

The payment structure in the CGAC project included the chargeable costs, overhead, profit, and incentive. There are three stages of paying out for all the non-owner parties on the team. The first was the chargeable costs and overhead, which were paid out monthly upon approval from the PMT. The definition and details of the chargeable costs are provided in a separate exhibit attached with the IPD agreement. The second stage was for the profits as per the percentages agreed on in the ICL (incentive compensation layer), to be paid out at several predetermined project milestones. When the project achieves a milestone, the PMT must approve the payment, making sure the project is on budget and on schedule. However, if the projection showed that the project was not on track, the owner was entitled to stop the payment.

The third and last stage was for the incentive, which paid out at the end of the project. The incentive represents the team's savings from the risk items, and those savings are distributed between the owner and the non-owner parties. In this project, the contract mentioned that the savings will be shared on a 70/30 basis, while the construction savings would be distributed 50/50. However, the team voluntarily opted to increase the percent for the owner for the construction savings to 70/30 to allow them more for their Wishlist items.

The project team expressed high satisfaction with the financial results of the CGAC project. They reported that 100% of their ICL was achieved. As well, savings from the risk register and returns were achieved for the owner, who was satisfied that the project was completed on budget and able to fulfill many items of the Wishlist.

Key takeaways:

- The CGAC project was completed on budget.

- Achieved savings in the risk register and granted all items of the Wishlist.

- Achieved 100% of the ICL.

REAPING THE BENEFITS

BUDGET & SCHEDULE

Schedule: The project was completed on time despite the entire construction phase coinciding with the first wave of the COVID-19 pandemic. In fact, the team had just completed the validation phase and was in the early days of design when the lockdowns forced the facility to shut down., The plan had initially contained scheduled closures and predetermined access schedules to the building. Therefore, the team seized this opportunity and managed to start the construction onsite a month earlier than scheduled. Although they were in the early stages of the design, the collaborative spirit created within the big room before the pandemic left the team in an excellent position to still take advantage of the situation and limit the hindrances caused by the lockdowns.

Impact of COVID-19

- CGAC was the only project of the three case studies that was directly impacted by the COVID-19 pandemic. Indeed, COVID-19 hit right after validation, right as the project team was starting construction. This interfered with and impacted several aspects on the project. Of course, the project was forced to turn to virtual meetings, which made it more difficult to align new members who later joined the project in the construction phase with the project values and IPD concepts. This was due to the absence of a proper onboarding process during that period. "COVID had a lot to do with this, when we got to construction, we couldn't get together anymore. So, there was a lot of folks that were on the building team that didn't have the benefit of doing that proper onboarding. So, I think there was a lack of alignment, because they just didn't get to see the culture and benefit and buy into that whole process." However, the project was fortunate that the core team had completed the training and the big room sessions in the validation phase before the COVID-19 lockdown. This helped them maintain the team culture because the bonds were forged in that early stage.

- For the CGAC project, COVID-19 was an opportunity to get work done in the facility while it was empty due to the lockdown. As such, having created a cohesive team pre-pandemic, and shifting online into virtual big rooms, combined with having full access to the facility, made it so that the impact on project schedule was mitigated.

Budget: The project was successfully completed under budget, meaning it met the validated target cost. To be more accurate, the project successfully obtained savings of $1 million, $700,000 of which consisted in the owner's share of the incentive distribution formula, which was reinvested in the project to include

several items from the Wishlist. Therefore, it can be stated that CGAC was completed on budget, and with more value for the owner.

The owner entered the validation process with an evaluation of the building's condition, a pre-design, and a $9 million budget. Initially, the intention was to simply address the issues and keep the structure operational for another 20-30 years. They presented this information to the team and adjusted the basic budget to the $10 million dollar figure due to market changes between the two estimates. Once they began validating, the owner wanted to modernize the building rather than just repair, which purposefully increased the budget to 14 million.

The team was required to develop the project concept to a certain degree of layout and specifications to estimate the costs accurately. Due to the owner's indeterminate scope boundary, the validated scope was flexible in CGAC. The team developed the project, then provided various options to the city council, phase one alone, phase two alone, and phase one and two together. The fact that it was a renovation project presented some challenges to the team. As a result, determining which items were related to which phase and determining the Wishlist items associated with each choice was unclear. The team, on the other hand, stated that the teamwork and workshop sessions in the big rooms were their go-to method to figure things out and meet the owner's specifications. Later, the city approved phase one on its own, and the team began identifying possible saving opportunities early in the design phase.

The team scheduled a monthly meeting to review the costs and update the forecast. Each team member reported their numbers to the PMT to provide them with a clear picture of the project's status and enable them to decide if corrective action was needed.

REAPING THE BENEFITS

BUILDING OUTCOMES

The owner of CGAC expressed their total satisfaction with the project's outcomes. They believed that IPD was the solution to many of the problems they faced in the previous project. Thus, they decided to expand the application of this approach moving forward. The owner was also very satisfied with the added value obtained, and which was distributed in many Wishlist items that the public could see and identify with. "Now, suddenly, they are getting everything they wanted, and these extra things. So, we over-delivered honestly, and we have never been able to do that. So that is awesome." Moreover, the project was able to reduce greenhouse gas emissions and achieved step two on the BC step code, which was one of the project conditions of satisfaction. In addition to expanding the application of IPD, the owner, because of this project, decided to adopt many concepts and tools they used such as the RFP, Lean concepts, and TVD into their organization and apply it within non-IPD projects as well.

In terms of the project team, all the team members we met showed a high degree of satisfaction with the project results. As per a survey conducted by the GC, 100% of the surveyed persons stated that they would like to do IPD again. Indeed, the culture dominated the workspace, and the cohesion created was much appreciated by the team members and was highlighted as one of the project's main outcomes. "We made it through the project, and we don't want to kill each other!" Another respondent stated, "There are solid relationships built and still, you know, going down, I guess, would be the biggest moniker to that. Because typically, most jobs by the end of it, (…) (people do) not want to talk to each other anymore for a while." Even the team members who had previous IPD experience said that CGAC was a typical example of the successful implementation of IPD. "I'd just like to mention this is one of the best IPD projects I've been involved in thus far."

PROJECT CREDITS

Project team:

- Owner: City of Kamloops
- Architect: Group2 Architecture
- Structural Engineer: WSP Canada Inc.
- Building envelope Engineer: Entuitive Corporation
- Mechanical Engineer: Stantec Consulting Ltd.
- Electrical Engineer: WSP Canada Inc.
- General Contractor: Chandos Construction Ltd.
- Building Envelope Contractor: Western Roofing Master Roofers Ltd.
- Mechanical Contractor: Interior Plumbing and Heating Ltd.
- Electrical Contractor: AltaPro Electric Ltd.

Interviews:

- Owner: Matt Kachel
- Architect: Craig Webber, Troy Smith, and Ian Douglas
- Structural Engineer: Patrick Taylor
- Building envelope Engineer: Paul Creighton
- Mechanical Engineer: Benjamin Ellah, Ian Chen, and Doug Bryan
- Electrical Engineer: Michael Jackson, Leandra Shade, and Jerry Espino
- General Contractor: Leah Ulyot, Michael LaRocque, Jason Towers, and Randy Dupree
- Building Envelope Contractor: Colin Rasmussen and Mark Gruber
- Electrical Contractor: Jake Gandy
- Facilitator: Darlene Cadman

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THELMA CHALIFOUX AND SORAYA HAFEZ SCHOOLS

Project Description

PROJECT	Thelma Chalifoux School and Soraya Hafez School
LOCATION	Edmonton, AB
BUILDING TYPE	Education
PROJECT TYPE	New Construction
CONTRACT	Custom
OWNER	Edmonton Public School Board
ARCHITECT	ACI Architects and Number TEN
CONTRACTOR	Delnor
PROJECT START	November 2017
COMPLETION	February 2020

Project Images

Project Delivery Experience
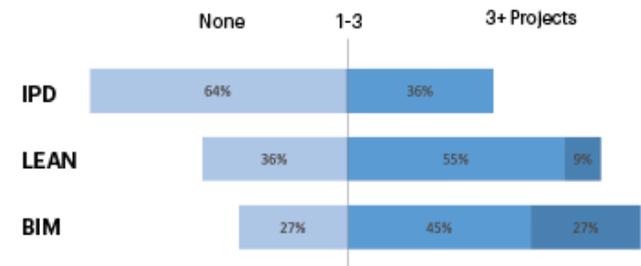
PROJECT PARTICIPANTS SURVEYED: 11

Approximately half of the team members were new to IPD, and half had some or extensive IPD experience. A majority had some experience in Lean, with the remaining having either no previous experience or substantial experience. Significant majority of the team members had experience working with BIM.

Building Size   88,640 sq. ft.   and   58,910 sq. ft. respectively

Budget $27,057,901 and $18,151,753 respectively

Schedule   6 months design   32 months contruction

CONTRACT
Pre-Planning: 1 year of research & reading

2017
RFP Architect

2017
RFP Contractor

DEC 2017
Design consultation

MAR 2018
Design consultation

2019
Signatory parties contract signed

MAY 2018
Validation Report submitted

TEAM BUILDING TRAINING

2018
IPD / Lean bootcamp

CO-LOCATION

Contractor and trade partners fully co-located big room during construction

Weekly colocation during early design phase

OFFICIAL START
(NOV 2017)

ONE YEAR
(NOV 2018)

TWO YEARS
(NOV 2019)

OFFICIAL END
(FEB 2020)

■ PROJECT STARTUP   ■ DESIGN   ■ CONSTRUCTION   ■ MOVE-IN | SIGNATORY AND RISK REWARD AGREEMENT EXECUTED

● DISCRETE EVENT   —— PHASE   ●●●● PHASE OF REGULARLY OCCURING DISCRETE EVENTS

MAKING A CASE FOR IPD

OWNER CONTEXT

This project consisted of building two schools commissioned by the Edmonton Public School Board: Thelma Chalifoux School and Soraya Hafez School (TCSH). The owner wished to anchor the school in 21st century learning and design principles. Thus, the team needed to develop a program and floor plan for the school that utilized the areas allocated by the provincial grant agreement to reflect a 21st century education approach.

The Thelma Chalifoux School project was designed to accommodate 900 new junior high students while the Soraya Hafez School was similar but smaller in size, aiming for a capacity of 650 students. The two building projects were grouped into a single IPD project and team, even though they were two separate IPD contracts. Therefore, in this document, the TCSH project refers to the construction projects for the two schools, Thelma Chalifoux School, and Soraya Hafez School.

MAKING A CASE FOR IPD

CHOOSING IPD & LEAN

The project characteristics and prior unsatisfactory experiences with traditional project delivery systems were key considerations that led to choosing an IPD approach.

Project characteristics: A project to build two schools is not a typology that would normally strongly motivate one to choose an IPD approach. Indeed, the schools had to be delivered to meet the Alberta Education/Alberta Infrastructure School Capital Manual. However, what makes this project different is the owner's plan to incorporate 21st-century learning principles into the school's design, which is a relatively new concept with few precedents to help guide the process. The IPD approach provided a collaborative environment and early participation of all stakeholders, which was an ideal process for working through how to apply this new concept at the design phase. "I think TCSH would have struggled to get the 21st-century and to get these schools built if it would not have been an IPD delivery method."

Previous experience with traditional delivery models: The owner of this project is a public-school board. Their projects are inherently community-based and held to a strict timeframe because they need to be ready for students and personnel on a specific date. In the past, their projects frequently encountered roadblocks and delays, putting the project delivery team under constant stress. In describing past projects, the owner said, "I personally managed five of those. It was extremely stressful. We were over budget; I think on at least half of those schools. Two of them were delayed, and we ended up delivering them in January instead of September. Just very, very stressful, not a lot of collaboration."

Furthermore, the owner expressed their dissatisfaction with the traditional process in general, citing a significant number of change orders they had to deal with on every project, as well as conflicts coming from adversarial relationships that affected their projects. "You just know that things are not going well when you are in the middle of the construction, and your change orders are in the hundreds, rather than being about 20 or 30 change orders on a brand-new build. Some of those schools had over 100."

Recognizing the potential benefits of IPD: The owner first learned about IPD at a conference in the United States and quickly saw its value for their organization. As a result, they decided to give it a chance to see whether it might help them avoid repeating the problems of their current projects. "But the biggest thing we learned is that the culture you can create on an IPD is just so absolutely different than what you have (now). So, then we asked for this pilot project."

Key takeaways:

- The owner concluded that the collaborative environment and early engagement of all stakeholders offered by IPD would be beneficial in the plan to incorporate 21st-century learning concepts into the design of the school.

FRAMING THE PROJECT

DEVELOPING THE CONTRACT

Drafting the contract: A Hanson Bridgett IPD agreement was utilized for the contract. The contract was negotiated during the validation process and signed shortly after validation was completed. The RFP contained a copy of the Hanson Bridgett IPD agreement. The team members were encouraged to invite people from their organizations, including legal staff, to a contract workshop led by an IPD expert. The workshop focused on clarifying the contract clauses and making sure everyone understood the IPD approach clearly since everyone's experience with it varied. The team described the procedure as more of a discussion than a negotiation. This demonstrated the high level of trust among the team members, facilitated the process and helped them feel more comfortable signing the agreement. One respondent said, "So, to me (that) eliminated a lot of risk, because we're all partners, so you don't have to worry. I would take an IPD contract any day of the week over the other ones I've signed."

The owner's perspective: As previously stated, the owner's biggest issue regarding the contract was obtaining the funding agent's approval. Due to a misunderstanding of IPD and major concerns about liability, the no-litigation provision had to be removed, and many team members saw this as counter to the spirit of IPD. Basically, allowing for lawsuits in IPD is like enabling one to sue oneself, because the teams are all bound by the same contract, making the failures of any member their responsibility. As one project participant stated, "(This) is kind of strange, because if you're part of the party agreement, you're suing yourself. That's, that's crazy to me. Because it's not just that we have errors and omissions for that, if we've done something wrong, there's errors, that never changes. But to sue somebody in the contract rather than errors and omission. You're actually suing yourself."

On the other hand, the funding agent saw this issue as a loophole in the contract. To their understanding, if one party made a mistake and cost the project an amount of money, there would be no provision in the contract to retrieve that money. The IPD team would work harder to deal with the situation, but the bottom line would be that money would be lost. Many of the team members expressed their dissatisfaction with this outcome. However, they were able to overcome it and did not let it affect the team culture, stating: "Our word to each other is more important than what is in writing. I mean, we were not concerned about having lawsuits or suing each other, getting into any silliness. It was no. We are here together to do the project. So, whatever the contracts are, great, but let us just go do it."

Contract's form: Once again, the team's perspectives on the contact form were diverse. Some people were pleased with the contract, but others preferred alternative forms such as CCDC30. The primary criticisms focused on the contract's length and the usage of American terms in several clauses. "I led the team going through and putting kind of fine details and going through some of

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the language in Hanson Bridgett IPD agreement to change it because it has some unique American contract things in it that we needed to straighten out as well."

Key takeaways:

- To secure official permission, the project was required to eliminate the liability waiver provision.

- An expert-led contract workshop was conducted. The session focused on clarifying contract conditions and ensuring that everyone understood the IPD approach completely.

FRAMING THE PROJECT

CLARITY OF THE GOALS

Developing the goals: The goal-setting process for the TCSH project began early in the big room. The owner made sure that all team members were included in the process and that all the principles were presented in the project values definition workshop. This provided a lot of value to the team since it helped them better grasp the owner's needs and expectations, namely by, as one stated, "understanding what success means to the owner, understanding what success means in terms of the checkpoints that we are going to go through, and then also creating some milestones for the project as well."

Two types of goals were considered and agreed upon. 'Hard goals' were measurable targets such as meeting deadlines, maintaining on budget, and achieving a LEED® Silver Certification rating at a minimum. Along with the conditions of satisfaction that outlined the project values and were related to the design parameters of the two schools, such as belonging, collaboration, community, and comfort. Those conditions of satisfaction were formed collaboratively and included in the validation report. On the other side, the team interviewed indicated some more qualitative soft goals, such as team values and behavior, which were agreed upon and tracked during the project. As mentioned by one project member, "A lot of the goals also focus on the team itself, so we set goals to have kind of the expected behavior of the entire team, which kind of totally lines up with trying to create an environment of respect and trust." The team saw to the 'soft goals,' such as fun, openness, honesty, and respect, and was able to track them throughout the project by conducting surveys among the team at set intervals.

The team members and the owner also set other goals. The team explained that the Wishlist items served as a target for them and that they intended to reach their objectives and more. The owner also wanted to be able to return funds to the funding agent as a stand-alone aim to demonstrate the benefits of IPD.

Communicating the goals: According to most of the team members, the TCSH project did an exceptional job communicating the project goals and values to the team on the field. The team determined early on the importance of engaging the construction team and ensuring their alignment with the project culture. Therefore, regular meetings were held with the project foremen, where they were invited to the big room and introduced to what had been done and what was to come, allowing them to experience and develop the sense of the team culture and provide them with leadership training to develop skills and tools they would use on-site. One explained, "What we are doing is trying to take the values that were originally developed by the validation team, understanding the goals, the why the project has developed the history that got to us to this point and then pass the baton to them in a really empowering way." Moreover, the team communicated and explained the project goals, including the 21st century learning concept, to the entire team on-site through stand-up meetings, which

was appreciated by the team. One said, "I think they actually appreciated, you know, us taking the time to set that up for them and walk them through that because they are the ones building it and making our dreams come to life."

Clarity of the owner's goals: The owner goals were both conventional and ground-breaking. On the one hand, the owner received government funding for schools, and this implied specific requirements in terms of area, number of classrooms, and other major aspects such as total budget. It was easy for the team to translate these conventional requirements into project outlines. On the other hand, the owner hoped to apply 21st century learning concepts the two schools' design. At the time, there was no clear understanding of these concepts or knowledge as to how to incorporate them into the project design. As stated by the general contractor, "To be quite honest, no one really knew what that meant. And so, it was kind of taking a different look at what the traditional schools and what this new concept is going to look like and how that's going to be functional." The owner stated that the collaboration and participation of the entire team, thanks to IPD, was extremely beneficial in achieving this goal, saying, "I think we actually got better 21st century learning ideas because of having more people sitting around the table."

> **Key takeaways:**
>
> - The project ensured that the whole team participated in the goal-setting process, which helped them better understand the owner's needs and expectations.
>
> - Consistent attempts were made to explain the project's aims and values and involve the construction team to ensure their alignment with the project culture.

CHOOSING THE TEAM

TEAM SELECTION

RFP Strategy: Prior to this project, TCSH had completed one earlier IPD pilot project. They used a batch group recruiting strategy in their pilot project, and based on that experience, they chose not to reuse that technique. They felt that they missed out on an opportunity by not being part of the team selection process, which they realized was a critical process in which the owner should participate. The alternative was to use the waterfall strategy, in which the key players, such as the general contractor and the architect, were hired first, while the other players, such as the engineering companies and specialized trades, were hired afterward, in a cascading manner. They were concerned, however, about the time it would take to complete the team selection using the waterfall strategy, especially because, as a public body, they were obligated to publish the RFP for three weeks. Two steps were taken to work around this. First, they employed a hybrid waterfall method in which the general contractor was paired with the architect, the electrical engineer with the electrical contractor, and the mechanical engineer was paired with the mechanical contractor. Second, rather than waiting until the general contractor and architect joined the team before starting the RFP for the rest of the team, they issued RFPs for all the combinations simultaneously. As a result, the RFPs for the rest of the team were already effective when the general contractor and architect joined the team.

RFP process: Following the selection of the general contractor and architects, they collectively, including the owner, began assessing and selecting the other partners. This procedure was repeated at each level, with each new member joining the process of reviewing the proposals for the rest of the team. The general contractor and architects helped to develop an RFP process based on the project's requirements, which was used to recruit the rest of the sub-trade teams. In this regard, they appreciated how the owner was explicit and good at specifying their requirements.

Evaluation criteria: The evaluation criteria consisted of two main stages, the proposal evaluation and interview. First, the RFP document was reviewed and evaluated based on: (1) the experience and capabilities of the proposed IPD team members, (2) the proposed project delivery and collaboration, (3) innovative practices, and (4) pricing and compensation. The second stage was the interview process. The final decision was based on the cumulative score of these two components. Notably, for the first stage, the financial aspect counted for only 15 points out of 200 and in proportion more points were allotted to team capabilities and the collaborative experience.

The evaluation criteria for the interviews included factors like understanding of IPD, qualifications in collaborative project delivery, understanding of 21st century learning environments, the cohesiveness of the proposed IPD team, and demonstration of benefits of selecting proposed IPD Team. In fact, the interview process focused on establishing whether a team member could fit and

collaborate effectively with the rest of the team. More attention was placed on their personalities and their view on a problematic situation. The project facilitator explained, "You hire for attitude, you hire for character, and you ask a bunch of open-ended questions that feel uncomfortable. Tell me about a time when you had a conflict? So, their answer is going to tell you whether they see themselves as a victim, whether they see the other person as wrong, or whether they own their side. But maybe that person says, like, I learned this out of it. And that's that growth mindset, that collaborative mindset that, we're looking for." However, the owner emphasized that to optimize assessing these aspects in the interviews, it is important that the people who will be collaborating in the project be involved in the interview process, adding, "I don't want to see your VP of sales in there. I want to see who is in the big room with me; I want to see your pm team member; I want to see your foreman; I want to see your site superintendent."

Key takeaways:

- A hybrid waterfall RFP strategy was utilized. They combined the general contractor with the architect, the electrical engineer with the electrical contractor, and the mechanical engineer with the mechanical contractor.

- The evaluation was divided into two stages: proposal evaluation and interview. The evaluation focused more on the person's ability to collaborate, while the financial components of the proposal were given a lower weighted score.

CHOOSING THE TEAM

DEVELOPING THE PARTIES

Nature of the roles: The decision to consider a partner and invite them to join the team was made based on the potential influence they could/should have on the project's scope, schedule, cost, and quality. The owner valued the flexibility that IPD offers in terms of being able to adjust project roles and being able to add or remove team members without having to go through a legal process. Prior to signing the contract, all the team members were on equal footing, regardless of the volume of their work. However, as one of the participants pointed out, "Everyone's equal, but some are more equal than others. So, it's the hierarchy of importance of success, of understanding." The relationship between the owner, general contractor, and architect, as well as their role, was viewed as the most important to the project's success. Furthermore, several team members noticed a transition in IPD projects from industry standard methods that focus on the owner-architect connection to a new arrangement that prioritizes the relationship between the owner and the general contractor. "I think of the odd IPD project that we did that was less successful than these TCSH schools. It was because the general contractor was sort of everyone's equal on the team, but some people are a little more equal. And the relationship between the owner and the general contractor, probably is the most important relationship, and then the relationship between the general contractor and the architect next." As a result, they said of this shift, "It changes the highest focus from function to delivering value."

Additionally, three trade partners participated in the TCSH project as team members and signatories to the multi-party agreement. These trade partners regarded their partnership differently. While some viewed their role as helping in the design process and bringing workability issues to the table, others questioned the value of their contributions. They believed their involvement was not necessary at every phase of the project and that the time required in the big room was substantial. As mentioned by a project participant during an interview: "I don't think we provided enough value to be at the table, to be honest. What I learned is that it is a lot of time management. It is a lot of invested time for one of my team members."

Owner involvement: The representatives for TCSH were involved throughout the project delivery process, making themselves available to provide support to the team and facilitate the project process. According to one of the team members, "They (the owner) are very involved in IPD, and they know their role very well. So, they don't have to be reminded or told kind of where they are supposed to stand in the project." Moreover, the owner was able to help the project team overcome the contradictions between the IPD process and the government requirements, in addition to continuing to engage the personnel responsible for the operations to provide the necessary input for the project team. On the other hand, the team believed that IPD required more work from the owner to be as successful as intended compared to traditional projects. As one of the team members thought, "IPD is not right for every project and every

client. Without the right client involvement, it is not necessarily going to be a success, probably won't be." However, the owner evaluated their experience with IPD as less work than the traditional projects, where the efforts invested upfront paid off, and the processes moved smoothly after a while. "I feel like I need to be doing more. It's just like it's running itself. And I'm not used to this. So, a lot more time certainly spent in the front end, and the go slow to go fast theory certainly applies."

Forming joint ventures: The team was asked to identify a suitable partner and submit their proposal jointly, as stated in the RFP section: the architect and the general contractor, the electrical engineer and the electrical contractor, and the mechanical engineer and the mechanical contractor. However, this was not a formal joint venture. It was only a hiring technique, and after the proposal was accepted and the work was granted, each organization of the joint venture bid participated in the project independently.

> **Key takeaways:**
>
> - The owner evaluated their involvement in IPD project as a less work than traditional projects since the early investment paid off and the processes went smoothly.
>
> - Inviting a partner was based on their possible impact on the project's scope, time, cost, and quality.

CHOOSING THE TEAM

CHAMPIONS

The owner as a champion for IPD: All of the team members we interviewed saw the owner of the TCSH project as the project's champion for IPD, and they characterized the owner's contribution as critical to the project's success. "We can all talk about the contractors and the consultants and everybody working together, but the owner is a really key piece of this." Championing IPD by the owner was featured in a few aspects. First and foremost, the owner demonstrated a thorough comprehension of the IPD process and backed up the team throughout the project. "Having a client that is aware, is willing, you know, to be part of the conversation, is a tremendous asset to the project." Second, the owner led by example and built confidence in the team's ability to succeed, which the team viewed as a key factor in the project's success. "The owner really drove that and enjoyed the process, and we are committed to it, which made all the difference in the world." Third, the owner's involvement also helped mitigate the impacts of the IPD process's conflict with traditional requirements, which was that the funding agent did not espouse the same views on relational contracting and procurement as TCSH.

Team members: Many people thought that, in addition to the owner's role, the championing of IPD was a team effort, with each team member contributing by completing their duties and supporting their partners. "I think there was a sort of a collective vibe and culture and understanding that this is the way we were going to do it."

Key takeaways:

- The owner understood the IPD process and supported the team throughout the project.

- The owner demonstrated success and faith in the team's abilities, which the team valued highly.

- The owner's engagement helped mitigate the IPD process's contradiction with the conventional approach, helping the team figure out how to transition to the more collaborative project environment put forth by IPD.

SETTING THE CONTEXT

DECISION STRUCTURE

According to the team members, the decisions were very collaborative in the TCSH. The project made decisions based on project values that everyone understood and agreed on. They acknowledged that IPD had the advantage that many experienced people can participate in the decision process, which increases its chances of being the right decision for the project instead of leaving that responsibility to only a few participants. "Those decisions would have been made between the architect and the owner. Now you have got 35 people in the room that represent every facet of the project." Although managing the decision-making process with such many people was difficult at first, the project soon benefited from the team culture that had been established and the process was kept efficient and productive. "I think there was a bit of discomfort at the beginning doing that because perhaps people voting were not informed or understanding enough to make an informed decision. But I think we found that it became very much almost everybody was voting the same way over time. Because the culture of the team, the project, that is what we should be doing."

Furthermore, the project had a conscious and ongoing attempt to incorporate the whole team in the process. That effort represents the partners' respective responsibilities regarding one another and in terms of decision-making, which the team sees as one of the features that distinguishes IPD from traditional project delivery systems.

At PITs level: As the lowest management level on the project, the PITs could either decide regarding a particular system or element, if this decision was within the agreed-upon project objective or propose a decision to the PMT for additional discussion and team agreement.

At PMT level: The PMT held weekly meetings with a representative from each member team. The project used a decision matrix to examine the influence of a proposed decision on the project and facilitate the decision-making process. The team saw much value in utilizing this tool and discovered another benefit in allowing them to maintain a record of why a particular choice was made in the project for future review.

At SMT level: The effectiveness of the PMT in the TCSH project lowered the workload of the SMT. The team stated that they did not encounter a situation that required the involvement of the SMT. The decisions were successfully handled at the PMT level. However, the SMT team knew it was important that they stay informed about the project. Therefore, they held quarterly meetings for project updates. As stated by the project architect, "There were zero issues or conflicts that arose to the SMT. Everything was resolved at PMT. I do not even want to say resolved. Everything was decided at the PMT, and nothing ever escalated."

However, even though the TCSH project never encountered a situation of conflict or disagreement, some team members expressed concern about the decision-making process considering changes made to the project's contract (i.e., the clause allowing lawsuits). They felt that opening the possibility of suing went against the IPD philosophy. They further explained, "You formed a company, and we are a board of directors, and that is the SMT. And, as a company, you got to decide at that board. And somebody on that board may not like it, but at the end of the day, that company is liable for the decisions that the board made, they live with it, and the board cannot sue itself. It should not be the case here. The company will live with the consequences." Allowing team members who are taking consensus-based decisions in the IPD project to sue each other will make them feel like they are not liable for the choice they were a part of making, potentially causing the entire system to collapse. As one stated, "That is a fundamental principle of IPD. If suddenly, we are going to say everybody can sue each other, then I am not going to be liable for this decision. Everything else about the whole concept falls apart."

Key takeaways:

- The team found the decision metrics tool very useful in keeping track of why certain decisions were taken in the project for future reference.

- The effectiveness of the PMT in the SHTC project lowered the workload of the SMT.

SETTING THE CONTEXT

RESOURCES & FACILITATION

For the TCSH project, a specialized consultant was hired as an IPD facilitator. They joined the team as a member of the multi-party contract and as part of the risk-reward pool.

At the owner level: TCSH learned how to optimize IPD by doing a pilot IPD project prior to the two schools. Thus, many of the lessons learned were taken into consideration for this project. The owner recognized the value of having an IPD expert to support the owner's role, such as the facilitator assisting in setting up the system. In the owner's words, "They kind of helped us set up the big room and set up all the pieces that we needed. So, I think that was a huge win for that project." The owner makes this recommendation based on this project, "I always recommend a good IPD facilitator, regardless of your experience, because they oftentimes become that sort of unbiased third party. Having that facilitator has always helped."

At the team level: In the TCSH project, a few aspects highlight the process of IPD facilitation. First, the continued presence of the facilitator throughout the project. As part of the multi-party contract, the facilitator in the TCSH project participated in all the project phases, unlike the other two cases where the facilitator was available at the validation phase only or intermittently. Second, the facilitator's role ensured proper communication of the project goals and values to everyone outside the big room. It is worth noting that this was a more formal process led by the facilitator, involving a unique program used to inform the site supervisors about what was discussed in the big room, as well as constant outreach to field personnel and presentations of project concepts and goals.

Key takeaways:

- The facilitation roles in TCSH were assigned to a specialized consultant who joined the team as a signatory of the multi-party contract.

- The project used a structured procedure led by the facilitator to inform site supervisors about what was discussed in the big room and continuous outreach to field staff and presentations of project concepts and goals.

SETTING THE CONTEXT

ONBOARDING & OFFBOARDING

In the first days of the big room, when all the team members had been hired, a quick and intensive onboarding activity took place. The process was guided by the facilitator, and it was focused on improving IPD knowledge, tool training, identifying project values, and team culture building.

Harmonizing knowledge about IPD: While some of the team had prior IPD experience, it was for many, including the general contractor, their first IPD project. As a result, much of the onboarding process was devoted to explaining the key ideas and terminology associated with IPD. An overview of the procedure was presented, which outlined the various stages of the project. It was also critical to go through each firm's understanding of IPD and set up their own cost accounting and planning to work in tandem with the IPD processes.

Establishing knowledge about IPD was not limited to the people in the big room. As previously stated, the TCSH team did a considerable job of including the site foremen and superintendents in the process, which included exposing them to IPD ideas and procedures.

Team building: Team building started during the onboarding process and remained a priority throughout the project to ensure an environment of trust and respect among the team members. This was mainly achieved through a variety of social activities. Some took place in the big room, like icebreakers, others, on the construction site, included all the workers, for example sharing a meal to celebrate a milestone achievement, while others took place off-site such as, sporting activities to help the team build their relationship and establish the desired culture within the team. As described by the project facilitator, "(We) want people to speak up so that that becomes a more diverse heuristic background, everybody is better, provides a better outcome." Therefore, team building, having fun together, and enjoying one another's company are all ways to ensure that people feel more at ease with each other.

Training: During the onboarding process, the team was given training on tools they would use during the project, such as the principles of IPD including Lean Design and Construction, Target-Value Design (TVD), and Pull Planning. The facilitator noted however that the training was more of an introduction to highlight the benefits rather than an actual training on how to use them.

Defining the project values: Similarly, to what was done in the CGAC project, part of the onboarding process was utilized to set goals and identify the project values. However, in EBSP, there was an emphasis on making sure that all key parties were onboarded before doing a project values exercise. In addition, the project created an onboarding guide that team members could use to inform their employees on the project's values and goals before they began working.

Offboarding: The TCSH did not need to offboard any of its team members. However, at one point, one of the team members unexpectedly shut down their structural division, which was a part of the multi-party agreement. The team members described the situation as critical, with potentially serious consequences if a different project delivery method was used, as well as the prospect of a lawsuit. Remarkably, the project team was able to recover and promptly solve the issue, minimizing any negative effects.

EXECUTING THE WORK

TOOLS & PROCESSES

The TCSH project witnessed the use of many management and digital tools. However, the extent and intensity of usage of those tools varied.

Management tools: The project utilized a dashboard that provided real-time performance data and other team-related factors, contributing to transparency within the project team. In addition, the team mentioned a tool they did not use in the project but that they understood would be vital as the project progressed. The accounting data and numbers were manually obtained from all the teams. The work of consolidating the figures linked to payroll, expenditures, and other forms of invoices was a significant problem and time-consuming procedure because each firm used a different accounting system and reporting method. In the future, it would be more beneficial if the entire team used a dedicated platform.

Digital tools: There was a noticeable difference in the usage intensity and the types of digital tools used in general between projects completed before and after COVID-19.

The favored methods of communication on this project were direct and face-to-face contact. Although email was discouraged within the team, no mention was made of an alternative digital tool to assist in communication. Some digital tools were used, such as a Google spreadsheet for sharing meeting minutes and SharePoint for hosting project documents. "SharePoint was well organized so that it was easy for everybody to know where to find things and where things went. So, I think that was pretty important." In addition, during the construction phase, the project used Procore for tracking shop drawings and different construction documents.

Key takeaways:

- Using a dedicated accounting platform that all team members contribute to can save time and eliminate issues associated with each team member's usage of separate accounting systems.

EXECUTING THE WORK

LEAN

In the TCSH project, the use of Lean was not extensive. This may be because the concept was new to many of the team members, as one said, "Certainly, understanding what lean was for a bunch of the team members was unique."

The implementation of Lean: Most of the lean scenarios centered on the use of pull planning and implementing waste-reduction measures that benefited from the IPD environment. "It breaks down some of those barriers around equipment, sharing of resources, sharing of deciding who is in the best position to do the scope of work." Lean thinking, as reported by the team, was reflected in the way they looked at every small decision in the project, making sure it was the most efficient and could reduce waste, such as: What is the optimum location for the site restrooms? What is the ideal location for garbage cans? How can we reduce the distance that workers on the job site must travel between their materials and their work area?

On the other hand, the project's overall implementation of the Lean concept was limited. Pull Planning was employed more frequently during construction than during the design process, where it was only used at a few stages. Some members of the team emphasized the usefulness of Pull Planning: "Pull Planning was used, and it was used very effectively, in my opinion." This allowed the team to identify the many elements needed for a certain activity, such as resources, constructability, sequencing, and task attribution to proceed. In addition, the team saw another advantage to Pull Planning. If anything went wrong, it made it easy to trace the cause, determine the person responsible, the implications, and corrective actions if needed, making it easier to hold everyone accountable.

Through their positive experience, the owner believed that Pull Planning could be useful for all the projects they work on, whether executed with IPD or not. They described it as one of the main wins they got out of the IPD project and said, "Pull Plan has been not only successful for IPD projects but in almost everything that I do now."

The relationship between IPD and Lean: The TCSH project team believed that IPD assisted in breaking down some of the barriers that typically exist in traditional projects and enabled the project to apply Lean concepts. Situations where the project was able to share resources without dealing with the complexity of tracking and distributing costs among the various parties were highlighted as examples of the aspects facilitated within IPD projects. As stated by one of the team members, "IPD breaks down some of those barriers around equipment, sharing of resources, sharing of deciding who is in the best position to do the scope of work." As a result, the team identified the IPD impact as an enabler and facilitator of Lean principles and techniques. "So, I think Lean just happens better with IPD."

On the other hand, participants in the TCSH project did not think Lean was necessary for a successful IPD project. They clearly expressed many benefits the project could achieve by applying Lean, which would lead to better outcomes, but it was not seen as though it contributed directly to whether the IPD project succeeded or failed. As was mentioned by one of the project participants: "I have learned that IPD and lean do not necessarily have to be the same thing." This is a surprising take as IPD was designed to facilitate the implementation of Lean. However, this could mean that the benefits of IPD are perceived by the project team members to surpass the application of specific Lean tools.

Key takeaways:

- The owner concluded that Pull Planning would be valuable for all their projects, whether they used IPD. They called it one of the IPD project's major successes.

- The team recognized the IPD effect as an enabler and facilitator of Lean concepts and tools, and it helped break through some of the traditional project hurdles.

EXECUTING THE WORK

BIM

Degree of usage: In TCSH, BIM was not utilized to its full potential. "We certainly did not get into BIM. So, it was not taken to a production level of detail." However, the project developed a model and made it live so that all the team members could contribute to it. Furthermore, according to one team member, a few fruitless attempts to apply the model for prefabrication, such as sheet metal fabrication, were undertaken but abandoned due to unfamiliarity and lack of experience with the system. "We wanted to utilize the BIM model directly into their fabrication process. They tried, but it failed, just because it was a little early for them."

Barriers: Three main barriers to the complete implementation of BIM in the TCSH project were identified. First, the lack of owner requirements. The owner was not interested in using BIM for operations and maintenance, which cast doubt on its practicality and reduced motivation across the team to move further with the model's development. "At the end of the day, if you don't want that model and have no intention of using it, then, let's not go to that level of detail." Second, there was a technological barrier within the owner's organization. The owner acknowledged that BIM could be beneficial for their operation and maintenance teams, however, they admitted that their staff was still not ready to use BIM, saying, "But technology-wise, we are just not there yet." The third barrier was cost. Cost constraints were noted by several team members as a hurdle to fully implementing BIM, especially since not everyone on the team was ready to work with it.

Benefits of BIM: One of the main benefits of BIM in the TCSH project related to using the live model. It was described as a consistently validated source of data enabled through the collaborative efforts that continuously contributed to the model. Another benefit reported was accessibility. The entire team, including the site supervisors, could access the model on their own devices at any time. In addition, the model facilitated a more efficient review process and made it possible to perform collaboratively, which is a process that the team believed enhanced their communication and the chances of arriving at the best outcomes. Lastly, clash detection was also reported and perhaps the most notable use of BIM in the project. It was used widely within the team to proactively detect incompatibilities within the design.

The relationship between IPD and BIM: The TCSH project team did not perceive the use of BIM as crucial to project success. The project owner did not require BIM and identified that they were not yet ready to utilize it; however, they were still able to deliver a successful IPD project.

	Project
Case Studies	B C T

Marker	*Project*
Making a case for IPD	
Owner Context	B C T
Choosing IPD & Lean	B C T
Framing the Project	
Developing the contract	B C T
Clarity of the Goals	B C T
Choosing team	
Team Selection	B C T
Developing the Parties	B C T
Champions	B C T
Setting Context	
Decision Structure	B C T
Resources & Facilitation	B C T
Onboarding & Offboarding	B C T
Executing Work	
Tools & Processes	B C T
Lean	B C T
BIM	B C T
Workplace	B C T
Maintaining Excellence	
Team Alignment	B C T
Collaboration	B C T
Team Culture	B C T
Reaping the Benefits	
Profit & Payout	B C T
Budget & Schedule	B C T
Building Outcomes	B C T
Project Credits	B C T

Key takeaways:

- Three primary barriers to full BIM deployment in TCSH project were:

- The lack of owner requirements. The owner was not interested in using BIM for operations and maintenance.

- Technological barrier within the owner's organization.

- Cost constraints were noted by several team members as a hurdle to fully implementing BIM.

EXECUTING THE WORK

WORKPLACE

In the TCSH project, collocation took place one full day per week at first, then half a day per week as the intensity lessened in the late stages of the design phase. The goal was to gather the project participants in a collaborative environment, where everyone could participate simultaneously, allowing the team to integrate design processes and methods effectively.

Big room benefits: The time spent in the big room was characterized as a problem-solving session, with the presence of all team members given a chance to obtain and provide meaningful input in a short period of time. According to the team, this frequently resulted in an immediate PIT meeting arranged by the affected parties to discuss an issue. "You could mention something, and then next thing you know, you would have an informal PIT, happening immediately with the experts in the room." Furthermore, the project benefited from having the full team around the table, which allowed for a quick decision-making process that could generally be completed in the same meeting. Consequently, the project workflow was improved and accelerated, as one described it, "That streamlines workflow, and it also empowers people, I think, much more than a traditional project."

In addition, the big room was where the team really got to know each other, where the relationships were created, and where trust was established, which, in the team's opinion, justified the big room's cost. Furthermore, because the team met on a regular basis, there was more in-person contact for any issue, which reduced the number of emails sent and received during the project. This was highlighted by a project participant, who stated: "There were not a lot of emails, and it was not necessary. So, I think we eliminated a lot of that waste. We see each other every week at least. So, we did not have to [send e-mails]; we communicated in person."

Big room space: The team was housed in one of EPSB's school until the site was ready to receive the big room. As the project moved into the construction phase, a double-wide site trailer, with no enclosed spaces, was used for the project office and big room. The project prohibited the use of any other trailer on the site to encourage everyone to gather in the same place. This boosted team spirit, and it quickly went from being a forced measure to a pleasant experience. As mentioned during an interview: "That was really big in terms of setting the culture because there was absolutely no divide between trades."

Big room concerns: Although there were several advantages to bringing everyone together in one room, the team acknowledged that it was a costly exercise. Not all the issues required the entire team's involvement, so not everyone in the big room offered value. The project, on the other hand, was committed to keeping collocation as a critical component of the project's success. As a result, many techniques were proposed to reduce the cost. First,

the big room served as a place to work during the allotted time, although not necessarily on the project. While in the big room, the team was permitted to work on other projects and report just the hours related to the TCSH project. Second, more PIT meetings were held, in which only those concerned were invited. The sessions in the big room became shorter and more efficient because of this. As mentioned during an interview: "I think we soon learned that we are bringing people together, and you know what, not everybody is adding value so let us keep the big room meeting shorter, and then have a bunch of project implementation meetings that we tracked and be made people accountable, that way it was much more efficient."

Key takeaways:

- To reduce the costs associated with the big room, two different approaches were used: expanding the number of PIT meetings instead of having longer big room meetings and allowing the team to work on other activities unrelated to the project while in the big room and only report the hours linked to the project.

MAINTAINING EXCELLENCE

TEAM ALIGNMENT

Being part of a poly party agreement where individual success and failure belongs to all team-members had a significant effect on making the team feel and act as a single-unit working toward a common goal. "We have a contractually shared goal that goes beyond idealism, and it does align everyone's intentions." That alignment was reflected in the team's risk management, and they felt that their risk exposure was fair and anticipated. As a result, coordinated efforts to limit risks and deal with unforeseen situations were strengthened. "(It) does not matter who makes a mistake. We share it based on that percentage of the risk. So, it is an interesting dynamic, I find, and this leads me to another reason why IPD is successful."

The mutually identified project goals served as another illustration of the project's alignment. This was one of the IPD success drivers, according to the team. They appreciated creating project goals that allowed them to have a better understanding of the situation and guarantee that everyone is on the same page. "Understanding what drives success, what are the conditions of satisfaction. So, in an IPD job, not only do you have full exposure to what those are, but you are also part of that process in determining them."

The project took concerted efforts to keep the team on track, including using a survey tool to analyze where the team was and how they performed in relation to the agreed-upon goals and values. The survey findings were examined, and corrective steps were implemented as necessary. "If the surveys were done, we would review it as a team, and if there are any lower scoring areas, we try to dig into why isn't this scoring as high as we thought it would be."

Key takeaways:

- Team alignment needs to be tracked and maintained throughout the project. Tools like surveys can be used to identify areas that need to be enhanced.

MAINTAINING EXCELLENCE

COLLABORATION

Many of the team members interviewed stated that the TCSH project was the most collaborative project they had ever participated in, benefiting from the trust and open communication that removed the barriers between the team. For example, the structural engineer stated, "The collaboration between the designer and the steel trade, this IPD project was the best we have had to date." This resulted in many opportunities to save time and cost for the project. "Like anything that involves a ton more collaboration, when we got to be able to utilize that extra collaboration that was given with the IPD, translates into some decent savings on time and a lot of times the money as well."

The collaboration in the TCSH project, like in the CGAC project, had a positive impact on many dimensions of the project, including accountability, problem-solving, fiscal transparency, and facilitating more efficient processes.

Accountability: The IPD projects' collective management approach has a direct influence on the team's feeling of accountability. Because everyone understood that their contribution might make the difference between the project's success or failure, they recognized they had to hold themselves accountable before the project team. "That's shared responsibility, so everyone has shared accountability." The stark difference IPD made was the accountability of the parties, even those who have a smaller share of the project or less profit at stake. In the TCSH project, the IPD model was successfully able to share the accountability evenly among the entire team. "The biggest thing I learned from IPD, at least one of the earlier ones, is that the same level of forecasting accountability that gets placed on the trades gets placed on the designers." And that was noticed in how the team perceived responsibility. Whoever experienced a drop in performance metrics was responsible, stood before the team, set the context, and proposed a recovery plan.

Problem-solving: As one of the team members remarked, the responsibility reached in this project was also mirrored in the accountability of knowing when to call for support from the rest of the team so that a collective action could be taken to correct an issue. "I think a good example, in this project was like the mechanical contractor needed help with some underground work. And the general contractors, carpenters were out there in the snow, helping them get it done to meet the targets. And that would never happen. There is no way that would ever happen in a traditional model." The team reported many occasions where the collaboration and integration of the capabilities of the different parties were employed to solve a problem or overcome an obstacle throughout the project. "I mean, definitely the willingness to find the best possible or the most economical solution was amazing."

Fiscal transparency: Full transparency and open book accounting were considered essential to enabling collaboration and promoting far more trust in

the approach and the project's status at any given time. "I think just all of the transparency that comes along with IPD. It really, I mean, you are laying everything out there for everyone to see. So, a lot of the time, it is a very open, honest, and candid discussion." The team in the TCSH project was able to see and question each other's numbers. Collaborative efforts of the PMT included reviewing the invoices monthly, looking at the rates and budget, and highlighting anything back to the concerned team.

More efficient processes: The team's capacity to fulfill their jobs more efficiently was directly influenced by the collaboration enabled amongst them. The opportunity to work together with all the teams was highly valued, and it was seen as critical to the project's success. "The nice thing with IPD is, you know, we are working hand in hand with the contractors to get a better result." This teamwork kept the team fully informed with the required information to perform better. "It just happens because of all that direct and detailed information." Another observation about the collaboration that facilitated more efficient processes was noticed in the simplified decision-making process and the absence of bureaucratic barriers in this project. Practical solutions in the best interest of the project were found quickly via a group discussion or an open communication channel, rather than having to go through unnecessary rounds of back-and-forth formal correspondence. "This talks to the streamlining of the decision-making process that I have been involved with in other projects, where that back and forth could have taken weeks of iteration."

Key takeaways:

- Many team members interviewed stated that the TCSH project was the most collaborative they had ever been a part of, owing to the trust and open communication that helped break down barriers.

- Full transparency and open book accounting were considered essential to enabling collaboration and promoting far more trust in the approach.

MAINTAINING EXCELLENCE

TEAM CULTURE

As previously stated, the main characteristics of an IPD project are team culture and collaboration. They make all the difference in comparison with the traditional practices in the industry. All the team members we met strived to find words to express how pleasant the experience was to be on the IPD project. Like the CGAC project, the expressions used by the team of the TCSH project to describe their experience were: fun, enjoyable, we do not want to leave the project, we take care of each other, no one was trying to get anybody else in trouble, how pleasant it is to be on these IPD sites, this is the only kind of work I want to do now, different environment, we were partners, and we want to talk to each other, when you have a taste of what IPD can offer it is certainly a more pleasant way to go or pleasant to go to work every day, to name a few.

These positive feelings for the TCSH project reflected on the overall evaluation the team had for the project, as one said, "The IPD delivery is a significantly better experience. For the work culture, I will just start with this, that is the first thing that comes to mind. It is much easier on the people engaged in the work." The team believed that this culture helped them focus on the project work and achieve the goals and prevented disturbances such as tension among the parties. "It is a completely different environment, which I think goes back to the purpose of IPD, or at least one of the purposes as well, parties to focus on designing and constructing the building."

The same attributes that described the relationships of the CGAC project, such as fun, partnership, trust, and no-blaming non-adversarial culture, can be noticed in the TCSH project. Having fun was a big part of it. The intent was to make it feel different on the IPD project in a positive way that can bring the best out of people; as stated by one of the team members, "Human nature is such that if you enjoy what you are doing, your chances of success are better." On the other hand, the partnership and trust were significant advantages of the IPD in this project. The project team mentioned many occasions where the partnership created reflected on how they dealt with each other or how their crew on the site dealt with the typical day-to-day clashes that keep happening in a traditional project site. "You run through the first meeting or two, and you feel like you have worked with that person for years already."

In addition, the team credited the project's key players, namely the owner, general contractor, and architect, for creating an environment that encouraged everyone to express their opinions and enhance discussions to find a mutual solution to any issue that arose, rather than the blaming behavior that usually dominates discussions.

Key takeaways:

- The most obvious and immediate impact of IPD can be noticed in the team culture, which is seen as dramatically different from traditional projects.

REAPING THE BENEFITS

PROFIT & PAYOUT

The team members of the TCSH project expressed their satisfaction with the fiscal outcomes of the project. They reported that 100% of their ICL was achieved, all the owner Wishlist items were granted, in addition to achieving some savings on the risk register. Another outcome that improved satisfaction was the prompt payments the project team received; the team mentioned that their payments were paid within two weeks, which was much appreciated.

In the TCSH project, there were three payout stages. The first stage was monthly payments representing the chargeable costs. The second stage was for the ICL, which was divided into five pre-set milestones: Validation, Foundation and Structural Slab Complete, Rough-in Inspections, Substantial Completion, and Project Closeout. The agreed-on ICL percentage was released at each of these milestones. Moreover, several conditions had to be met to achieve the milestone and release payment, namely (1) Project schedule had to track to be substantially complete on the Substantial Performance date, and (2) the Estimated Final Cost had to be less than or equal to the Base Target Cost. The Parties agreed that based on the overall Project performance, 100% of their prospective ICL would be at risk. Even though a portion of the ICL was to be paid at the Project Milestones, the full extent of ICL was not confirmed until the project was completed and all changes to the ICL had been made.

The third stage of payout was at the Substantial Completion of the Project, where the shared savings would be paid, and the ICL percentages would be officially earned.

Regarding tracking of Estimated Final Cost, the team documented one issue with how the risk register funds were managed on the project. In the contract, the team agreed that any savings would be split 50:50 between the owner and non-owner parties. However, the Wishlist items were more delicate because the team had to determine whether to grant it or not depending on the last responsible moment for each item. Some team members stated that it was very challenging at times to know if they were performing well enough for the risk to have vanished and thus be able to grant a Wishlist item, while others expressed concern about the entire approach, believing that this way would allow risk-averse teams to keep the sums allocated to the risk register and carry it through to the end of the project, resulting in more profits for the team. Nevertheless, the team was able to manage those challenges in the TCSH and successfully granted all the Wishlist items.

Key takeaways for TCSH project:

- Completed on budget

- Achieved savings in the risk register and granted some items of the Wishlist.

- 100% of the ICL was achieved.

REAPING THE BENEFITS

BUDGET & SCHEDULE

Schedule: The TCSH project was successfully finished one month ahead of schedule. The project's ability to overcome various hurdles was primarily due to effective team collaboration and the synergies created among the team members. The team mentioned that at one point, the area was under very cold weather for several weeks and that this would have typically caused a scheduling delay in other projects. Surprisingly, the team profited from the attendance of all key players and was able to identify ways to compensate for the delays by working collectively. "We had to think outside the box a little bit to do those things. We ended up prefabricating a bunch of things that would happen later in the project that really sped up the installations, and then that helped. Lots of great synergies, but you needed the consultants and the owner to be onboard to understand."

This project was so different from their past projects, in which they were desperately trying to finish before the students and employees arrived, and occasionally failing. The owner was delighted to see early completion of the schools in February and have more time to prepare for the schools' openings. As mentioned by the owner representatives during the interview: "It's really different to finish a school before it is scheduled to open, and that was really a unique experience for us."

Budget: The TCSH project was successfully completed under budget. The team was able to deliver the project, grant all the Wishlist items, return some money to the funding agent and achieve savings for the team. The team believed that the advantages of IPD were the key to this success. "Because of the advantage of IPD, the team was able to deliver more." The initial estimates were over budget during the validation process. The team then held a one-day session with the full team, going line by line through the budget and questioning each estimate until they found savings that allowed them to lower the budget. This accomplishment has been attributed to the PITs' combined efforts, where each group maintained the budget at first and uncovered areas for savings.

The budget that resulted from this process was described as reliable and well maintained. The team checked it monthly and reviewed the numbers to make sure the project was on track. One of the IPD takeaways from this project was how the team assigned various project duties depending on who was the most effective team member to do the work among the contractors present. However, the savings were not limited to the builders' work. As the team indicated, project engineering firms were able to generate savings of 20 to 30% in their budgets as well.

During the process of establishing the budget in the validation phase, some challenges were encountered regarding the number of assumptions that must be made due to the incomplete design. The challenge was to provide enough

information to arrive at a realistic estimate, not too conservative so as not to overestimate the budget nor underestimate and have a budget that cannot be achieved. In addition, deciding to go ahead with a Wishlist item was also challenging. The team had to be confident enough that they would have savings at the end of the project to choose Wishlist items that had been determined early in the project. The fact that the team had a well-established design that was subject to very few change requests from the owner was a key component in developing cost certainty. "We had a really strong design with, you know, very few changes required through construction. So, there is a high degree of comfort with kind of the certainty of what the final cost was going to be even early in the construction."

REAPING THE BENEFITS

BUILDING OUTCOMES

The TCSH project's owner was delighted with the project results. They thought IPD assisted them in meeting their goal by providing schools aligned with 21st-century learning, adding greater value to the two schools by including many of the Wishlist items, and by allowing TCSH to return money to the funding agent. The project's early completion helped to avoid the stress that normally comes with a school opening. Furthermore, the owner regarded the positive impact of the successful implementation of IPD in those two schools as a revelation and realized many missed opportunities over their career. As mentioned by a project participant during an interview: "It is incredible what has been done. It has just opened our minds to just a whole different mindset of how we can work and how we can build the team and collaborative environments. And it is just crazy that it took this long. Frankly, I have been doing this for 25 years, and you know, I can only say that like 20 of them were wasted on the wrong type of construction."

On the team side, all the team members we spoke with expressed their satisfaction with the project results. Whether it was the quantitative aspects of the project, such as receiving their ICL percentages in full and receiving additional benefits because of the savings they generated, or the more qualitative aspects, such as the positive relationships they developed on the project, the fun they had, the collaboration, and the true partnership they experienced. Surprisingly, non-signatory parties shared in the delight and enthusiasm for the IPD experience. "This project still had quotes from a non-risk pool team member, and he was like, this is the best project I have worked on in 25 years, and I hope all my projects could be like this."

PROJECT CREDITS

Project team

- Owner: Edmonton Public School Board
- Architect: ACI Architects Inc.
- Specialty Architect: Number TEN Architectural Group
- IPD Facilitator: EcoAmmo Sustainable Consulting
- Structural Engineer: Read Jones Christofferson Ltd.
- Mechanical Engineer: Arrow Engineering Inc.
- Electrical Engineer: SMP Engineering
- General Contractor: Delnor Construction Ltd.
- Mechanical Contractor: ICON Industrial Contractors Ltd.
- Electrical Contractor: Altapro Electric Ltd.
- Steel Trade: Collins Industries Ltd.
- Drywall, Steel Stud, and Painting: Ideal Contract Services Ltd.
- Sprinkler Trade: Streamline Fire Protection Ltd.

Interviews

- Owner: Crystal Plant And Terri Gosine
- Architect: Eddo Cancian
- Specialty Architect: Greg Hasiuk
- IPD Facilitator: Stephani Carter
- Structural Engineer: Jeffrey Rabinovitch
- Mechanical Engineer: Glen Tichkowsky
- Electrical Engineer: Corey Boulais
- General Contractor: Glenn Cyrankiewicz
- Mechanical Contractor: Rob Nespliak
- Steel Trade: Randy Perry
- Drywall, Steel Stud, and Painting: Harley Chorney
- Sprinkler Trade: Richard Strain

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