Innovative Features of Integrated Project Delivery
Shaping Project Team Communication

Authored by

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ABSTRACT
Innovations in the construction industry offer opportunities for advances in product delivery, collaboration, and product improvement. Integrated project delivery (IPD), an organizational innovation in the construction industry, seeks to improve project outcomes through: a collaborative approach of aligning incentives and goals of project teams; shared risk and reward; early involvement of all parties; and a multiparty agreement. Recent research calls for improved information exchange achieved through project team communication for better project outcomes. The critical questions to be answered are: Can IPD improve team communication with its innovative features? Or would those features become disabling for members of the construction industry when sharing information with other project team members? The aim of this study is to understand how IPD, as an organizational innovation, shapes communication in project teams. The study first lays the theoretical groundwork for process innovations and discusses the innovative features of IPD compared to other delivery methods. An ethnographic investigation of an IPD project is next conducted. The results present innovative features of IPD shaping team communication. Activities mold the integrative nature of the IPD project and their own internal processes as the principles enacting ownership of the project are recognized.

KEYWORDS: Integrated Project Delivery; Innovation; Communication

INTRODUCTION
Innovation can be defined broadly as “an idea, a product or process, system or device that is perceived to be new to an individual, a group of people or firms, an industrial sector or a society as a whole” (Slaughter 1998; Roger 1995).

Dulaimi (2002) recognized a low level of innovation as a significant barrier for the development of the construction industry. However, Slaughter (1998) argued that it occurs consistently throughout the industry sectors. Recent studies in construction innovations feature: technology evolution from computer-aided design (CAD) to building information modeling (BIM) (Azhar 2008), managing cross-cultural differences in a globalizing industry (Park et al. 2011), widespread adoption of green-building approaches (Korkmaz et al. 2010), and new alternative forms of project delivery that redistribute risks (Kent and Gerber 2010).

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One of these alternative forms is integrated project delivery (IPD), defined as "a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harness[es] the talent and insight of all project participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication and construction" (AIA California Council 2007). IPD was initiated to solve inefficiency due to fragmentation within the construction industry by promoting integration among project participants. Integration promotes a working environment in which communication can facilitate a free exchange of information between different project participants (Baiden 2006).

The aim of the study is to understand how IPD as an organizational innovation shapes communication in project teams. This goal is translated into the following objectives: (1) Examine the concept of innovation from a project organization’s perspective, (2) theoretically investigate innovative features of IPD, and (3) explore how IPD shapes team communication within project organizations. To achieve these objectives, the researchers conducted a comprehensive literature review and collected team communication data ethnographically from an IPD project. Findings show how IPD principles and tools were implemented within the observed project and their contribution in shaping team communication. Project activities representing the integrative nature of IPD were recognized, including their functions and challenges in terms of project team communication.

BACKGROUND
Innovation in Organizations
Vakola and Rezgui (2000) state that innovation in process and organization management is necessary for improving existing processes and working practices. Innovation has become the foundation of competitive strategy and a major key to competitive advantage for almost all modern organizations (Harris 2003). All organizations today need to innovate to survive. Literature provides a handful of definitions for innovation. Rogers (2003) defines it as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” Park et al. (2004) term it “the generation, development, and implementation of ideas that are new to an organization and have a practical or commercial benefits.”

The Organization for Economic Cooperation and Development (1992) categorizes innovation in the Oslo Manual as being either “technical” or “organizational.” Technical innovation involves either “product” or “process” innovation, whereas organizational innovation includes changes to organizational structure, introduction of advanced management techniques, and implementation of new corporate strategic orientations. Specifically, Zaltman, Duncan, and Holbek (1973) state that innovation can happen in: (1) a product or service, (2) a production process, (3) an organizational structure, (4) people, and (5) policies. Harris (2003) argues that innovation is the only sustainable source of growth, competitive advantage, and new wealth due to rapid commoditization, time compression, demand-based market, and intense international competition. However, there are three main factors that an organization should assess in deciding which innovation, i.e. its resources, its processes, and its values (Christensen, 2000). An organization should have necessary resources and process in place and its values should support the adoption to be success in implementing the innovation.

Diffusion of innovation, defined as the process in which a new idea, concept or technology has been introduced throughout a social system over a time period (Rogers 1995), has received significant interest from researchers across a wide range of disciplines (Kale and
Arditi 2010). However, innovation research is more focused on traditional, hierarchical organizations while mechanism and rates of innovation in project-based organizations such as construction differ from the more traditional ones (Taylor and Levitt 2004).

Innovation in the Construction Industry
Innovation in the construction industry can take many forms, including advances in product delivery, collaboration, and product improvement. Technical innovations involve either “product” or “process,” whereas organizational innovations include changes to organizational structure, introduction of advanced management techniques, and implementation of new corporate strategic orientations (Maqsood 2006). Bossink (2004) concludes there are four distinguished drivers of innovation in construction:

- Environmental pressure – comprised of the influences that force and stimulate organizations to innovate;
- Technological capability - consisting of technical factors enabling organizations to develop innovative products and processes;
- Knowledge exchange - consisting of the arrangements that facilitate sharing of knowledge and information needed to innovate in and between organizations; and
- Boundary spanning - representing the initiatives to coinnovate across the boundaries of departments, organizations, and partnerships.

Recent studies in the construction industry reveal both process and product innovations such as technology evolutions from computer-aided design (CAD) to building information modeling (BIM) (Azhar et al. 2008), managing cross-cultural differences in a globalizing industry (Park et al. 2011), adoption of green-building approaches (Potbhare et al. 2009) and green-building products such as photovoltaics (Lippiatt 1999), and new alternative forms of project delivery (i.e. IPD) that redistribute risks among project participants (Kent and Gerber 2010).

Recent research on sustainable building delivery calls for innovative delivery practices to improve team integration (Riley and Horman 2005; Lapinski et al. 2006; Horman et al. 2006; 7 Group 2009; Korkmaz et al. 2007; Enache and Horman 2009; Korkmaz et al. 2010; Swarup et al. 2011). Characterized by technical systems with high levels of interdependency and interaction, sustainable buildings demand increased levels of design collaboration and coordination between structural, envelope, mechanical, electrical, and architectural systems during design (Magent et al. 2009). This interdisciplinary interaction suggests that attributes such as early involvement of participants (Riley and Horman 2005), team experience (GSA 2004), levels and methods of communication, and compatibility within project teams result in better outcomes (Lapinski et al. 2006; Korkmaz et al. 2010; 7 Group 2009; Enache- Pommer and Horman 2009).

Communication in Organizations and the Construction Industry
Organizations enable teamwork through design and support. According to Hollenbeck, Beersma, and Schouten (in press), teams vary in the length of time they are created to endure, heterogeneous versus homogenous skill sets, and self-managing versus being led by a powerful supervisor. The appropriateness of team design to the construction industry therefore depends upon the organization’s aims and available expertise among potential team members. In general, teams whose members have a range of skills, and who share information with each other and
establish norms for working through disagreements and divergent points of view, are well suited for tackling complex issues (Kozlowski and Bell 2003; LaFasto and Larson 2001).

Teams also require support from top management if they are going to be effective over a long period of time (Poole 2001). Specifically, teams function best when organizational leaders do not take away their authority, create competing policies, give more than “lip service” to the implementation of the team’s decisions, and do not overrule team decisions. These acts demoralize team members and lead to cynicism among rank-and-file employees (Reichers, Wanous, and Austin 1997). At the same time, team members must find ways to resolve disagreements stemming from divergent values, share information among members, and create an open communication climate where disagreements can be voiced (Poole 2001). Team members must also develop procedures for organizing their processes in an effective manner, allowing for candid but constructive feedback and suggestions, engaging all members in major decisions, and developing ways to negotiate divergent opinions about courses of action. Consonant with organizational efforts to foster creativity, successful innovations are likely to be characterized by perceptions of openness in acceptance of negative feedback and willingness to receive suggestions from all ranks (Axtell et al. 2000; Redding 1972).

Of particular importance to innovations in construction processes, the diffusion of innovation relies heavily on the participation of all parties in goal setting, problem-solving efforts, and decision making. To obtain meaningful buy-in for innovative processes, Lewis, Hamel, and Richardson (2001) point to the need for consensus building among parties. Yet they posit that achievement of consensus derives not a “marketing” or sales blitz to members, but instead comes from low-efficiency meetings that stress equal participation.

Chinowsky et al. (2008) mention that project success depends on two main elements; management of technical components, such as tasks and resources, and effective collaboration between project participants. They emphasize that these collaborative works face some challenges due to the fact that they are organized as project based where the project participant has little or no previous connection and is forced to move from the formation and collaboration stages in such a short period of time. Pekericli et al. (2003) state that there are information dependencies within construction project organizations. Interactions as well as communication by project participants with other organizations involved are as important as internal communication within the individual organization. Chinowsky and Taylor (2007) conclude that since each individual or organization within a project brings a set of skills and knowledge to the network, leadership that motivates teams to innovate, adapt, and learn is needed to allow the system to be successful.

METHODODOLOGY
To understand how IPD as an organizational innovation shapes team communication in project organizations, the authors first conducted a theoretical investigation through a comprehensive literature review on the innovative features of IPD. The authors then did an ethnographic study to understand how these features shape project team communication.

Developed by anthropologists to study human culture (Spradley 1979), ethnography can be used to understand how project participants create, exchange, and communicate information during the design and construction process and what methods facilitate their communication (Hartmann et al. 2009). The first author of this paper has been involved as an embedded participant in the selected project for the past six months, ever since the preconstruction activities began. During this time, she was involved in formal/informal communication of all project
participants, including attending meetings (both “actual” and online), joining the project’s “daily huddle,” and have access to email communication. Field notes and meeting minutes were also recorded for use in this study. For reliability purposes, audio recording in certain meetings was also done. The first author also has access to the online tool used to manage documents and other project information. The findings reported in this paper are the combined results of the theoretical investigation and ethnographic study of the selected IPD project.

THEORETICAL INVESTIGATION OF IPD AS AN INNOVATION IN CONSTRUCTION

Project delivery processes include programming, procurement, design, construction, and turnover (Lapinski et al. 2006). Project delivery systems define how projects teams form, their working relationship, levels of involvement over project timelines, and incentives to encourage contribution to the project. Common project delivery systems in the United States include design-bid-build, design-build, and construction management at risk. Each system has a different process and involves various relations between project participants.

Project delivery methods for construction projects have been evolving over the years (Konchard and Sanvido 1998; Konchard and Sanvido 1999). Before the 20th century, an owner used to hire a master builder to handle the entire design and construction process. As buildings began to require more sophistication, specialization in design and construction was needed, leading to the traditional design-bid-build method (DBB). However, this specialization created fragmentation that caused inefficiency and interoperability problems. To solve them, construction management (CM) was introduced in the 1970s and 1980s. During the same time, the design-build (DB) method was developed to improve project performance through the collaborative approach of designer and contractor. The industry has become more and more fragmented, however, with extra specialization areas. Each component seeks only its own success and benefits. There is a call for additional energy-efficient and sustainable architectural, engineering, and construction practices. Consequently, an organizational innovation that can impact the way project teams work in an integrated manner with a whole systems-thinking mindset is needed (Lapinski et al., 2006). Greater numbers of people in the industry have started to talk about how they can establish integrated delivery practices in their projects.

In response to this need, an alternative delivery method called IPD has emerged recently (AIA 2007). Sive (2009) summarizes the factors driving increased adoption of IPD as follows:

- Market demands: The construction industry still suffers problems that lead to over-budget and over-schedule delivery. This condition creates demands for new, efficient, and reliable processes that can produce predictable outcomes.

- Industry desires: Support for IPD also comes from architects, contractors, engineers, and other project participants who have to deal with problems caused by lack of coordination, poor communication, missed information, change orders, and cost overruns. They see IPD as a solution to these problems, one that can enable internal efficiencies, improve quality, and show greater profit.

- Technology drivers: Availability of technology that supports IPD implementation, such as BIM increasing the adoption of IPD as the delivery method.

- Sustainability pressure: Achieving sustainability as another criterion for project success requires robust interdisciplinary development of options and analysis of tradeoffs and choices. IPD enables construction teams to work in an integrated manner with a whole systems-thinking mindset.
Collaborative style: The construction industry, as well as other industries, values a collaborative working culture as one solution for ongoing inefficiency. A culture of collaboration has become a social trend supported by personal values of people in the industry.

A consensus document developed by the National Association of State Facilities Administrators (NASFA), Construction Owners Association of America (COAA), Association of Higher Education Facilities Officers (AHEFO), Associated General Contractors of America (AGC), and American Institute of Architects (AIA) highlighted innovative features in which IPD differs from traditional project delivery.

Practically, those innovative features of IPD are implemented using a number of tools and approaches. Some IPD devices come from Lean Project Delivery (LPD), a “production management-based” approach to project delivery developed by the Lean Construction Institute (LCI). The following section outlines important components and tools for IPD collaboration, including lean methodologies such as process planning, target design value, pull scheduling, and set based design (Sive 2009; Kim and Dossick 2011; Kent and Gerber 2010; Smith et al. 2011; Singleton and Hamzeh 2011):

- **Integrated Form of Agreement:** Unlike contracting in traditional project deliveries, all the parties (including owner, designers, constructor, and trade partners) join into a single agreement requiring them to share risks and rewards. This cooperation encourages everyone on the team to think of the project first, since their commercial interests are clearly bound up with the overall success of the project.

- **Process Planning:** IPD emphasizes process planning even at the early project stages. Robust planning is conducted to define how the design and construction processes will be performed. Workflow is mapped out with the involvement of all relevant participants, instead of directed only by the owner.

- **Charrettes:** Design processes are conducted as group work. Options are created, analyzed, and decided in group working sessions. Unlike traditional-method delivery, meetings in an IPD project are not assigned only for making decision, but also function as working sessions for all project participants.

- **Building Information Modeling (BIM):** BIM is used not only for the technical design process. It also facilitates coordination among all project participants, as well as improves visualization and fosters interdisciplinary collaboration that leads to team integration.

- **Target Design Value (TDV):** In IPD, design is conducted to fulfill owner’s need and expectation under an allowable budget. To achieve this, verification of owner’s needs is conducted robustly. Unlike in the traditional design-bid-build delivery method, where the designer finished the design first and defined the cost to actually build it, design is conducted to achieve the maximum value the owner can received within the allowable budget.

- **Pull Scheduling:** IPD expects each participant to produce only the level of design documentation of a particular component needed by the next member of the team. Schedules start with milestones and long-lead items. Detail is developed by all those responsible for identifying specific needs and exploring the most efficient sequence. The team can decide when to invest more or less effort to produce the information needed.

- **Set-Based Design:** Set-based design is the parallel development of multiple design solutions for a given element, until it is absolutely necessary for one solution to be chosen. The benefit is ensuring the best decision, not the most expedient. Balancing the additional effort of set-based design are the efficiencies gained from pull scheduling and other methodologies.
Detailing and production commitments are made at the “last responsible moment,” so that effort is spent only on what is needed, and early work by one discipline does not needlessly limit another.

The ethnography study used this paper observed that to use these tools in the design and construction process, the project should develop and occupy some other activities/tools. For example, to facilitate process planning, charrettes and pull scheduling, the project need to manage appropriate project meetings. These activities and tools will be described in later sections of this paper.

COMMUNICATION IN INTEGRATED PROJECT DELIVERY
As mentioned earlier, IPD was proposed to overcome problems caused by fragmentation within the construction organizations by improving project procurement and product delivery processes to achieve team integration. Integration can be considered as the merging of different disciplines or organizations with different goals, needs, and cultures into a cohesive and mutually supporting unit (Austin et al. 2002; Jaafari and Manifong, 1999). In defining integrated construction project teams as highly effective and efficient collaborative teams responsible for the design and construction of a project, Baiden (2006) posits that integrated project teams: have a single focus and objective for the project, operate without boundaries among the various organization members, work toward mutually beneficial outcomes by ensuring all members support one other and share achievements, are able to predict more accurate time and cost estimates by fully utilizing the collective skills and expertise of all parties, share information freely among members so access is not restricted to specific professions and organizational units within each team, have flexible member composition to be able to respond to change over duration of a project, have a new identity and are colocated (usually in a given common space), offer members equal opportunities to contribute to the delivery process, operate in an atmosphere where relationships are equitable and members are respected, and have a “no blame” culture.

Adopting Anumba et al. (1997) and Fussel et al. (1998), one common factor by which to achieve all of Baiden’s integration dimensions is communication. As Baiden (2006) concludes, integration, as the final objective of IPD, promotes a working environment where communication can facilitate free exchange of information between different project participants. However, Kent and Gerber (2005) argue that although there has been a huge interest in IPD in principle, and several projects have demonstrated its benefits, many people in the industry are still looking for more evidence to adopt IPD fully as a project delivery method. There are also cultural, procedural, and organizational barriers to adopting the use of IPD within the construction industry. How a suggested delivery method, such as IPD, can facilitate team better communication remains unanswered.

PROJECT DESCRIPTION FOR THE ETHNOGRAPHIC STUDY
The project used in the ethnography study is the renovation of a dining center at a residence hall on a university campus. The project scope includes some other minor renovation elements to the existing structure. The allowable budget of the project is 11.7 million dollars.

Using IPD as the delivery method, the project implements lean construction principles and practices throughout, starting from the preconstruction phase including pull scheduling, charrettes, TDV, etc. The preconstruction period is divided into four phases: validation
(programming), conceptual (conceptual design), design development, and construction drawings. Currently the project is at the design development phase. The construction phase is expected to start in May 2012 and finish by the end of 2012. BIM is to be used at later stages of the project, starting from the design development phase.

The delivery process of the project is managed by the Engineering and Architectural Services (EAS) of the university while the “actual” owner of the project is the Residential and Housing Services Unit (RHS). Parties involved in the multiparty agreement include the designer and engineers, and the contractor. Since the beginning of the design development phase, the mechanical, electrical, and plumbing (MEP) trade partners have been involved in the preconstruction process. As facilitator for the IPD process, all parties selected one person of the EAS to be the “project steward.”

RESULTS
Based on observation of project activities, five primary and two minor tools all shape the integrative nature of the IPD project which in turn shape its own internal processes as the principles enact ownership of the project as presented in Table 1.

IPD Training Session
This project is the first IPD project for all participants (owner, designer, contractor, consultants, and trade partners). To facilitate IPD learning, the owner hired a specialist. During six months of the preconstruction phase, four two-day training sessions were conducted. All project team members attended these sessions where they learned about IPD, why it is used and how it is different from other delivery methods. The participants learned about tools used in IPD in general (as described in the previous section) and particular tools to be used in this project described in this section. As the project progressed, the training sessions also functioned as: 1) working sessions, where actual works such as pull scheduling and design decision making were conducted, and 2) retrospective analysis sessions, where the trainer asked the participants to evaluate of the team’s IPD spirit.

As reported in 1, the IPD Training Session offered an opportunity for the various parties to learn the vocabulary and become acquainted with information-sharing methods that would later be used in the regular group meetings. This event was a critical point in the project team’s evolution, partly because the training facilitated development of informal relationships between parties, and taught them how much common ground they shared (Lewis et al. 2001). However, the Training Sessions also enabled individuals to develop information exchange skill sets, fundamental to any long-term team endeavor (LaFasto and Larson 2001). Equivalent skill sets, whether in information sharing or knowledge of processes, are essential to coordinated action and make possible “in the moment” responses with shared responsibilities or duties (Eisenberg 1990). Easily overlooked as well is the development of a team’s internal culture, separate from its primary organizational affiliation. The internal team culture in this case coincides with the development of shared norms within the group (Poole 2011), which have acted to reinforce lessons learned in the training and continue to generate expectations for participation in Project Meetings.

Project Meetings
During the pre-construction stages, project meetings were conducted on a weekly basis. Meetings were categorized into Project Implementation Team (PIT) meetings and Project Management Team (PMT) meetings. PIT meetings functioned more as working sessions where
technical aspects of the project were discussed while PMT meetings address management issues such as contract, sub-contractor method of selection, etc.

Both PIT and PMT Meetings were conducted in the project’s “big room” functioning as “the integrated office” of all project participants. The room was occupied with teleconference equipment to allow some participants joining from remote locations. Some of the meetings involved project stakeholders such as the university dining hall chef, students using the current dining hall, faculty and staff from offices around the dining hall and other related units such as the recycling center and the campus police. These stakeholders were expected to give inputs to the design in progress. At some points, they were also involved in the decision making process.

During these meetings, design process was conducted from scratch. Unlike traditional projects, inputs were given even before the architects develop any drawings. All relevant stakeholders were involved in the decision making process. Options were elaborated deeply and kept open until the last possible moment. Meetings are functioned not only for making but also as working session where team members works together in the actual design process.

Project Meetings provide opportunities for public information updates, solicit feedback that may or may not have been sought in private meetings, and showcase the team’s workings for other stakeholders (Cohen and Bailey 1997; Lewis et al. 2001). Primary political stakeholders who attend Project Meetings receive a weekly update on the projects’ progress and setbacks. In complicated, costly, and public projects, a mechanism by which information can be relayed to all key parties in person is most advantageous (Tompkins 1993).

**Daily Huddle**

The Project Meetings also offer a forum for formal negotiations among parties — formal in the sense that most issues have been discussed in other venues, such as the Daily Huddle. This “huddle,” attended by the primary representatives of all contracting organizations and owners, consists of quick commentaries, queries, and reports... More than anything, the Daily Huddle provides participants with an informal negotiation venue, where the overriding framework is a problem-solving one and issues can be aired in a constructive, exploratory manner.

Daily huddle is a fifteen – thirty minutes phone conversation addressing issues related to current tasks that team members committed to perform individually. So, it functioned more as coordination meeting. Information regarding whether a task has been completed by the relevant party or not and problems encountered in performing the task is presented and recorded in the commitment log.

The Daily Huddle, then, provides another critical element in the innovative IPD effort. Its integrative outcome represents the best of the theoretical intentions of moving individuals from an independent ambivalent (toward others, at best) orientation toward one where participants have a stake in each other’s success and show mutual concern for others’ progress (Sive 2009). Such orientations foster only where there is openness (Lewis et al. 2001; Redding 1972) and perceptions of support and psychological safety (Edmundson 1999; LaFasto and Larson 2001). The nurturing of the Daily Huddle is, in part, the responsibility of the participants and is under their ownership (Hollenbeck et al., in press; Lewis et al. 2001), and who accordingly are championing the IPD innovation.

**Project Steward**

Project steward is the person selected from the EAS as the facilitator of the project management. One interesting note of the steward of this project is that she actually was not assigned to work on this project from the beginning. She was invited to the training session to learn about IPD. During the second training session, the trainer introduced the concept of project steward in IPD
and promoted her to be the project steward due to her active involvement and interest in the IPD training. All project participants agreed to this.

The main job of the project steward is not directly related to the project’s technical aspects. Her role is facilitating project management activities such as meetings, project documentation, and task management including the daily huddle. However, her previous experience in managing the owner’s construction projects gave her advantages to understand the technical aspects of the project. The project steward is also playing an important role in maintaining the IPD spirit of the project participants. An example of this role is reminding the team members to keep their commitments. This role requires considerable skill in integrating various parties’ concerns, acting as a liaison (i.e., not a member of any stakeholder group but interacts with all groups), coordinator, and energizer. This position is pivotal in the sense that the Steward connects with all parties. The Steward must exercise political savvy in advocating cooperation, as well as sticking to agreements and timelines, and present the “face” of the project to the public. Druskat and Wheeler (2003) note that effective leadership of self-managing teams requires strong interpersonal and group process skills as well as external skills of information seeking and giving — plus advocacy and negotiation.

**Commitment Log**

The Commitment Log provides a public record of project accomplishments and future tasks. It was updated daily by the project steward. The information recorded in the commitment log include task description, performer, customer of the task, deadline of completion, actual completion date, and constraints faced in performing the tasks.

Outwardly, the commitment log shows the progress of the endeavor and challenges ahead, much like a Gantt Chart. Inwardly, its creation is a function of the IPD Training Session, Project Meetings, Daily Huddles, and Project Steward’s labors. The extent to which the tasks are accomplished in an integrative fashion is known only by the stakeholders themselves (Tompkins 1993).

**A3 Documents and Project Newsletters**

A3 Documents and Project Newsletters present the aims of the project to the public but do not show the difficulty or ease of collaboration. Yet A3 Documents and Newsletters may be useful in winning over external stakeholders embedded within each of the participating firms. When project team members bring “outsiders” to Project Meetings or relay the ebb and flow of the construction project, they serve as linking pins (Likert 1961) to a wider audience whose support or opposition may be crucial to the adoption of IPD innovations in future projects (Rogers 1995).

The tools explained in the section above enable communication among team members. However, some challenges can still be observed. Changes in the delivery method require changes in attitude toward the project, which cannot be done easily. For example, at the early stage, the RHS did not specifically mention their condition of satisfaction, nor give authority to make decision to its project meeting representative. It creates negative iteration in the decision made. Some decisions that have been discussed and decided need to be rediscussed or decided again. Reluctance to elaborate on different options before making decisions are also observed. For example,

**DISCUSSION**

Wolfe (1994) defines the stages of process innovation in organizations as: idea conception, awareness, matching, appraisal, persuasion, adoption decision, implementation, confirmation, routinization, and infusion. Rogers (1995) summarizes these stages as; (1) knowledge: the
process of being exposed to an innovation’s existence and gaining some understanding on how the innovation is functioning, (2) persuasion: the process of forming a favorable or unfavorable attitude toward the innovation, (3) decision: the process of engaging in activities that lead to a decision to adopt or reject the innovation, (4) implementation: the process of adopting the innovation, and (5) confirmation: the process of continuing or discontinuing the adoption of the innovation. Observation on IPD adoption in the project shows there is no strong line separating the innovation adoption process. For example, even though project participants have made a decision to adopt IPD as the delivery method for the project, the process of persuasion in how the team members should behave in accordance with the IPD spirit is still happening. Meeting observation shows that at some point, certain project participants tend to move back to the traditional delivery process. For instance, they tend to make decisions at the earliest possible moment. Ignoring the set-based design principle, options available were not fully considered before the decision was made. The IPD training sessions help this persuasion process. During the training sessions, project participants frequently tried to get confirmation from the trainer or other participants on whether or not they were performing an appropriate procedure according to IPD spirit.

The tools explained in the section above enable communication among team members. However, some challenges can still be observed. Changes in the delivery method require changes in attitude toward the project, which cannot be done easily. For example, at the early stage, the RHS did not specifically mention their condition of satisfaction, nor give authority to make decision to its project meeting representative. It creates negative iteration in the decision made. Some decisions that have been discussed and decided need to be rediscussed or decided again. Reluctance to elaborate on different options before making decisions are also observed.

The study also shows that the project team needs to translate innovative features of IPD into actual tools implemented during the design and construction process. Tools such as training sessions, commitment logs, and project meetings will shape team communication processes and also facilitate innovation processes within the project organization. The role of the Project Steward, then, is especially critical in facilitating information sharing and encouraging individuals to participate and follow through on their agreements to engage in the IPD process. Collectively, open communication patterns and protocol observance are necessary to IPD success, but not sufficient. Individuals in liaison and instigating roles (LaFasto & Larson, 2001; Poole, 2011) must also actively advocate and enact IPD principles for such projects to result in their promised outcomes.

CONCLUSIONS
Innovative features of IPD that shape team communications based on theoretical investigation are: Integrated Form of Agreement, Process Planning, Charrettes, Building Information Modeling (BIM), Target Design Value (TDV), and Pull Scheduling: Set-Based Design. Our ethnographic study shows how features listed in the literature are actually implemented in the project through particular tools. Several recognized devices for shaping project team communication include IPD Training Session, Project Meetings, Daily Huddle, Project Steward, Commitment Log, and A3’s Documents and Project Newsletters. These tools can improve interactions among members, but a credible advocate and facilitator such as the Project Steward may be necessary for project success.
It is not surprising that some project members do not fully embrace the adoption of IPD. Resistance to information sharing and collaboration can disable the tools’ functions and create challenges for the way the team should work.

Although there have been communication loops at early validation phases of the project, such as “negative iteration” in the design process, they are likely to benefit the project in the long run. One thing that should be noted in the observed project is the high learning spirit among the major project participants in the IPD adoption process. It is believed that this spirit will play a key role in the project outcomes.

A limitation of this study is that there is only one project being observed. It offers great insight about team communication, however. Another limitation is that there are no team members experienced with IPD on the observed project. Since IPD is a very learning-intensive process, the ability of the project team members to fully implement IPD might be questionable. While the training sessions can address this problem, they might not be adequate to make the project team members fluent in IPD. Such a limitation is however expected in any study involving innovations but still will be considered when conducting following case studies. Observations from this study will be continued in other projects for further understanding of the team communication and integration phenomena, and in whether adoption of IPD enables project organizations in those directions.

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Table 1. Summary of IPD Communication Activity, Function, and Challenges

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<th>Tools</th>
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<tbody>
<tr>
<td>IPD Training</td>
<td>Development of IPD process</td>
<td>Quality training experience,</td>
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<tr>
<td>Meetings</td>
<td>Experience Viewed As Worthwhile from Participants’ Perspectives, Development of Relationships</td>
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<tr>
<td>Project Meetings</td>
<td>Information Updates, Feedback Solicited and Given, Problem-Solving, Formal Negotiation, Internal and External Network Contacts</td>
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<tr>
<td>Daily Huddle</td>
<td>Feedback, Problem-Solving, Informal Negotiation, Comraderie, Identifying Network Contacts</td>
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<td>Project Steward</td>
<td>Integrator Role, Liaison, Coordinator, Energizer</td>
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<tr>
<td>Commitment Log</td>
<td>Public Record of Accomplishments and Future Tasks</td>
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<tr>
<td>A3’s Documents and Project Newsletter</td>
<td>Public Relations Tool to Team Members and Public</td>
<td></td>
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</tbody>
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Professional Presentation, Timeliness, Dissemination to Appropriate Audience