

Electrical Contractors and Integrated Project Delivery

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Integrated Project Delivery (IPD) is a project delivery system that has the potential to address the inefficiencies inherent in today's construction industry. Being an emerging project delivery system, comparatively little research has been performed on IPD. Furthermore, very little of this research focuses on specialized subcontractors such as electrical contractors (ECs). The purpose of this research is to develop a better understanding of the point of view retained by ECs with respect to IPD. The authors conducted interviews with two different groups of ECs, one without experience working in IPD projects and one with experience working in IPD projects, to identify their points of view with respect to a multitude of topics revolving around IPD. The findings from the interviews with ECs without IPD experience show that they have both optimism for and concerns about IPD. The findings from the interviews with ECs with IPD experience show that overall, they have been happy with the IPD projects they participated in with the exception of schedule issues. Future research is encouraged to further investigate the topics discussed herein for other specialized subcontractors as well.

Key Words: Project Delivery Systems, Integrated Project Delivery (IPD), Electrical Contractors

Introduction

In the construction industry, owners are increasingly demanding collaborative processes that result in increased productivity, and reduced requests for information, field conflicts, waste, and project schedules (AIA, 2007). In 2009, the Financial Management Institute (FMI) and the Construction Management Association of America (CMAA) surveyed owners. When asked to define the greatest improvement potential for the construction industry, the most popular response included "more use of integrated project delivery" (FMI, 2009).

Integrated Project Delivery (IPD) is an emerging project delivery system that has the potential to address the inefficiencies inherent in today's construction industry. IPD is defined as: "*a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.*" (AIA, 2007, p. 1). Although IPD is still in its development stage, several stakeholders have reported success in terms of cost, time, and quality as obtained through the utilization of IPD in construction projects. Some examples of these projects are Giants-Jet Stadium, Las Vegas Convention Center, and One Market Street Autodesk Building (Yoders, 2008).

Electrical Contractors (ECs) specialize in the design, installation, and maintenance of electrical systems (NECA, 2014). Similar to the rest of the construction industry, ECs have felt the impact of the recent economic downturn. A 2010 study reported that 40% of surveyed ECs had to lay off employees in the prior 18 month period. The study also found that compared to 2008, a significantly higher percentage of ECs reported that their annual revenues were less than $250,000, indicating shrinking revenues (Kelly, 2010). Furthermore, productivity losses ranging from 25-40% are common for ECs to incur on a typical project. Some of the causes include jobsite congestion, out-of-sequence work, lack of information, and change orders (Thomas & Oloufa, 2001). ECs have the potential to address these issues by taking advantage of IPD's collaborative process.

Research Purpose

For the commonly-used (traditional) project delivery systems (i.e., design-bid-build, design-build, construction manager at risk, and multiple-prime contracting), there is an abundant number of studies. Those studies discuss how risks are allocated and handled, what the advantages and disadvantages of using each system are, and the areas of concerns and conflicts. Those studies also provide decision support as to which commonly-used project delivery

system to choose in a given scenario (Konchar, 1997; Konchar & Sanvido, 1998; Luzzatto, Guggemos, & Khattab, 2007; Oyetunji, 2001; Plugge, 2007). However, being an emerging project delivery system, comparatively little research has been performed on IPD. Furthermore, very little of this research focuses on specialized subcontractors such as ECs. Preliminary findings of a study which conducted interviews with multiple stakeholders showed that specialized subcontractors could be more likely to be reluctant in participating in projects using IPD. This is mainly because they are normally involved in a construction project for a short period of time and have a limited scope of work; whereas in a project using IPD, they need to be involved in the project for much longer, i.e., starting with the design phase, that may cost them more time and money (Ozbek & Youssef, 2010). This reluctance can cause major deficiencies in the IPD system, as integrating all project participants (regardless of their scopes of work and the time they will spend in a project) is one of the key attributes that will make IPD successful for a given project. On the other hand, it has also been reported, in a recent study about the electrical contracting industry, that over 80% of ECs state that they already have a medium or high ability to influence the overall design; and that in the last few years, ECs have made an effort to be involved earlier in design collaboration (Kelly, 2010).

Given all of these, the purpose of this research is to develop a better understanding of the point of view retained by ECs with respect to IPD. As such, the authors conducted interviews with two different groups of ECs, one without experience working in projects using IPD and one with experience working in projects using IPD, to identify their points of view with respect to a multitude of topics revolving around IPD.

Literature Review

IPD is an emerging project delivery system details of which were formalized rather recently (AIA, 2007). According to AIA, being "integrated" is accomplished by bringing in all participants over the project lifetime from conceptualization until the project closeout (AIA, 2007). These participants are normally the owner, architects, engineers, general contractor, specialized subcontractors and vendors, and review agencies. The key is to bring the parties together early in the life cycle of the project. This way, they will all share their expertise as early as possible and minimize risks before construction physically starts (AIA, 2007).

IPD's contractual principles take a more aggressive approach than other collaborative delivery systems such as design-build which also depend on similar behavioral principles such as mutual respect and trust, willingness to collaborate, and open communication (Lewis, 2012). IPD depends on a shared risk/reward model. The main idea behind this model is that a specific amount for the total project cost is established at the beginning and then any cost underrun or overrun is shared by all of the project participants. Therefore, project participants benefit together when there are project cost savings and mutually share the risk of cost overruns. In other words, the financial success of an individual stakeholder is dependent on the financial success of the overall project (AIA, 2007; Thomsen, Darrington, Dunne, & Lichtig, 2009). Additionally, some other contractual principles of IPD are liability waivers and fiscal transparency between key participants and that IPD stakeholders are bound together contractually through a multi-party agreement (Lewis, 2012).

Electrical contracting industry in the US is valued at over $130 billion/year. It is made up of over 70,000 electrical contracting firms with 650,000 electrical workers (NECA, 2014). ECs can be categorized by the type of work they perform, e.g., outside or inside (NECA, 2014). About 70% of ECs have less than 10 employees and earn less than $1 million/year. 8% of companies have more than 100 employees. On average, ECs earn more of their revenue from commercial, industrial, and institutional (CII) projects than from residential or non-building projects. Companies with less than 10 employees perform much more residential work, whereas larger companies perform more CII and non-building work (Kelly, 2010).

Methodology

To be able to achieve the purpose of this research, the qualitative research methodology was used with interviews as the main data collection tool (Creswell, 2009). Two sets of interview questions were developed. The "Without IPD Experience" questions were developed for ECs with no previous experience working in a project that used IPD. For the participants with previous experience with IPD projects, the "With IPD Experience" questions were developed.

To be able to develop interview questions that would help the authors collect the necessary information to achieve the purpose of this research, a thorough literature review was performed.

Even though much effort was made to recruit more professionals, the authors were able to interview a total of 13 professionals from the electrical construction industry (7 without IPD experience and 6 with IPD experience) to gather the findings as reported in their respective sections in this paper. ECs without IPD experience had different number of employees and revenues ranging from $250 K to exceeding $25 M. All of the ECs with IPD experience had more than 100 employees and revenues exceeding $25 million. Although interviewing more professionals could have potentially resulted in more findings (and this is acknowledged as a possible limitation of this research), it is important to note that this research is an initial attempt at collecting and presenting information with respect to ECs' thoughts on IPD; as such the findings presented herein are aimed at starting the discussion and motivating possible future research on the topic as outlined in the "Conclusions and Future Research" section of this paper. Furthermore, as Creswell (2009) suggests, the qualitative research does not necessarily require the selection of a large number of interviewees as typically is the case for quantitative research for data points (Creswell, 2009).

The majority of interviews were conducted via telephone. The interviews were semi-structured in format, where predefined topics (developed by the authors as a result of the literature review process) were introduced and the respondents expressed their thoughts. Depending on the response, the respondent was prompted to expand on an idea, or was asked a follow-up question (Fellows & Liu, 2008).

Findings from the Interviews with ECs without IPD Experience

Encouraging and Discouraging Factors to Pursue IPD Projects

In the context of the economic downturn in recent years, the majority of respondents were open to the idea of pursuing IPD projects in order to expand their services and become more profitable. All ECs mentioned that their major issue with the traditional delivery system is their lack of early involvement; and IPD's potential to addresses that issue is an encouraging factor for them to participate in IPD. ECs that had experience with similar collaborative delivery systems such as design-build were more open to consider pursuing IPD and stated that IPD's early collaboration potential and potential to give them more control of the construction process (even more so than design-build) would eventually allow it to achieve wider adoption as in the case of design-build. Overall, ECs believed that early collaboration would help them have a more definitive picture of what a project is going to look like. This in turn would improve workflow, enable clash detection between trades, and reduce the number of change orders.

However, ECs also took the opportunity to discuss issues/concerns with IPD. The fact that IPD is a new delivery system that has only been utilized in a relatively small number of projects was a discouraging factor for some ECs. They went on to say that there is not enough historical financial data from projects that show the potential for increasing the profit margins of ECs. The respondents also emphasized the fact that IPD is mainly utilized on large/complex projects. They stated that ECs who lack experience with large/complex projects would not be as willing to pursue IPD. The respondents did not like the fact that they would have to participate in a shared risk/reward system with stakeholders who have traditionally been adversaries. In discussing this, one interviewee stated how they would have to change their organization's overall mentality and business model in order to be successful with IPD. Another respondent could not justify the requirement for increased time commitments inherent in IPD due to the size and limited scope of work of the projects they complete. Furthermore, one respondent emphasized the fact that pursuing IPD would require additional overhead for research and development. This overhead would offset the slim profit margins from the low volume of work being completed.

As a whole, the willingness of the respondents to pursue IPD was dependent on their knowledge of- and experience with- the other members of the project team. In other words, ECs would only be willing to participate in IPD projects if they know the other team members and/or have had good experiences working with them. This is important as with the shared risk/reward model, EC's profit margins would be dictated by the rest of the IPD team.

Upfront Investment Required by IPD

Upfront investments would include providing design input and potential building information models during design (which could take a long time depending on the complexity of the project); which is not necessarily the case in a design-bid-build approach in which an EC's scope of work is limited to just installing the electrical systems. ECs that had experience with project delivery systems similar to IPD were more open to increased upfront investments. One EC discussed their involvement with design-build and design-assist projects, expressing no issues with increased investment in terms of increased time commitments (indirect costs). Another respondent was open to the idea because of their previous experience involving the increased upfront costs of value engineering. This respondent described how they try to assist early to get the required information necessary to provide the best value to the customer, while reducing risk in the process. The respondent went on to say that they would welcome the opportunity to do this process more formally in order to incorporate it into their compensation model, rather than trying to do it as an added value approach.

The interviewees who didn't have experience with project delivery systems similar to IPD were not as open to an increase in upfront investments. Some of the respondents feared that the unsatisfactory performance of one stakeholder could eliminate the return on investment (ROI) for the entire IPD team (due to the shared risk/reward concept). Another EC stated that the potential for a higher ROI with an increased upfront investment is only in theory, and may not apply to every construction project. This respondent added that under lien law, legal recourse to recover money invested in a project only applies to the actual product installed. Therefore the upfront investment for design input and creation of a building information model would be lost if the owner went under.

Notwithstanding some concerns from a few ECs, in general, all of the respondents were open to the increased upfront investments inherent in IPD, as long as they had adequate knowledge of and trust in the project team.

Issues with Shared Risk/Reward

The respondents did place various conditions they wanted to be met in order to participate in shared risk/reward. The majority wanted to have a prior business relationship with the members of the project team, or at least have the knowledge that the stakeholders were trustworthy companies who regularly complete quality work on time and under budget. One respondent added that they would like to be part of the team deciding on the initial contingencies. Two other respondents stated that they would like to have prior knowledge of how much profit they stand to lose in the case of cost overruns.

Respondents also had issues with the owner being in charge of determining the criteria, amount, and distribution date of rewards on IPD projects. Two respondents suggested that a third party decision-maker would be more appropriate, as she/he could act as an impartial party in the process.

Issues with Building Information Modeling (BIM)

ECs with no BIM experience were asked if they anticipated any issues with utilizing the technology, given that it is an important component of IPD projects. They acknowledged the benefits of BIM, but felt it was better suited for contractors who work on large and complex projects. They went on to say that there is simply too much time and money required to input data and integrate the systems. ECs with prior BIM experience stated that there could be potential issues with integrating BIM layers, due to the fact that the other stakeholders may be using different BIM software platforms.

Findings from the Interviews with ECs with IPD Experience

Getting Involved in a Project Using IPD

The respondents first discussed how their companies originally became involved in a project using IPD. The majority expressed that they had prior relationships with stakeholders who approached them to participate in their

first IPD project. Each respondent also mentioned their company's experience working on collaborative systems like design-build, and that this was necessary in order to establish credibility as a qualified stakeholder. This experience allowed their organization to have many of the processes and procedures required by IPD already in place prior to being accepted onto a team. Many of the respondents also had previous experience with projects that are ideal for IPD, such as large medical facilities. One respondent mentioned that they wanted to pursue IPD to expand their services and become the "industry leader."

A few respondents discussed how their companies had to change and embrace the IPD mindset in order to participate in an IPD project. The majority expressed that they had to be much more involved with all project stakeholders. This included increased communication and incorporating the feedback obtained from other team members into their decision making. They also noted that it was a challenge to remove the adversarial relationship with other stakeholders, which was common under traditional delivery systems. According to the respondents, IPD requires increased effort by ECs, in order to put differences aside and work through problems when they arise. One EC cited the process of clash detection as an example of the importance of putting differences aside for the good of the project team and stated: "*With clash detection, if there is not a committed team, nobody will want to compromise on equipment location. We all make sacrifices at some point.*" ECs also need an understanding of what all stakeholders are trying to accomplish, essentially thinking from the role of the owner, designer, general contractor, and other subcontractors.

Contract Negotiations and Claims

Five of the six ECs stated that they had no more issues with IPD contract negotiations than they would have with the negotiations for traditional delivery system contracts. In fact, one respondent discussed a particularly fast contract negotiation period, where the contract was signed two weeks after the interview process. This was mainly due to the willingness of all of the IPD stakeholders to get the project moving forward without getting caught up in the contract negotiation process. All of the respondents stated they have never filed a claim on any IPD project they worked on. In terms of shared risk/reward pool, the respondents who contributed to the pool contributed between 5% and 13.5% of their contract prices.

IPD and Prefabrication

ECs believed that IPD projects gave them more opportunities to complete prefabrication work. This is because early collaboration between the project stakeholders enables ECs to have a better understanding of all project stakeholders' needs and to know the exact type/location of all of the electrical equipment. Using this information, they can perform constructability reviews to identify every possible prefabrication option before the construction begins. One respondent even stated that after they completed their first IPD project, they realized that IPD gave them new opportunities for prefabrication that they never had before. One respondent described how their goal was to prefabricate an amount of work equal to 15% of their total man hours and this was only possible in IPD projects.

IPD and BIM

All ECs stated that they had extensive experience with the BIM technology and were capable of producing the models in-house, and how that helped them to participate in IPD projects. One EC stated that BIM suffered with traditional project delivery systems such as design-bid-build, because the BIM effort did not start until the engineering and procurement work was to a certain point; and added that IPD enables BIM to reach its full potential.

Nevertheless, ECs also expressed several issues involving BIM and provided a few suggestions that can improve the utilization of BIM in IPD projects. Majority of the respondents felt that there is a general lack of BIM education and training for key project individuals. Respondents recognized the need to provide basic BIM education and training to key individuals from ECs such as the skilled technicians who coordinate the electrical work out in the field so that they can provide input to modelers during the modeling process. It was explained that these are the people that can better understand how the benefits of BIM translate into productivity increases. This is mainly because BIM specialists and designers complete the modeling work, but have no experience in coordinating electrical work out in the field, so they may not fully understand if their efforts save any time during construction. In short, bridging the

gap between the key BIM end users and the BIM modelers will allow a wealth of knowledge and experience to be transferred to the model. It will also allow BIM to be utilized in a more effective manner.
It was also highlighted that general contractors of IPD projects should have sufficient BIM expertise. One interviewee was involved in an IPD project where a general contractor did not have adequate BIM expertise, and could not take the lead on the modeling. As a result, the mechanical contractor took over and included more information in the model than was necessary, resulting in inefficiencies in the utilization of BIM.

To allow BIM to reach its full potential, it was suggested that it would be useful if all IPD stakeholders could work in the same software platform. Currently, various trades utilize different software platforms which optimize their own work; however, this creates compatibility issues, negatively affecting the overall project. Therefore coordinating with all of the stakeholders to determine the most appropriate BIM software platform to use is crucial.

Encouraging and Discouraging Factors to Participate in IPD Projects

Increased productivity was the major encouraging factor for the respondents to participate in IPD projects. The early collaboration gives ECs a better understanding of the work being performed and eliminates requests for information; thereby increasing the productivity. The respondents also felt that IPD's "team focused mentality" and "focus on positive business relationships" create a more productive work environment for the entire team and increase the overall quality of the project. They noted that with IPD, problems are approached as a team, rather than attempting to shift those to another stakeholder. ECs also saw the benefit of this in the form of new partnerships and thus future businesses with project stakeholders. However, it was also highlighted that delays resulting from too many stakeholders getting involved with project changes can negatively affect the schedule and that how it was not practical to bring every specialized subcontractor into every meeting for every single decision.

The main discouraging factor for ECs to participate in IPD projects was the perception of increased risk. Like the respondents without IPD experience, ECs with IPD experience mentioned that working with a team who did not have experience completing successful projects in the past was a significant risk. However, they also mentioned that a strong general contractor with good knowledge of IPD and BIM would eliminate some of the risk even if some team members are inexperienced. A few respondents also mentioned the fact that there is a lack of financial data due to the small number of completed IPD projects, which makes them unable to accurately assess the risks. This lack of financial data also makes it difficult for some owners to consider IPD during the project conceptualization phase as a potential delivery system to use for their projects.

Future of IPD in Electrical Contracting Industry

One respondent provided his thoughts about the future of IPD by recalling the history of the construction industry. When trade contractors first became popular, they were not very integrated to the rest of the construction team. In recent years, these contractors have become a lot more integrated, particularly in recent years where concepts such as design-build and partnering have become more common. IPD is simply the next iteration of this process. However, this respondent went on to say that the management and process requirements would not justify IPD on smaller projects right away stating: "*The contracting methods are foreign to so many people, so it would have to be a significant project. [Otherwise], by the time you got all the team members to understand how IPD works, half the project would be completed*." This respondent added that IPD will eventually catch on, which means everyone will eventually need to understand how to make it work on smaller projects. Two other respondents strongly believed IPD could be appropriate for smaller projects. One of those stated that their participation in the development of a BIM model on smaller projects was the driving factor for them to participate in IPD projects. The other one stated that they use the partnering approach on smaller projects, and that IPD would be the next step. Several ECs mentioned that moving to IPD will require the electrical contracting industry to shift to an "IPD paradigm." They described how this could be a difficult task because many people are accustomed to operating under traditional project delivery systems which did not require them to understand the viewpoints of all project stakeholders. They went on to say that understanding the principles and processes of IPD and embracing this new paradigm needs to happen prior to any EC's first IPD project. Educating stakeholders after the project has begun would be much more difficult and costly.

It was also noted that many owners began to recognize IPD and its principles so much that when they interview potential ECs for a new project, they are beginning to inquire about their ability to participate in a collaborative IPD model, even if that particular project does not happen to use IPD.

Discussion

The findings from the interviews with ECs without IPD experience show that they have both optimism for and concerns about IPD. While quite a few supportive statements were made about IPD, no EC was fully ready to participate in an IPD project. Conversely, while this group of ECs pointed out a number of concerns with respect to different topics, none of them was completely opposed to pursuing a project using IPD. These findings are somewhat different from the findings of a previous study which showed that specialized subcontractors would be reluctant in participating in IPD projects (Ozbek & Youssef, 2010). The main point that was made over and over by the respondents was the importance of other project participants and how that could affect their ultimate decision to participate in an IPD project. More specifically, these respondents stated that they could participate in an IPD project if other stakeholders have favorable aspects. These favorable aspects included experience with IPD or similar collaborative delivery systems, experience with BIM, experience working in large projects, prior successful business relationships with the EC, good reputation in the industry, ability to avoid claims, etc. From their perspective, if this condition (having favorable aspects) was met, many of the perceived risks of IPD would be eliminated. However, it should be noted that many of these ECs did not possess all of the favorable aspects they set as prerequisites for the other team members such as experience with IPD or similar collaborative delivery systems, experience with BIM, and experience working in large projects.

As discussed earlier the contractual principles of IPD are fundamentally different from any other project delivery system. IPD relies on stakeholders who must unite and work as a team in the best interest of the project (Thomsen & Sanders, 2011). Respondents with IPD experience recalled the challenges of switching to the IPD mindset when discussing how they originally became involved with the delivery system. ECs interested in pursuing IPD must be aware of the differences, and approach the project with a different mindset from what they are used to with traditional delivery systems. In addition to understanding the means and methods of their own trade, ECs must understand other stakeholders' in order to be successful in IPD.

The findings from the interviews with ECs with IPD experience show that overall, they have been happy with the IPD projects they participated in with the exception of schedule issues. With respect to the schedule issues, it was underlined that at times things may move slowly (negatively affecting schedule) when participation of every single stakeholder in every single decision is required. Nevertheless, it was also discussed that IPD's "team focused mentality" and "focus on positive business relationships" create a more productive work environment for the entire team and increase the overall quality of the project. Furthermore, these ECs believed that the IPD projects they participated in gave them more opportunities to complete prefabrication work due to the high level of collaboration.

Like the ECs without IPD experience, ECs with IPD experience mentioned that they would rather work with stakeholders with favorable aspects such as BIM expertise and previous IPD experience. An important point made by ECs with IPD experience was that their organizations had many of IPD's processes and procedures in place prior to being accepted onto an IPD team. They added that this was necessary in order to establish credibility as a qualified stakeholder.

The biggest concern that ECs with IPD experience had is the general lack of BIM education and training for key project individuals. It was highlighted that ECs interested in pursuing IPD should bridge the gap between the key BIM end users and the BIM modelers by providing basic BIM education and training to skilled technicians coordinating electrical work out in the field.

One main issue that was pointed out by the both group of interviewees is the fact that IPD is a new delivery system that has only been utilized in a relatively small number of projects. Due to this, there is a lack of historical financial data which makes ECs unable to accurately assess the risks.

Conclusions and Future Research

It is believed that the major impact of this research on the electrical contracting industry is that once the identified issues are addressed, ECs will be more willing to participate in projects using IPD. This will help ECs follow the trend that is inherent within the rest of the construction industry, i.e., the transition towards using IPD, and potentially benefit from the efficiencies attained in projects using IPD. Participating in projects using IPD, furthermore, provides ECs with the opportunity to expand their services to the pre-construction stage of a project (as IPD, by definition, requires that). By presenting the experiences of ECs who actually participated in IPD projects, this research highlighted the areas that other ECs should pay attention to when they participate in IPD projects. In other words, this research documented the lessons learned so that ECs with no IPD experience can learn from other ECs who have gone through the trials and tribulations of working in IPD projects.

This research was an initial attempt at collecting and presenting information with respect to ECs' thoughts on IPD; as such the findings presented herein are aimed at starting the discussion on the topic and motivating possible future research. The logical next step would be to further investigate the topics discussed herein in addition to others by having more participants and holding focus group sessions with the attendance of multiple ECs as well as other specialized subcontractors. It is believed that the wider adoption of IPD will allow for further studies on the topic with the attendance of more participants. More than a decade ago, a similar research to this one sought to help ECs interested in pursuing design-build, a growing project delivery system at the time (Rowings, Federle, & Rusk, 2000). Given this, the authors believe that the research presented herein, albeit an initial attempt at studying the topic, is timely for the electrical contracting industry in an era when IPD is emerging.

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