

IPD Teams: Creation, Organization and Management

December 28, 2011



HansonBridgett

*Howard W. Ashcraft
Hanson Bridgett LLP
425 Market Street, 26th Fl.
San Francisco, CA 94105
hashcraft@hansonbridgett.com*

Table of Contents

Introduction	1
IPD Project Management	2
The Challenge of Virtual Organizations	2
Team Composition	5
Team Organization	6
Team Structure.....	6
Team Size	9
Cross-functional Teams.....	9
Team Stability.....	11
Team Management.....	12
Leadership	12
Assembling the team.	12
Preparing the team.....	12
Setting the goals.....	14
Trust and Transparency	15
Decision Making	17
Purpose.....	18
Physical Proximity and Communication	19
Team Incentives.	19
Work Structuring.....	20
Visual Management.....	20
Agile and Scrum	20
Team Motivation and Creativity	23
Summary	26
References	27

IPD Teams: Creation, Organization and Management

Introduction

Integrated Project Delivery is built around teams. Early involvement of key participants is a core IPD concept, and these early participants, like virtually all IPD participants, are organized in teams. Teams provide the right knowledge at the right time, stimulate creativity, and lower the barriers among the many project participants. Interdisciplinary teams create alignment, commitment and engagement. Moreover, team processes improve decision making and increase support for the strategy chosen. And, not only is IPD executed by teams, it is managed by teams as well. Without teams, IPD does not function.

But the mere existence of teams does not guarantee success. For some tasks, individual or group action is more efficient than interdisciplinary teams.¹ In fact, an individual's performance may actually *decline* in group settings due to social loafing,² the bystander effect,³ groupshift⁴ and groupthink.⁵ In addition to these dangers, teams require additional training and management. Clearly, teams must be organized, managed and motivated properly to gain the benefits of teams while avoiding these performance pitfalls.

This article combines research on team performance with observations of teams on IPD projects and suggests practices from other industries that might be useful to IPD teams. It focuses on creating, organizing, managing and motivating teams, but does not address, except in passing, several related concepts such as target value design, building information modeling,

¹ *If performance aspirations can be met through individuals doing their respective jobs well, the working group approach is more comfortable, less risky, and less disruptive than trying for more elusive team performance levels* (Katzenbach, 1992).

² Social loafing occurs when the team member is not internally motivated and personal accountability is diluted by focus on team performance. If social loafing occurs, the average performance of the team is less than the individual performance of its members. This was first documented by Max Ringelmann in the 1920s and confirmed by later studies (Shepperd, January 1993; and Karau and Williams, October 1993).

³ The bystander effect occurs when an individual does not take action because he or she believes that someone else will. It is also called the Genovese syndrome because of alleged inaction by multiple witnesses to a brutal and protracted murder.

⁴ Groupshift can distort decision making by exaggerating individual positions through reinforcement and lack of individual accountability. This results in group views that are more extreme than the average of individual opinions (Robbins, 11th ed. 2011).

⁵ Groupthink occurs when individuals will not challenge beliefs or assumptions that are perceived as inherent in group self-identification. Group pressure results in conformance to group norms (Janis, 1972).

work flow, continuous cost modeling, or Lean principles and techniques. These topics are related to IPD teams, but deserve separate, detailed consideration.

IPD Project Management

IPD projects are managed by committees with members representing the key participants. At a minimum, the key participants include representatives of the owner, designer and contractor, but in some projects may also include selected design consultants and trade contractors or may have members who represent the interests of consultants and subcontractors. The name for these committees varies between contract forms. Often, there are two levels of management with project and senior level committees. Unlike the working teams discussed later in this paper, the project management committees have responsibility for the entire project.

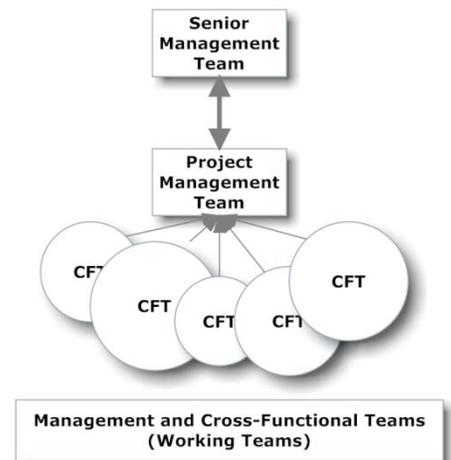
Although members of the IPD project management may also have direct roles as designers or builders, when they function as project management members, they put aside their identity as architect, contractor or owner and become joint managers of the entire project. In this role, their primary responsibilities are:

- Establishment of Project Goals
- Provision and Allocation of Resources
- Financial Oversight
- Selecting Members of Functional Teams
- Mentoring of Team Members
- Contract Administration (Change Orders, Amendments)
- Dispute Resolution

These tasks are vital to joint project management, and are discussed more thoroughly in a companion paper, *Negotiating an Integrated Project Delivery Agreement* (Ashcraft, 2011). One of the primary responsibilities of these management teams, and the focus of this paper, is effectively integrating high performance teams at the operational level.

The Challenge of Virtual Organizations

The AEC industry is specialized and fragmented. One of the advantages of specialization is the ability to develop deep knowledge of highly technical subjects and to efficiently execute specialized tasks. But the fragmentation that accompanies specialization can cause inefficiency, narrowed perspectives, apathy, and misalignment among the parties. IPD seeks to reap the benefits of specialization while molding the disparate parties into a virtual organization that is aligned to the project goals. It does not negate existing roles such as designer of record or builder, but integrates them into the larger whole.



Creating a virtual organization for a construction project requires overcoming many hurdles. The first hurdle is that the AEC industry is historically individualistic, antagonistic, and when people have worked together on projects, they have generally done so as groups, not teams. Moreover, many people who have worked collectively mistakenly assume that they have engaged in team work because the word "team" is frequently and loosely applied. For example, a team of carpenters may, in fact, be a group because they work under the immediate direction of a supervisor who defines what they will do, and how they will do it. Even when there are "team" meetings, people may be functioning as a group. For example, when people get together to share information and make decisions that allow each to execute their individual responsibility, they are a group, not a team.

Teams are fundamentally different because they require both individual and mutual accountability. They are committed to a common purpose, process and outcome for which they hold themselves mutually accountable (Katzenbach, 2005). Stephen Robbins distinguishes work groups and work teams,⁶ stating:

Work groups have no need or opportunity to engage in collective work that requires joint effort. So their performance is merely the summation of each group member's individual contribution. There is no positive synergy that would create an overall level of performance greater than the sum of the inputs.

A work team, on the other hand, generates positive synergy through coordinated effort. The individual efforts result in a level of performance greater than the sum of those individual inputs (Robbins, 2011).

Transforming groups into teams requires a fundamental shift in how people work together and a restructuring of work and hierarchies. As noted in a software context, "Successful implementation of multifunctional teams requires a fundamental redesign of the entire organization" (Larman, 2008). Whether this effort is worthwhile depends on the performance required.

A second challenge is that the teams are created from individuals from different companies with different management systems, incentive packages, and corporate cultures. When firms join an integrated project, they bring these differences with them. In this way, IPD is similar to a corporate merger. When mergers are successful, the individual firms are forged into a single seamless organization with common goals, common procedures, and a common culture. But mergers often fail because of cultural incompatibility. The failed AOL/Time Warner merger is a classic example of complementary capabilities stymied by antagonistic cultures. The success of IPD teams will reflect how well these cultural issues are addressed.

A firm's culture reinforces the behavioral norms and beliefs that may have attracted like-minded employees to join that firm. This combination of self-selection and reinforcement stubbornly resists change. Culture can strongly affect performance because most employees act in accordance with their corporate culture. In some instances, this strengthens the team. In other instances, the differing firm cultures will hamper team effectiveness. And if project and

⁶ In contrast, Katzenbach and Smith distinguish five levels of teams from a Working Group to a High Performance Team (Katzenbach, 1992). In the present article, a team or working team is synonymous with their high performance team.

corporate culture differ, employees are placed in the awkward position of complying with inconsistent norms.

Although project culture can be developed, successful teams are more easily created if their employing firms have cultures compatible with project values and with each other. Owners can improve compatibility by requesting qualifications or proposal responses from self-assembled teams of firms, rather than assembling the IPD team from individually selected firms. Firms that have chosen to work together, particularly if they have prior experience doing so, are more likely to have compatible cultures. Another useful strategy is to use rolling team selection where each key firm added to the team participates in the interviews and selection of additional team members. This allows considering how the new team member will fit into the existing mix. The contract should also have the option of replacing a party that does not meld well and the entire procurement strategy should consider how well a firm will fit into the IPD team as well as their subjective competence and competitiveness.

If you can't choose partner firms on compatibility—and likely some of the IPD member firms will not have supportive cultures—you will need to spend more time building a project culture. This will never be perfect because team members will be caught between two cultures, but it will be better than allowing them to bring their differing cultures to the common workplace.

The first step to creating a project culture is to have one. The project leadership must clearly express their values and expectations from the onset, and then must act in accordance with those values. The leadership must demonstrate the required behaviors, recognize and praise congruence and promptly correct deviance from norms.

Any action that builds or reinforces a common identity helps create project culture. Project logos and signage should replace individual company identification. Group events such as barbecues, community volunteering, fund raisers, project supported sports teams or any activity that intermingles individuals without reference to their employer helps to promote group identity. Jointly working on developing project norms and procedures can also strengthen project norms.

Co-location offers opportunities to enhance project culture. The co-location site provides a physical space separate from an employee's firm and a demarcation point between corporate and project cultures. The organization within the co-location site can reduce the effect of corporate cultures and support the project identity. Workspaces should be organized by cross-functional unit, not by employer. You shouldn't be able to tell who an employee works for without asking.

Boot camps can start building culture from project inception. The military has long known that separating people from their environment and then forcing them into intense, joint activity, creates group identity. In a similar, if less rigorous way, moving team members to a physically separate place, reorganizing them across corporate lines, and then engaging them in demanding training or work exercises, starts the transformation to a project identity. The boot camp projects should involve "real" work that benefits the project.

Whenever possible, teams should be built from participants who share similar cultures and the project leadership should take positive steps to create a project culture that supplants the participants' firm cultures.

Team Composition

Teams require a variety of skills. A well balanced team needs members with technical expertise, problem solving and decision making capability, and interpersonal skills such as the ability to listen effectively, provide feedback and resolve conflict (Katzenbach, 1993; Robbins, 2011). Because few individuals have all of these capabilities, the team members should be chosen to assure that these capabilities are represented within the team (Hackman 2011; Robbins, 2011). A good strategy is to choose two or three members that excel technically, assess their leadership and interpersonal skills, and then add members to balance the team. Conscientiousness is another key attribute and teams with more conscientious members perform better (Robbins 2011). Because team's work may change as the project matures, team leadership must be sensitive to the changing requirements and readjust team composition, accordingly.

The type of work being done also effects team composition. If a team is facing novel, complex problems, the team members need to be chosen for intelligence and creativity. These high ability teams are more adaptable to changing situations and can effectively apply existing knowledge to new problems (Robbins, 2011). But this same team will be less successful on routine tasks, whereas teams with more modest capabilities will remain focused and productive. High ability teams also tend to work best when led by equally high ability managers, and are often self-organized and self-managed (Robbins, 2011). High ability teams are preferred if project success requires innovation and creativity.

Teams should also be composed of individuals with differing backgrounds, viewpoints and experience (Hackman, 2011). The most creative teams are not homogenous (Amabile, 1998). This is one advantage of involving trade contractors, end-users and maintenance personnel early in design. Each brings a different perspective to the design problems being addressed.

Set up workgroups so that people will stimulate each other and learn from each other, so that they're not homogenous in terms of backgrounds and training. You want people who can readily-cross fertilize each other's ideas" (Pink, 2009)

Not only does this diversity provide more information to inform the design, the tension between perspectives stimulates greater creativity within all the individuals.

Personality should also be considered when choosing team members. Some percentage of people are not inherently collaborative (Benkler, 2011) and others do not like working in teams and will opt out if they have the chance (Robbins, 2011). Employees trained in command-and-control structures can have difficulty transitioning to team structures and either want to be told what to do or want to tell others what to do. They may not have the patience for the more deliberative processes used in IPD teams. And as noted previously, corporate culture is pervasive and the effect of the team member's home culture can undermine the member's effectiveness in the collaborative team.

Many firms have used personality data, such as the Meyers-Briggs Type Indicator (MBTI) and while testing may be useful for some purpose, there is little data supporting the use of Meyers-Briggs for choosing team members (Hackman, 2011; Robbins 2011) or assessing team performance. There is evidence that psychological attributes are correlated with individual success and the interaction of team members' personal characteristics is undoubtedly significant, but balancing a team profile appears to be currently more art than science.

Nonetheless, this is an approach worth considering if the personality traits measured are correlated to job performance and team interaction.⁷

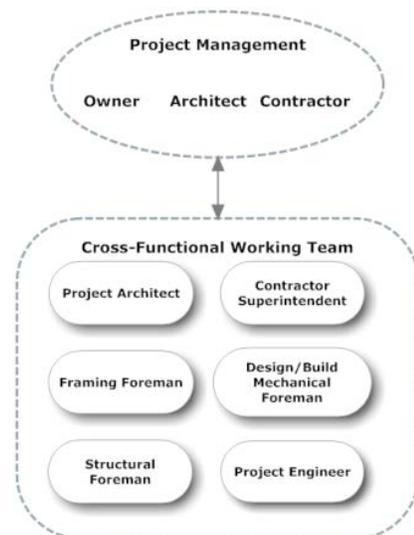
It is also important to weed out members who are undermining team performance. Research shows that a bad actor can damage the team, and unless the behavior is corrected, the team member needs to be removed (Robbins, 2007).

Team Organization

Team Structure

The organization of IPD teams varies significantly based on the size and technical details of the project. The size effects the number of teams, their individual scope, and how they will be directed and coordinated. The technical details of the project will determine how organizations are grouped and whether, and how teams are overlapped.

The most basic pattern, applicable for smaller projects, is to create an interdisciplinary team comprised of the key participants. Rather than create multiple teams, it is easier to create a stable core team that is augmented by other disciplines at appropriate moments in the project. This core team will minimally include the owner's project manager, project architect and the contractor's project manager or superintendent. As the project advances, additional owner's representatives, such as representatives from operations and facility management, structural engineer, and representatives for mechanical, electrical, plumbing and framing disciplines will join the team as their expertise is required. This provides continuity, and keeps the active size of the team at manageable levels while allowing representation of the key participants without requiring their participation before they will be fully engaged.



There are two complementary approaches to deciding what entities are key participants. The first approach focuses on which group's need to work together for success. For example, this approach leads to including MEP+F and foundation/structural/framing. The second approach focuses on building teams around problematic issues and trade contractor intersections. For example, a team could focus on the slab edge interactions among structure, framing and building envelope. In other projects, where information technology or /audio visual systems will be critical to project success, the core team should consider including these disciplines early in design, rather than after basic systems have been developed.

⁷ At least one consultant (TAG Consulting) is using StrengthsFinder™ data to develop profiles that can be compared to evaluate the strengths and weaknesses of a team. This type of group evaluation seem more relevant to team formation than individual psychological assessments.

If the basic approach is used, there should be a pre-design charette that involves all of the team members that will eventually participate. This charette should focus on the basic systems that will be used, opportunities that may exist for improving design and construction outcomes, and provide the designers with information and advice from the design team before design decisions are made. It should also set the expectation that construction level information will not be a separate information stream (shop drawings and submittals) but will be included within the design documentation.

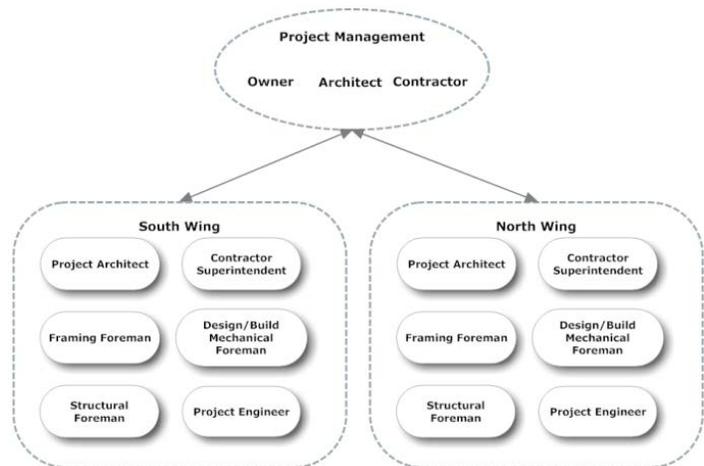
Subcontractors and consultants who do not have experience with IPD may be reluctant to participate before design decisions are locked down because they feel they are spinning wheels if they help analyze approaches that may not be used. But this is precisely where they may be most helpful to the project as the core team should challenge their reluctance and closely question the prospective participants to determine when they should be engaged and reengaged.

As project size increases, the basic approach (although not the basic theory) must change. One flexible team simply isn't large enough to do the work. As noted previously, work should be structured to fit the team rather than increase the team to fit the work. This means that the core management team must create a structure that keeps working teams reasonably compact, does not have responsibility gaps between teams, allows contemporaneous coordination, and provides alignment to overall goals.

Several structures are commonly used to divide work scope.

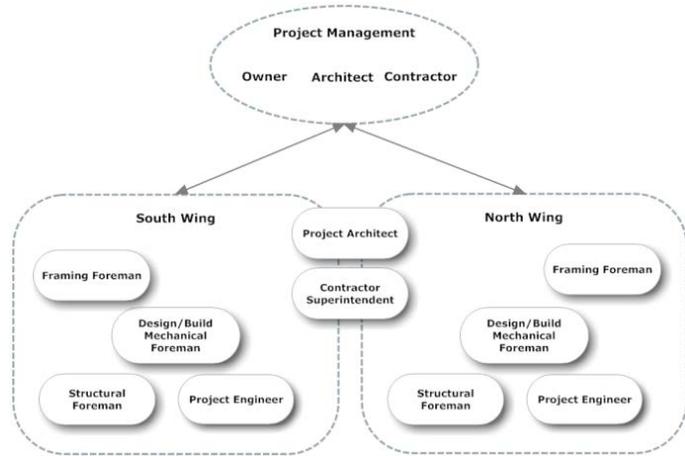
If the project is susceptible to geographic division, then the basic team approach can be used--but each team is responsible for a section of the project. For example, work can be divided by wings, floors, phases or structures. Within their geographic division, each team is responsible for all functions and disciplines.

Area responsibility teams will need to be provided an overall systems approach and will need to coordinate with other area teams. The overall systems approach is developed by a separate team that evaluates options and provides diagrammatic direction to the area teams.

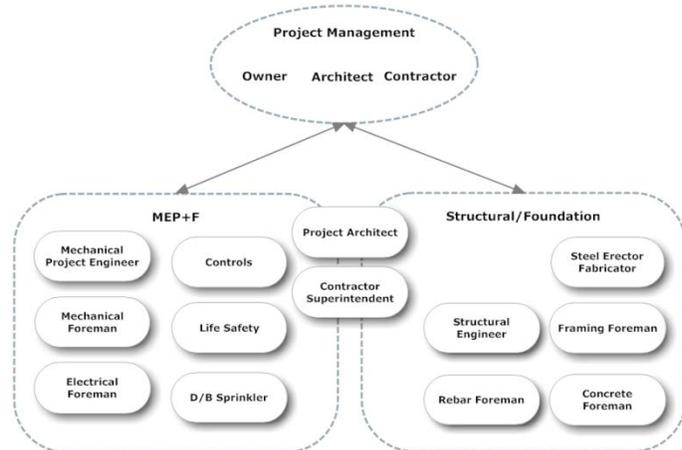


Coordination between area teams can be handled in three ways. First, the overall systems team can have coordination responsibility. This is not preferred as it releases the area teams from coordination responsibility and violates the rule of designing coordination into the process rather than testing for coordination after work has been performed.

A better approach is to place coordination responsibility on the teams and use team member overlap or regular “big room” coordination (or a combination of these techniques) to assure that the design being developed is coordinated. The “big room” coordination meetings should not only focus on coordinating the work that has been done, but should also engage in discussion of what design work will be done by each team in the interval before they again meet. This should be sufficiently detailed to allow the teams to uncover, and solve, potential coordination issues before detailed design is performed.



A second approach to larger scale projects is to divide the work on a systems basis, such as dry or wet mechanical systems. This has the advantage of providing an overall view of the specific system and allows all members to have high levels of subject matter expertise. It reduces diversity, however, and creates additional coordination issues between functional systems and between physical elements (penetrations and physical conflicts).



Systems based teams can coordinate through the “big room” process, with joint meetings between interrelated teams, such as dry mechanical and framing. In the “big room” meetings, the teams analyze problem issues, clash detect their work, explain what work they plan to accomplish before the next joint meeting and create the list of decisions and deliverables each requires of the other.

Team coordination can be enhanced by regularly posting design information in visible locations, such as corridors and walls. Although this information may be available digitally on servers, having the information present where it is regularly seen by other teams is a more effective tool. It may be worthwhile to create a prominent physical area where the teams post their current work such that other team members can see at a glance where each team is going.

Regular pull scheduling is also a useful coordination exercise because it focuses on the decision interchanges between teams. In order to pull schedule to a milestone, the teams must request and promise information and deliverables from each other, which exposes coordination issues.

On larger projects, information management can become a significant obstacle, particularly in sharing building information modeling data between different software tools. Moreover, even if systems are adequately interoperable, the information needs to be appropriately categorized, labeled, tracked and archived. This requires project standards and procedures. In addition, if information will be repurposed, then the parties that will create and

use the information must agree on how design and construction elements will be represented in the building information models. On larger projects, the information requirements are sufficiently challenging to require a separate team focused on the project's information requirements.

The technical nature of the project affects team composition. Hospitals have complicated MEP systems and hospital teams consequently emphasize this requirement. Theaters and university class rooms will have critical acoustic, display and information technology requirements. Projects with challenging environmental requirements may need to include specific energy efficiency or sustainability expertise. These projects will appropriately build teams around these elements.

Team Size

Team size should match purpose. Larger groups, 12 or more, are better at developing alternative project solutions, but are less effective in getting things done (Robbins, 2011). Smaller groups have limited skill sets and their lack of diversity limits knowledge and creativity (Robbins, 2007).

The most effective teams are neither very small (under 4 or 5) nor very large (over a dozen). Very small teams are likely to lack for a diversity of views, and teams of more than 12 have difficulty getting much done (Robbins, 2011).

A good rule of thumb is to keep working teams between five and nine members (Robbins, 2011). Several experts also recommend that the team be no larger than necessary to accomplish its task (Hackman, 2011, Larman 2008). If the task is too large for an efficient team, the task should be broken into subtasks. Keeping the team small reduces the information loss among members and creates greater individual accountability. Because the members of smaller teams know what each member is doing, it is hard for any team member to slacken his or her efforts without other team members noticing the imbalance.

When teams have excess members, cohesiveness and mutual accountability decline, social loafing increases, and more people communicate less. Members of large teams have trouble coordinating with one another, especially under time pressure (Robbins, 2011).

Unless a project is quite small, no team can do everything. Thus, a key element of team organization is the structure of teams within teams. In most projects, specific teams are created that handle the design and eventually the construction of specific elements, systems or physical areas of the project. A team working on the mechanical systems for a floor of a large hospital, for example, would generally report to a team responsible for MEP systems. Similar approaches could be used for foundations and structures, framing and exterior skin, or other systems. One strategy for team boundaries is to assess areas of historical failure (intersections between work such as slab edges) and assure that the team contains personnel with responsibility for both sides of a problem interface.

Cross-functional Teams

IPD teams should always be interdisciplinary and should generally be cross-functional. Interdisciplinary teams are composed of members with differing training and experience. Cross-functional teams are composed of members with differing responsibilities. For example, a

design phase team composed of architect, mechanical engineering, mechanical contracting and general contracting expertise is multidisciplinary, but they may all be focused on design during that phase. A cross-functional team would include representatives from procurement, cost management/estimating, and operations, as well as those responsible for design and construction. Their functions vary as well as their backgrounds. For example, a cross-functional IPD team should jointly design a portion of the project, but should also be responsible for managing the cost, meeting the schedule, constructing and commissioning that work. Scope, schedule, and budget should be tightly bound within the team, and not delegated to separate departments.

Cross-functional teams have been highly successful in manufacturing and software design. Boeing, Toyota, IBM and others have used teams with members from the different internal groups with entire responsibility for a product, or a portion of a product, from conception through creation and including sales and marketing. Cross-functional teams composed of people from design, engineering, production and sales were one of W. Edward Deming's Principles for Transformation of Western Management (Deming 1998). As noted by Stephen Robbins:

Cross-functional teams are an effective means of allowing people from diverse areas within or even between organizations to exchange information, develop new ideas, solve problems, and coordinate complex projects. (Robbins, 2011)

Craig Larman cautions that cross-functional integration of management is not sufficient.

True cross-functional integration in large product development is rare. Instead, we have frequently encountered cross-functional project management groups with management representatives of the different functional areas. They do not work. True cross-functional integration occurs at the working level (Larman, 2008).

Whenever possible, the team should have responsibility for all components necessary to achieve the project goals and should be responsible for coordinating with other teams. Responsibility for a discrete, complete portion of the project reduces errors at the interfaces between disciplines and promotes ownership and pride in the whole (Deming, 1982). As noted by J. Richard Hackman:

The better a team's work is designed (that is, the extent to which members have collective responsibility for carrying out a whole, meaningful piece of work for which they receive direct feedback), the higher a team's collective internal motivation (Hackman, 2011).

Current IPD teams have generally assembled around related systems, such as MEPF or foundations and structural systems. These have then provided their recommendations or work to a higher level team with broader responsibilities. The higher level team operates as an information accumulator, a coordination team, and a group that passes work down to the functional teams. There is evidence from software development that suggests that teams should take direct responsibility for coordination rather than relying on a coordination layer (Larman, 2008) although self-coordination may be difficult in larger projects.

Team Stability

Personnel turnover can increase waste and limit team effectiveness. Construction teams are often short-lived with members moving in and out of the team as work increases or slacks. This practice is contrary to research on project teams. As noted by Hackman:

Research findings overwhelmingly support the proposition that teams with stable membership have healthier dynamics and perform better than those that constantly have to deal with arrival of new members and the departure of veterans (Hackman, 2011).

Other researchers, notably Ralph Katz, have concluded that R&D teams increase their effectiveness for a period of three to four years, decline and rebound as shown in the below figure (Katz, 1982).



Many construction projects are completed in less than the time required to develop optimal team dynamics, and even in these projects, handoffs from design, to pre-construction, to construction, increase project turnover and shorten interaction time. However, there are several strategies to counteract this effect and improve knowledge transfer and performance. First, the proposing team should be the executing team, with little change to the core personnel. Not only is less information lost on transition, the stable team does not need to rebuild relationships and trust. Second, if an owner has multiple projects, it should consider engaging a specific team to do sequential projects *provided that the team shows continuous improvement and utilizes substantially the same personnel*. Third, firms should identify IPD experts who work with each IPD project to carry lessons learned among projects and to guide less experienced teams. If the firms do not yet have skilled 'gurus', they should consider augmenting their teams with consultants that have that experience. Finally, firms should actively incorporate the learning from on-going projects into their training programs. The knowledge of how to do IPD should be institutionalized. If you are lucky enough to have teams that are stable for long periods, then it may be wise to begin mixing in new members or have the team engage in a "creative disruption," to counteract the performance slump associated with long term projects.

Team Management

Leadership

Teams need communication, clarity, and consistency. They need to have stable goals and know what is expected of them. They need resources and they need mentoring. But they do not need to be told *how* to achieve their goals. IPD supervisors should heed W. Edward Deming's admonition that the "The job of management is not supervision, but leadership" (Deming, 1982). And as observed by Atushi Niimi of Toyota, the difficulty in teaching foreign managers "Is that they want to manage, not teach" (Larman, 2008). IPD team managers should build people to build projects (Larman, 2008).

This approach to transparent, compassionate and ethical leadership has been referred to as "Authentic Leadership" (Robbins, 2011), and is the goal to which IPD supervisors should aspire. Authentic leadership creates the trust that allows team members to commit themselves unreservedly and sweeps aside communication barriers.

Authentic leadership cannot be assumed. In any long term project, supervisors should be reviewed for team effectiveness and also reviewed by the teams themselves. Leaders that do not reflect the project values must be counseled and improved or removed.

Assembling the Team

In *Good to Great*, Jim Collins observed that great leaders initiate change by assembling the right team even before they decide where their organizations are going. Collins counsels that you need to get the right people on the bus, the wrong people off the bus, and the right people in the right seats (Collins, 2001). Amabile notes that matching personnel and assignments is one of the most significant decisions a team leader can make (Amabile, 1998). But in many instances, personnel are assigned based on who is available at the time, a common practice that should be strongly resisted (Hackman, 2011). Assembling a capable and functional team is the team leader's first priority.

Choosing team members can be particularly difficult on IPD projects because teams are assembled from employees of different companies. Team member options may be limited and the team leader may not be authorized to select who a participating firm will provide. If possible, the IPD contract should give the team leaders flexibility in selecting team members and authorize them to remove a disruptive participant and request a replacement. In all cases, team leaders should monitor the team's early interactions to identify, train, and if necessary remove personnel that are undermining team behavior. And where the team leader has had little control over team composition, early monitoring and intervention is critical.

After they have assembled their teams, the managers are responsible for setting goals, training, facilitation, dispute resolution, work design, and providing adequate resources.

Preparing the Team

Training should occur continuously throughout the project and should complement the team's self-evaluation and improvement processes. Coaching should have a dual focus: helping individual members learn ways they can strengthen their personal contributions and, at the

same time, exploring ways the team as a whole can best use its resources (Hackman, 2011). Whenever possible, the project should commence with a boot camp that begins the processes of developing trust among teams and management and trust between team members, themselves. This is also the opportunity to assess the strengths and weaknesses of team members, improve interpersonal skills, address training opportunities, clarify goals and expectations and enhance the team's ability to use the tools and techniques required for the project.

Research on team training shows that the greatest effect is obtained when coaching interventions address three task performance issues: (1) the level and coordination of member effort, (2) the appropriateness to the task and situation of the performance strategies the team is using, and (3) the degree to which the team is using the full complement of its members' knowledge and skill (Hackman, 2011).

For example, many team members have limited or incorrect understanding of Lean⁸ principles. Rather than lecture on Lean techniques, the team members should be actively engaged in tasks and training relevant to the project such as pull scheduling to a project milestone, mapping the value stream of a problematic process, reaching a joint decision using a structured decision method, or documenting a root cause analysis using a PDCA Cycle,⁹ A3¹⁰ format. Working jointly with the assistance of a skilled teacher increases the team's baseline capability while building the relationships necessary to work together—and unlike “ropes course” bonding, the team actually creates something relevant to them and the project.

Team effectiveness requires clear communication and the ability to dissent without damaging relationships. As discussed in Team Motivation and Creativity, modest levels of conflict regarding task and process heighten creativity. But the ability to freely and energetically differ without creating damaging personal conflict requires strong communication skills. Communication should be a focus of the initial bootcamp with training focusing on listening, clarity of communication and dispute resolution.

First, team members need to understand what others are saying. Covey counsels that to communicate clearly, listen first (Covey, 2006). Many people are not good listeners and need to be reminded how to listen. Speaking clearly is also a rare skill, especially when the information may not be well received. Yet the very basis of reliable commitment¹¹ is a clear understanding

⁸ Lean is a systems approach to project execution that focuses on continuous improvement, elimination of non-value adding activity, reducing variation and improving quality and flow. There are many tools and techniques associated with Lean project delivery, but the essence of Lean is developing a learning organization that can flexibly adapt and improve.

⁹ PDCA Cycle is a sequential approach to problem analysis and resolution of Plan, Do, Check and Act. The concept is to assess a situation, plan a solution, execute the solution, check to see if the solution worked, then apply the solution globally—and then start all over. It is a cycle of continuous improvement and is associated with W. Edward Deming's work, although he attributes it to his teacher, Dr. Walter Shewart.

¹⁰ A3 analysis is a methodology of documenting a PDCA analysis on a single sheet of A3 sized paper and was widely popularized by Toyota. A3 is an international paper size similar to 11x17 inches and was the largest size paper that could be handled by standard fax machines.

¹¹ From a Lean perspective, a project is a network of commitments. In order for each participant to execute its tasks efficiently, it needs to be able to request predicate information or tasks and (footnote continued)

of the conditions of satisfaction and the license to disagree. Unless there is honesty, improvement will not occur.

Honesty can be brutal, but it needn't be. The second skill is the ability to dissent or critique without personalizing the dispute. When issues are important or emotional, the slightest personalization triggers defensive reactions that trigger counter-reactions that reinforce the personal dispute and overpowering the substantive discussion.

The third skill is dispute resolution. When a disagreement has clearly been stated and understood, the team members need to know how to resolve the disagreement, or decide among options, while preserving the dignity of the team member whose suggestion will not be followed. The dissenter should disagree with and support the decision.

Healthy communication skills should not be presumed and must always be monitored. Communication skills and dispute resolution should be addressed in the boot camp and reinforced throughout the project. Team leaders should model listening skills, defuse damaging conflict and counsel team members whose communication techniques are ineffective or destructive.

Setting the Goals

Goals are critically important to team success. When they are challenging, they inspire creativity. When they are overwhelming they create defensiveness. They need to be specific, appropriately challenging, related to team performance, and measurable (Robbins, 2011; Katzenbach, 2005). General goals, such as "be the best" are ineffective because they do not guide behavior, defy measurement, and do not promote accountability. In contrast, a specific goal such as reducing HVAC cost by reducing the number of smoke dampers from x to y gives the team a specific goal on which to work. Research also shows that challenging goals result in higher levels of performance (Amabile, 1998; Robbins, 2011). One study noted that the goals were most effective when the team thought it had a 50/50 chance of success (Hackman, 2011). Amabile notes that the perfect match should stretch the employee's abilities. The employees should not feel bored, nor should they feel overwhelmed (Amabile, 1998)..When you start a project, the IPD team should be breathing heavily, but not hyperventilating.

Although the evidence regarding the importance of goal setting is strong, who sets the goal may be less important (Robbins, 2011). Highly creative teams (such as research and development teams) are often self-organized and develop their own goals. The argument for team created goals is that teams that create their own goals will be highly committed to their achievement (Larman, 2008). But because team goals on a construction project must generally fit within a project wide goal structure, externally supplied goals may be more practical. One way to have both coordination and commitment may be to have management supply the general goals while the team develops the specific goals that could achieve the general goal. As noted by Robbins, "Successful teams translate their common purpose into specific, measurable, and realistic performance goals. These goals help maintain their focus on getting results" (Robbins, 2007). For example, an overall goal might be to reduce MEP cost to meet a sub-target, and the

rely upon their accomplishment when promised. This can't occur unless both parties have a common understanding of the request, there is an absolute promise (or the preconditions clearly stated), and the conditions of satisfaction jointly agreed.

team would develop a series of goals (such as reducing the amount of ductwork or accessories) that if accomplished would result in achieving the higher level goal. In this way, the team adopts the provided goal while maintaining freedom to develop the means for achieving the goal.

Trust and Transparency

Robbins summarizes the importance of trust in working teams.

Trust between supervisors and employees is related to a number of positive employment outcomes. Here are just a few of the most important that research has shown:

- *Trust encourages taking risks. Whenever employees decide to deviate from the usual way of doing things, or to take their supervisors' word on a new direction, they are taking a risk. In both cases, a trusting relationship can facilitate that leap.*
- *Trust facilitates information sharing. One big reason employees fail to express concerns at work is that they don't feel psychologically safe revealing their views. When managers demonstrate they will give employees' ideas a fair hearing and show they are concerned enough to actively make changes, employees are more willing to speak out.*
- *Trusting groups are more effective. When a leader sets a trusting tone in a group, members are more willing to help each other and exert extra effort for one another, which further increases trust. Conversely, members of mistrusting groups tend to be suspicious of each other, are constantly on guard against exploitation, and restrict communication with others in the group. These actions tend to undermine and eventually destroy the group.*
- *Trust enhances productivity. The bottom-line interest of companies also appears positively influenced by trust. Employees who trust their supervisors tend to receive higher performance ratings. Mistrust focuses attention on the differences in member interests, making it difficult for people to visualize common goals. People respond by concealing information and secretly pursuing their own interests. A climate of mistrust tends to stimulate dysfunctional forms of conflict and retard cooperation.*

Members of effective teams trust each other. They also exhibit trust in their leaders. Interpersonal trust among team members facilitates cooperation, reduces the need to monitor each others' behavior, and bonds members around the belief that others on the team won't take advantage of them. Team members are more likely to take risks and expose vulnerabilities when they believe they can trust others on their team. ...[T]rust is the foundation of leadership. It allows a team to accept and commit to its leader's goals and decisions (Robbins, 2011).

In *The Speed of Trust*, Stephen Covey argues strongly that developing integrity and trust is fundamental to high performance organizations (Covey, 2006). Without trust, efficiency plummets and a firm suffers a "trust tax" that increases compliance cost and reduces productivity. As he notes when analyzing four quadrants ranging from blind trust to suspicion.

The biggest surprise for most people comes in Zone 4 (Suspicion). Many tend to think that this is the lowest risk zone of all. This is where you analyze and calculate and consider issues carefully. You're suspicious and guarded, so you don't readily extend trust to others. You hold things close; you try to keep everything within your direct control. While it may sound low risk, this is actually one of the highest risk zones of all. When you're highly suspicious, you tend to try to validate everything, to analyze everything to death—which ends up decreasing speed and increasing cost. In addition, you miss opportunities (Covey, 2006).

Trust is built by developing relationships, treating people fairly, and meeting your commitments. Interestingly, trust is also tied to transparency. Identification founded trust is based on a mutual understanding of other's intentions and appreciation of their needs and desires (Robbins, 2011). In contrast, hoarding information plants seeds of distrust that grow into defensive reactions. What starts as "prudent information control" spirals into team dysfunction.

Transparency is difficult for those who have interacted in internally competitive situations. If winning a negotiation means that the other party loses, then guarding information is an effective, and even necessary, strategy. When you are trying to create cooperation, however, this strategy is self-defeating. In fact, one of the most intriguing examinations of cooperation, Robert Axelrod's *The Evolution of Cooperation*, used the *Prisoner's Dilemma*¹² to show that collaboration, as long as you were also being collaborated with, is the optimal negotiation strategy for many common and complex situations. His findings have at least four implications for IPD projects.

- Overall project value is maximized if the parties choose a collaborative strategy;
- Collaboration requires knowing what signals the other party is sending, i.e., whether a provocation has actually occurred or whether they intend to collaborate. Thus, clarity and transparency are essential;
- Collaboration is improved if you increase the frequency and duration of interactions; and
- Payoffs affect collaboration. Thus, risk/reward systems can be used to increase collaboration.

It is very difficult to develop a mutual understanding of intention without face-to-face interaction. Moreover, research shows that face-to-face communication regarding attitudes and

¹² The Prisoner's Dilemma is simply an abstract formulation of some very common and interesting situations in which what is best for each person individually leads to mutual defection, whereas everyone would have been better off with mutual cooperation.

Requirements for a prisoner's dilemma:

1. The order of payoffs. $T > R > P > S$ where T is temptation, R is reward for mutual cooperation, P is punishment for mutual defection, and S is the sucker's payoff; and
2. Discount parameter, i.e. the immediacy and likelihood of future encounters, can't be so high as to negate the shadow of the future, i.e., the players must meet each other again in the foreseeable future.

feelings is only 7 percent in what is said, 38 percent in how it is said, and 55 percent in body language (Covey, 2006). This information is lost if the parties aren't physically present. Similarly, one of the 12 principles in the Agile Manifesto¹³ is that the most efficient and effective method of conveying information to and within a development team is face-to-face communication (Larman, 2008). One of the reasons that co-location is so important is that it provides the opportunity for frequent, direct communication. If continuous co-location is not practical, the teams should spend time developing relationships when the project commences, and should meet periodically when significant issues need to be discussed or decided.

Decision Making

Teams use different decision mechanisms, although virtually all teams rely on some form of consensus. The team members must understand how decisions will be made and disputes resolved (Larman, 2008). Research and development teams, or teams focused on high levels of creativity tend to be self-organized and managed. They define the objectives, define the metrics for success, and structure the assignment of work. Leadership may pass from member to member based on who is the most effective at any given point. In some IPD projects, team leadership depends upon the stage of a process with leadership initially focusing on the designers and later transferring to the construction team. In other instances, the leaders are selected before the team and are responsible for team selection, management and training. And in all instances, the owner has a strong and critical leadership role. This leadership role should not be delegated to outside consultants, because they rarely are empowered to make owner-level decisions, dilute the owner's understanding of the context in which decisions must be made, and inevitably slow decision processes.¹⁴ The important point is that leadership and decision making should be a conscious decision, not an afterthought.

In many instances, decisions will develop naturally and will require little formal effort. In other instances, approaches such as brainstorming, nominal group technique,¹⁵ virtual prototyping, and other techniques may help the team rapidly develop multiple ideas and options. Brainstorming may also help develop group cohesiveness. To get the maximum value, these techniques may need to be facilitated by a trained person, which might be the team leader.

¹³ The Manifesto for Agile Software Development was published 2001 and was accompanied by 12 principles Agile Software development. www.agilemanifesto.org.

¹⁴ Owners with limited staff may benefit from adding consultants to manage and organize information flow, thus freeing the owner's staff to interact with the team and focus on decisions. Consultants, with IPD or Lean experience, are often very useful when initially organizing a project, mentoring, or facilitating team interactions.

¹⁵ In the nominal group technique, the team meets as a group to address a problem or series of problems. But rather than openly discuss or note possible ideas, each member independently writes down his or her ideas and when the initial period ends, presents the ideas to the group as a whole. Only when all of the ideas have been presented and recorded does the group begin to assess and select among options. Each member silently rank orders the ideas and the cumulative results are tallied. The chief advantage of the nominal group technique is that it permits a group to meet formally and draw on all of the members but does not restrict thinking because members are intimidated by the status or forcefulness of others. Research generally shows that nominal groups outperform brainstorming groups (Robins, 2011).

For complex problems, formal approaches, such as A3 analysis, decision matrices, decision trees, Ishikawa diagrams, causal or influence diagrams or Choosing by Advantage™ can be effective because they increase visibility of key determinants and allow all viewpoints to be considered. Moreover, if properly facilitated, they channel differing opinions into a less adversarial process, encouraging dissent while preserving relationships.

Many of the formal techniques are quasi-quantitative and deliver a numerical score or similar calculation and at least appear to be "rational." It should always be remembered that the resulting numbers depend upon subjective evaluations and, in the end, the analysis process may be more valuable than the calculated result. As noted by Larman, "We diagram to have a conversation." In fact, research on decision making shows that emotion is critical to rational thinking (Robbins, 2011). "Reason may not be as pure as most of us think it is or wish it were...emotions and feelings may not be intruders in the bastion of reason at all: they may be enmeshed its networks, for worse *and* for better (Damasio, 1994). Most significant decisions are made by judgment rather than a defined prescriptive model (Bazerman, 1994)¹⁶and decisions divorced from intuition are less accurate.

Intuition is a highly complex and highly developed form of reasoning that is based on years of experience and learning. It appears that rational analysis has been overemphasized, and in certain instances, relying on intuition can improve decision making (Robbins, 2011).

The best approach is to use a combination of rational and intuitive processes such as the steps recommended by Robbins

- Analyze the situation;
- Be aware of biases;
- Combine rational analysis with intuition;
- Improve creativity; and
- Increase your options.

Purpose

Teams are more motivated if their work product fulfills a valuable purpose. Team leaders can strengthen commitment by focusing on the value of the work to others. The value can be inherent in the project, such as a center to care for veterans, or can reside in the appreciation of end users or project participants who rely on the team's work. In healthcare projects, for example, front line users, such as nurses and doctors can explain to the team how they will use the facility to treat patients. Similar approaches can be taken with schools and many other types of projects. The project's positive purpose can be reinforced by photographs or other information that shows how the facility will affect others. Even if the project does not fulfill a grand purpose, the leader can explain how the team's work benefits the project as a whole and the customers of the team's work to regularly show their appreciation.

¹⁶ M. Bazerman, Judgment in Managerial Decision Making, 3rd ed. (New York: Wiley, 1994), p. 5.

Physical Proximity and Communication

Successful teams spend a large amount of time working face-to-face. In larger projects, the cross-functional teams are often co-located throughout the project or use "big rooms" as meeting places for intense interaction and discussion.

Physical proximity of team members has immense advantages. The most obvious advantages are the ease and speed of communication. Direct communication is also more effective, especially if the team is dealing with a problem that requires group intelligence and creativity. And if the issue is important or emotional, the larger portion of information is communicated through context and visual cues, which is lost without face to face communication. Face-to-face interaction improves communication quantity and quality.

Physical proximity also develops understanding and appreciation of each team member's strengths, weaknesses, and personalities. Getting to know each other is a critical step in developing the relationships that grow into trust. And trust is the currency of collaboration.

Without physical proximity, it is very difficult to jointly manage the team's work. For example, if the designers return to their offices between meetings, then a lot of work can occur that no one besides the designers even know is occurring. The team members can't provide input or advice, nor can they decide whether work should or should not be performed. If the participants are physically present, they automatically know what the others are doing and can head off wasteful detours before they occur.

Team Incentives

Incentives are discussed more deeply in Team Motivation and Creativity. If incentives are used, they should reward teamwork or team outcomes, not individual actions. Currently, the formal incentives in most projects focus on project outcomes, such as comparing projected to actual costs, assessing project quality, or measuring energy efficiency. A smaller number of projects are using behavioral metrics, such as plan percent complete goals,¹⁷ 360 degree team reviews, or readjustment of profit based on a subjective assessment of teamwork. At present, there isn't sufficient experience to evaluate the relative effectiveness of outcome, behavioral or mixed incentives.

A potential disadvantage to behavioral incentives is diverting effort towards meeting the behavioral incentive, regardless of its effect on outcome. At least one researcher recommends against behavioral incentives because they can lead to overvaluing the behavior and compromise good management, or even ethics, to achieve the numerical goal (Hackman, 2011).

We do know, however, that informal incentives, such as praising effective teamwork, breaking out a six-pack at the end of a hard week and commemorate an achievement, or simply expressing appreciation, are very effective, and are recommended by almost all commentators.

¹⁷ In Lean practice, the team members regularly make requests for action (pull requests) that the recipient will promise to satisfy by an agreed date. The team monitors the reliability of the promises by tracking the percentage of commitments achieved as planned, i.e., plan percentage complete.

Work Structuring

To assess why an employee is not performing to her or his best level, look at the work environment to see whether it's supportive. Does the employee have adequate tools, equipment, materials, and supplies? Does the employee have favorable working conditions, helpful co-workers, supportive work rules and procedures, sufficient information to make job-related decisions, adequate time to do a good job, and the like? If not, performance will suffer (Robbins, 2011).

The necessity of adequate resources may seem obvious, but in many instances teams are hampered by lack of adequate hardware or software, insufficient administrative or technical support, or lack of time or other restrictions that distract team members from their primary purpose. Not only are the restrictions inefficient, they are frustrating, disheartening and imply management disinterest in the team's tasks. Team leaders should be sensitive to how team members' time is being spent and should use Lean tools and processes to reduce non-value activities.

Visual Management

One of the obvious difference between IPD and conventional projects is the use of wall space. In IPD, information about cost, schedule, and goals is plastered across almost every inch of wall space. Progress towards targets is reported visually with charts, thermometers, banners and other visual tokens. At any moment, the team members can see where the project is going, how far it has to go to reach goals and what obstacles need to be overcome to achieve them. Wall space is also used to show the results of A3 analysis and to display work in progress. Visual management creates clarity and strengthens the common purpose.

Agile and Scrum

The challenge of working in cross-functional teams seems to be most difficult for design professionals, particularly consultants and consulting engineers. Part of the difficulty may stem from the economics of design practices. Management consultants have long recommended that designers maintain high utilization rates. To be financially successful, their professional employees need to be billing as many hours per day as possible. To maintain this high utilization rate, consultants must often work on many projects simultaneously to assure that they don't have unbillable down time. If the billing sheet isn't full, work more and improve the product. But this is directly contrary to the Lean principle of pull where you only work in response to a signal from the 'customer' and otherwise rest or improve (Larman, 2008). In a Lean system, the question is not "What can we get the workers to do to increase utilization?," the question is "What can we remove or stop doing if it doesn't provide value?" (Larman, 2008). Moreover, it is difficult to achieve high utilization on multiple concurrent projects unless the professional stays in his or her office where the files of multiple projects are readily available. This undermines all of the benefits of co-location.

The utilization mandate has another pernicious effect. Queuing theory shows that high utilization rates in systems with variability strongly degrade throughput.¹⁸

As utilization goes up in a system with lots of variability, average cycle time gets worse, not better. This is counterintuitive to an average accountant or management consultant who has been taught to 'improve productivity by increasing utilization of resources.' Most have not been exposed to queuing theory—how to understand stochastic systems with queues (People doing work with variability)—and so demonstrate a thinking mistake (Larman, 2008).

This means that information that is necessary to team performance is sharply delayed because of high resource utilization. The "traditional" 14 day turnaround time for RFIs reflects the difficulty in rapidly providing critically needed information from systems focused on maximizing utilization and has been a source of contention since it was first introduced.

Finally, many engineering firms are used to completing design during the construction documents phase in conjunction with receipt of submittals. Given the queuing issues discussed above, late involvement compounds the delay.

Large software development projects and complex design projects have similar needs for creativity, efficiency, quality, and coordination and they have similarly suffered from many of the problems that bedevil the design and construction process.

Traditionally, large software projects were developed using a "waterfall" methodology. The client needs were assessed, a global architecture was developed which was broken into component parts, individual tasks were then developed, documented and scheduled. As the project neared completion, testing would commence to expose and correct programming errors. Teams were organized around their special talents or tasks. The waterfall project structure is similar to traditional approaches to building and design. Despite immense effort and expense, the waterfall did not work. Projects were routinely late, bloated, error ridden and over budget.

About twenty years ago, groups of programmers started experimenting with flexible approaches built around small cross-functional teams that were self-organized and managed. Work was quantized to fit the teams and time-boxed.¹⁹ The changes worked. The result was the development and adoption of flexible approaches such as Lean, Agile and Scrum. Although some of the concepts need to be translated to fit the design/preconstruction phase of a project, their experiments and successes serve as hints for those seeking a better way.

"Agile" is not a practice. It is a quality of the organization and its people to be adaptive, responsive, continually learning and evolving—to be agile, with the goal of competitive business success and rapid delivery of economically valuable products and knowledge. Although people speak of agile practices, the concept is to be agile, rather than to do "Agile" (Larman, 2008).

¹⁸ The mathematics of queuing theory show that throughput is degraded *exponentially*, thus gridlock is reached well before high levels of utilization. (Larman 2008)

¹⁹ Time boxing is setting absolute time limits for achieving a specific deliverable. The time periods are short and linked to specific outcomes. Breaking the work into short duration pieces reduces variability, discourages excessive activity, and improves flow.

The nine principles of Agile software development are remarkably similar to the recommendations for efficient, Lean design.

- Deliver something useful to the client; check what they value;
- Cultivate committed stakeholders;
- Employ a leadership-collaboration style;
- Build competent, collaborative teams;
- Enable team decision making;
- Use short time-boxed iterations to quickly deliver features;
- Encourage adaptability;
- Champion technical excellence; and
- Focus on delivery activities, not process-compliance activities.

Three points of Agile are worth mentioning in a design context. To be agile is to be close to the client. To avoid queuing issues, an agile team works on specific deliverables in specific time limits (time-boxing or sprints), reducing variability by adjusting batch size, another Lean concept, and increasing throughput. This allows reasonable utilization without gridlock. Finally, the software, not the documentation, is the goal. Thus, the output of structure design is the building, not the prints or even the model. From this viewpoint, the designer's client is the contractor²⁰ and design should be "pulled," i.e., design should provide the information requested by the contractor to allow it to achieve the designer's intent. Finally, testing is not a culmination phase, but is built into every step of the progress. Thus, QA/QC is not a separate phase, but is continuous throughout design.

Scrum is a specific adaptation of Agile built around small, self-managed, cross-functional teams. Scrums are usually composed of around 7 people from different backgrounds and with different responsibilities. Moreover, the scrum does not have a "leader" *per se*, but is mentored by a person with excellent subject matter and interpersonal skills (Scrum Master) who provides experience, training and resources. The team selects the projects it will accomplish within a sprint from a prioritized list (product backlog) and then determines the best method for accomplishing the goals.

One of the visible elements of Scrum is the daily scrum meeting where each person reports three things he or she is working on, what they have accomplished since the last meeting, what will be accomplished by the next meeting, and any blocks or impediments they are facing. The entire meeting takes 15 minutes or less, there is no discussion within the meeting. As the meeting breaks up, if parties have ideas or suggestions, they can talk in smaller groups. The scrum's time is not used to discuss issues that are only relevant to one or two nor is anyone allowed to monopolize the conversation. In some scrum meetings, management is not allowed to attend. The meeting is to enable the team to operate better, not to allow management to grade or guide the activity. Each day, the team members update their estimate of the amount of time required to complete their current task in the sprint backlog. The

²⁰ Permitting agencies may also be a "client" from this perspective. Specific design deliverables will be necessary to meet their needs or requirements even if unnecessary to build the structure.

remaining hours in the sprint are calculated and the progress recorded in the sprint burndown chart. The team's goal and its progress are completely transparent.

Just like Agile, Scrum has underlying values that resonate in a design and construction environment.

- **Commitment**— Be willing to commit to a goal. Scrum provides people all the authority they need to meet their commitments.
- **Focus**— Do your job. Focus all your efforts and skills on doing the work that you've committed to doing.
- **Openness**—Scrum keeps everything about a project visible to everyone.
- **Respect**—Individuals are shaped by their background and their experiences. It is important to respect the different people who make up a team.
- **Courage**—Have the courage to commit, to act, to be open, and to expect respect.

The design and construction industry has benefited from techniques such as Lean, pre-fabrication, cross-functional teams, and even BIM that were commonly used by other industries long before they were adopted by the AEC community. Agile and Scrum move the focus of efficiency from utilization to the creation of value. Short time-boxed sprints limits scope creep, reduces gold plating and increases focus on producing useful deliverables. Design quality is built into the process and teams are empowered to achieve results the client values.

Team Motivation and Creativity

All projects require motivated teams and many require innovation too. Fortunately, the principles that improve motivation also improve creativity. Team leaders who want both should start by creating a work environment that improves motivation and engagement and then layer additional factors that stimulate innovation.

It may seem soft and fuzzy to suggest that job satisfaction and job performance are related. However, there are at least 300 studies that suggest the correlation is quite strong and long term studies show a high correlation between employee engagement and productivity (Robbins, 2011).

The most important thing managers can do to raise employee satisfaction is to focus on the intrinsic parts of the job, such as making the work challenging and interesting. Although paying employees poorly will likely not attract high-quality employees to the organization, or keep high performers, managers should realize that high pay alone is unlikely to create a satisfying work environment. Interesting jobs that provide training, variety, independence, and control satisfy most employees. There is also a strong correspondence between how well people enjoy the social context of their workplace and how satisfied they are overall. Interdependence, feedback, social support, and interaction with co-workers outside the workplace are strongly related to job satisfaction, even after accounting for characteristics of the work itself (Robbins, 2011).

Work satisfaction is perhaps the most significant motivating factor. As an engineering supervisor was overheard to say: "Never tell engineers to work late. Just make the job so interesting they never want to leave" (anonymous).

Generally, people are motivated by what interests them and what they believe is important. Having the authority to use their skills as they think best, is also important.

Teams work best when employees have freedom and autonomy, the opportunity to utilize different skills and talents, the ability to complete a whole and identifiable task or product, and a task or project that has a substantial impact on others. The evidence indicates that these characteristics increase members sense of responsibility and ownership over the work and make the work more interesting to perform (Robbins, 2007).

Although having goals is critical, and the team should be free to determine how to achieve them, it may not matter whether the leadership or the team sets those goals. Some commentators recommend team involvement in goal setting, but other studies indicate that teams with imposed goals work as hard as teams with self-imposed goals (Robbins, 2011). One advantage to self-imposed goals is that management does not need to convince the team of their value. Another advantage, predicted by self-determination theory,²¹ is that if people feel they have control over which task to undertake it will feel less like an obligation (Pink, 2009; Robbins 2011). For example, a person who chooses to garden has a rewarding hobby, but a person who is paid to garden is just going to work. Regardless of who sets goals, they should be specific and should relate to actual project performance (Katzenbach, 2005). False goals, false deadlines, or goals that are abandoned while the project is underway, lead to cynicism.

Recognition also motivates team members. For professionals, the recognition may count more than a tangible token (Hackman, 2011). The most important recognition is from the team members themselves, and is more powerful than externally generated feedback (Robbins, 2011). Recognition from management can be helpful provided that it reinforces team activity. Recognition of a "star", especially if tied to money or perquisites, can lead to corrosive competition within the team.

Much has been written about the ineffectiveness of external rewards, such as cash.²² Commentators as early as Deming have stated that monetary rewards for outstanding achievement may be counterproductive (Deming, 1982). Daniel Pink's bestseller, *Drive*, was based on the concept that intrinsic motivation was much more powerful than external rewards and that external rewards can be counter-productive (Pink, 2009). In fact several researchers have found that pay for performance actually *decreased* engagement and creativity (Deci 1971, 1972; Robbins, 2011; Pink, 2009; Amabile, 1998). If external rewards are used, they are most

²¹ Self-determination theory proposes that people are motivated by the freedom to choose their tasks. If the tasks are imposed, *even if they are exactly the same*, they become an obligation and less enjoyable.

²² The sharing of risk and reward common to IPD contracts addresses issues separate from the motivation of individual members. For a discussion of incentives in IPD agreements see Darrington & Howell, *Motivation and Incentives in Relational Contracts*, Journal of Financial Management of Property and Construction, Vol. 16, No. 1 (2011) and Ashcraft, *Negotiating an IPD Agreement*, The Construction Lawyer, Vol. 31, No. 3 (Summer 2011).

effective if unexpected—a treat rather than a payment (Pink, 2009). And if rewards are used, they should be based on team performance, not individual success (Robbins, 2007).

Creativity is often associated with dramatic achievements in art or science, with breakthroughs and stunning structures. For IPD teams, creativity is developing efficient and elegant solutions at every level of execution and encompassing revolution *and* evolution. Properly managed teams are an essential component to increasing project creativity.

Current theory posits three major elements to creativity: expertise, creative thinking skills, and intrinsic motivation (Amabile, 1998; Robbins, 2011). In most projects, there is not enough time to significantly improve the critical thinking skills of team members. As a practical matter, team leaders must try to select team members who already have these attributes.

Expertise, however, can be affected by management practices. First, the creation of cross-functional teams increases the expertise of the team as a whole. By providing personnel with a broad range of training and experience, the team has access to more information and more options. This is one of the reasons that creativity experts suggest diverse teams (Amabile, 1998; Pink, 2009; Robbins, 2007; Larman, 2008).

If you want to build teams that come up with creative ideas, you must pay careful attention to the design of such teams. That is, you must create mutually supportive groups with a diversity of perspectives and backgrounds. Why? Because when teams comprise people with various intellectual foundations and approaches to work—that is, different expertise and creative thinking styles—ideas often combine and combust in exciting and useful ways (Amabile, 1998).

But diversity can also lead to conflict because of different experiences and work styles. Kept within limits, conflict can actually boost creativity by stimulating higher levels of innovation and exchange.

Conflict on a team isn't necessarily bad. Teams completely devoid of conflict are likely to become apathetic and stagnant. Thus, conflict—but not all types—can actually improve team effectiveness. Relationship conflicts—those based on interpersonal incompatibilities, tension, and animosity toward others—are almost always dysfunctional. However, on teams performing nonroutine activities, disagreements among members about task content (called task conflicts) stimulate discussion, promote critical assessment of problems and options, and can lead to better team decisions. The way conflicts are resolved can also make the difference between effective and ineffective teams. A study of ongoing comments made by 37 autonomous work groups showed that effective teams resolved conflicts by explicitly discussing the issues, whereas ineffective teams had conflicts focused more on personalities and the way things were said (Robbins 2011).

Thus, the conflict that may be created by diverse teams is an asset that should be carefully managed. Teams should be taught how to interact forcefully without engaging personally and team leaders should keep conflict within bounds and focused on task or process. In addition, team members must recognize and respect the knowledge and contributions of each team member.

Team leaders can also increase knowledge through continuous education and information exchange. This can occur formally, as in regular teaching sessions, and can occur informally through periodic information exchanges or even information updates on walls or banners. The goal is to disperse information broadly throughout the team.

The final element, intrinsic motivation, should flow from the nature of the work itself and should be a result of proper team and work organization. *"When people are intrinsically motivated, they engage in their work for the challenge and enjoyment of it"* (Amabile, 1998). And intrinsic motivation, is a crucial driver for creativity.

Although creative motivation is intrinsic, it can be affected by management practices. According to Amabile's research, challenge, freedom, resources, work-group features, supervisory encouragement and organizational support all affect intrinsic motivation. Challenge is matching the proper employees to tasks that are challenging but within their reach. Freedom is allowing the team to determine how to achieve the assigned or agreed goal. Resources include providing sufficient material support, but also the right amount of time to address the problem. Real and realistic (not arbitrary) time pressure spurs creativity, but truly impossible deadlines are seen by the team as not worth attempting. Work group features include having diversity of knowledge, but also diversity of skills, such as problem solving and interpersonal skills. Supervisory encouragement acknowledges the importance of the team's work and keeps the team engaged even if results are not immediately evident. Moreover, the leader must not allow criticism to kill good ideas—or prevent their expression—before they can be fairly developed and analyzed. Finally, organizational support mandates information sharing and collaboration and sweeps aside political issues that may undermine the creative efforts (Amabile, 1996, 1998).

Although creativity cannot be reduced to a formula, there are management practices that increase a team's ability to develop new and innovative solutions to existing problems. Luckily, most design and construction participants are intrinsically motivated and want to be proud of their projects. The challenge for team leaders is to remove impediments that prevent them from doing so.

Summary

Effective teams:

- Have adequate resources;
- Have competent leaders who they trust;
- Have appropriately challenging goals and the freedom to achieve them as they best determine;
- Are given work that they can own and be proud of;
- Believe in and value the tasks they are given;
- Are no larger than necessary for their tasks—generally fewer than 10 members;
- Have members with diverse backgrounds and experiences;

- Trust and respect each other;
- Communicate well, disagree and resolve their differences without personalizing the conflict; and
- Are evaluated and rewarded based on team contributions.

References

- Amabile, Teresa M., *Managing for Creativity*, Harvard Business School (Feb. 21, 1996)
- Amabile, Teresa M., *How to Kill Creativity*, Harvard Business Review (September-October 1998)
- Ashcraft, Howard W., *Negotiating and Integrated Project Delivery Agreement*, The Construction Lawyer, Vol. 31, No. 3, American Bar Association Forum on the Construction Industry (Summer 2011). (Also available at www.hansonbridgett.com/practices_industries/IPD_BIM.php.)
- Axelrod, Robert, *The Evolution of Cooperation*, Basic Books (Revised Edition 2006)
- Bazerman, M., *Judgment in Managerial Decision Making*, 3rd ed. (New York: Wiley, 1994)
- Benkler, Yochai, *The Unselfish Gene*, Harvard Business Review (July-August 2011)
- Covey, Stephen M.R., *The Speed of Trust*, Free Press (2006)
- Damasio, A.R., *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Quill, 1994)
- Darrington, Joel and Howell, Gregory, *Motivation and Incentives in Relational Contracts*, Journal of Financial Management of Property and Construction, Vol. 16, No. 1 (2011)
- Deci, Edward L., *Effects of Externally Mediated Rewards on Intrinsic Motivation*, Journal of Personality and Social Psychology (1971)
- Deci, Edward L., *Intrinsic Motivation, Extrinsic Reinforcement and Inequity*, Journal of Personality and Social Psychology (1972)
- Collins, Jim, *Good to Great: Why Some Companies Make the Leap...and Others Don't*, HarperBusiness (2001)
- Deming, W. Edward, *Out of the Crisis*, MIT (1982-2002)
- Finneg, Martha, *The Truth About Getting the Best from People*, FT Press (2008)
- Hackman, J. Richard, *Collaborative Intelligence: Using Teams to Solve Hard Problems*, Berrett-Koehler (2011)
- Janis, Irving L., *Victims of Groupthink*, Boston, Houghton Mifflin Company (1972)
- Karau, S. J. and Williams, K. D., *Social Loafing: A Meta-analytic Review and Theoretical Integration*, Journal of Personality and Social Psychology (October 1993)
- Katz, R., *The Effects of Group Longevity on Project Communication and Performance*, Administrative Science Quarterly, Volume 27 (Mar 1982)
- Katzenbach, Jon R. and Smith, Douglas K., *The Wisdom of Teams*, Harvard Business Press (1992)

Katzenbach, Jon R. and Smith, Douglas K, *The Discipline of Teams*, Harvard Business Review (July-August 2005)

Larman, Craig, *Scaling Lean and Agile Development*, Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley Professional (2008)

Pink, Daniel H., *Drive: The Surprising Truth About What Motivates Us*, Riverhead (2009)

Robbins, Stephen P., Judge, Timothy A., *Essentials of Organizational Behavior*, Prentice Hall (11th ed., 2011)

Robbins, Stephen P. quoting, A. R. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Quill, 1994).

Robbins, Stephen P., *The Truth About Managing People*, FT Press (2007)

Sheppard, J.A., *Productivity Loss in Performance Groups: A Motivation Analysis*, Psychological Bulletin (January 1993)