A GUIDE TO THE BOOK:

Integrating Project Delivery
A Simple Framework for Putting IPD into Action

Who is this guide for?
This guide was created for owners, designers, builders and students who want to discover how to transcend the status quo and deliver buildings that are truly the best possible outcomes for building owners and occupants.

Why was it created?
While there is a lot of information available, the “how-to” for executing a truly integrated project was lacking in the industry. Book authors—Martin Fischer of Stanford University, Howard Ashcraft of Hanson Bridgett LLP, and Dean Reed and Atul Khanzode of DPR Construction—created a simple framework in their comprehensive book, Integrating Project Delivery. This guide provides a brief overview of the simple framework, or roadmap on how to get there.

Published by Wiley, Integrating Project Delivery is authored by: Martin Fischer, Howard Ashcraft, Dean Reed, Atul Khanzode
The need for a better way to deliver better buildings

Design and construction projects are long and complex and require collaboration between many parties. While there are benchmarks in place to help owners achieve efficiencies, the traditional delivery model leaves much to be desired.

What if we could do better?

- What if we could create buildings that exceeded expectations instead of falling short?
- What if we could create buildings that are beautiful, efficient, useful, cost-effective and sustainable instead of often needing to compromise?
- What if a building operated as a whole instead of multiple, disparate systems housed inside one facility?

Enter integrated project delivery, or IPD.

The book, Integrating Project Delivery, provides something of value for both experienced practitioners and students of the industry and helps readers understand the following:

1. The elements of integration.
2. How they interconnect.
3. Why they are all necessary.
4. How they can be put into practice and key examples.

Worlds apart in every way: traditional delivery vs. integrated delivery

How do traditional building methods differ from an integrated approach?
According to The American Institute of Architects (AIA), they differ in more ways than one.

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>TRADITIONAL</th>
<th>INTEGRATED/IPD</th>
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<tbody>
<tr>
<td>Teams</td>
<td>Fragmented, hierarchical, controlled, formed on “as-needed” basis</td>
<td>Integrated team of key project stakeholders, assembled early in process, highly collaborative</td>
</tr>
<tr>
<td>Process</td>
<td>Linear, segregated, siloed</td>
<td>Concurrent, multi-level, openly shared information</td>
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<tr>
<td>Risk</td>
<td>Managed individually, transferred to greatest extent</td>
<td>Managed collectively, appropriately shared</td>
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<tr>
<td>Compensation</td>
<td>Individually pursued, usually on a first-cost basis (lowest price of design and construction of the building alone, without maintenance and other costs)</td>
<td>Value-based team success tied to project goals established up front</td>
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<tr>
<td>Communications</td>
<td>Paper-based and two-dimensional</td>
<td>Digital, virtual, rely heavily on BIM and simulation</td>
</tr>
<tr>
<td>Agreements/contracts</td>
<td>Unilateral effort, allocate and transfer risk, no sharing</td>
<td>Multilateral, open sharing of risk and information</td>
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<td>Behaviors</td>
<td>Self-preservation, combative</td>
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Where to start?
A simple framework.

Between The American Institute of Architects (AIA) and other industry organizations, there is a large amount of good information on IPD available. But since it involves a shift in mindset and practice in just about every aspect of designing, building and delivering facilities, the authors dug deeper and created a roadmap for integration.

It took eight years to write *Integrating Project Delivery*, because the authors wanted to explain what IPD is and develop a roadmap, or framework, that can be applied to deliver high-performance buildings. The book was written to empower owners and AEC teams in a wide range of markets to learn from the experience of other pioneers who have been leading the industry in this relatively new delivery model.

It all starts with a high-performance building (the desired outcome) and works backwards to determine all the components necessary to get there. While this simple framework is not designed to be followed in a linear fashion, it is a useful demonstration of how the elements must work together.

This guide will briefly cover each of the key elements and how they work together toward the common goal—a product where the sum is greater than its individual parts. Learn more about how to put the simple framework and integration into practice in the book, *Integrating Project Delivery*. 
The best outcome for owners and occupants after construction

Design and construction projects require collaboration between many parties. While there are benchmarks in place to help owners achieve efficiencies, the traditional delivery model leaves much to be desired.

Because high-performance buildings have such aggressive goals, they require performance that is difficult to achieve with current disparate methods, processes and systems. For true integration, behaviors must shift to become more collaborative while engaging in every aspect of the simple framework.

High-performing buildings must be:

**Buildable:**
- Easier to assemble, saving hours and materials
- Safer to assemble
- Constructed using the best available methods and practices

**Operable:**
- All systems work together and are easily maintained and fixed
- All operations and maintenance requirements are considered early on during design

**Usable:**
- Support the core functions of the building and its occupants
- Enable uses to be more effective (examples: layout, flexibility, atmosphere)

**Sustainable:**
- Works in harmony with natural, social and economic contexts
- Allows client’s management team to sustain its business
- Reduces waste, environmental impact and disposal costs
- Costs less to operate, helping owners remain competitive
All parts work together for the greater good

Achieving optimal performance is feasible when all of a building’s systems are designed to work together and complement each other. While traditional buildings are designed as a series of disparate systems combined into a building with each fabricator focused on a specific discipline, IPD requires that all designers, engineers, builders and specialty trades collaborate to give input on the final design at the front end of the project. The result? The best possible outcome.

There’s so much more to IPD than integrating the systems of the building itself.

**Integration must take place among:**
- The program to performance criteria
- The building to its climate and site
- The team members to each other
- The building systems to themselves

How can integrated building systems be achieved?

It all begins with understanding user values, such as environmental impacts, energy consumption, ease of maintenance, flexibility of layout and other values. Team members can use a product organization process (POP) framework to interview stakeholders on a variety of building use and comfort criteria.

From there, team members must map these user values to building features, then build integrated simulation models to predict how these systems will interact with each other.

Once the design is finalized, the team develops a fully integrated building system that achieves optimal performance on the metrics that matter most to the owner.
DPR’s Phoenix office demonstrates how an integrated systems approach leads to a high-performing building. While the industry standard is to build oversized cooling systems to accommodate worst-case scenarios—increasing installation costs, wasting energy and costing more in overall operating costs—the team instead embraced the concept of “right-sized” cooling for everyday conditions. By understanding how the cooling system affected all other systems, the team achieved the right size and the best energy savings.

In addition, for the office renovation, the team modeled its performance and used computational fluid dynamics (CFD) simulations to predict the temperature and distribution inside the building.

The integrated systems approach enabled DPR to transform a marginal 1972 retail building into a certified net-zero energy showcase facility, with a projected payback of just 10 years.
Aligning owner goals with building performance

While the process for traditional product delivery is often linear, where one discipline performs in a silo, then passes that portion on to the next discipline, integration requires the exact opposite. Upstream and downstream collaboration is essential, including user and stakeholder values, construction methods, building operations and sustainability. It’s the only way to continuously validate design against user values and make necessary adjustments.

How can integration be achieved?

It requires shared knowledge from the start:

- User value is translated into design solutions
- Design informs and enriches user value and is continuously checked against user value as it progresses
- Builder’s knowledge informs and shapes design
- Operator’s knowledge informs and shapes design
- Sustainability concerns and knowledge inform and shape design

Integration + prefabrication = efficiency

Off-site fabrication enables key components to be produced together in a safe and controlled environment, reducing costs while enhancing safety and construction efficiency. But it can only be achieved when the design is as close to the final product early on. This requires input from disciplines who may not weigh in on initial designs, like building occupants and operators, to ensure all performance goals stay on track.
Removing silos to empower stakeholders

In traditional design and construction projects, players from many different firms collaborate and share necessary information, but they are primarily motivated to only minimize risk and maximize profit for their own bottom line.

True integration requires a shift in mindset and behavior. Acting as a team of strategically assembled experts from various firms isn’t enough. They need to act as if they belong to the same organization—one that is focused on the good of the project above all else. The structure of an integrated organization is established by the contract or agreement. There is no formal chain of command, so everyone is responsible for the project as a whole—not just their individual work.

How does the organization align people to the project?

1. **Connects** people’s actions, information and decisions
2. **Uses clear language**—making clear requests for what they need when they need it and negotiating and collaborating with team members whose work is interdependent
3. **Promotes** individual and collective learning so the organization’s IQ is greater than any single individual’s
4. **Connects** the work that people do to the unique combination of things the owner has defined as value (the project goals)

How is a truly integrated organization achieved?

Work must be connected through project organization to customer value. A product organization process (POP) model can be used to connect work to what is being built.

Mapping the flow of value through value streams enables individuals to better align themselves with their work processes. By forming and working in cluster teams, work is structured to produce greater value.

Implementing integrated concurrent engineering (ICE) is a valuable tool, helping teams work faster to make decisions and solve problems.
How can you manage and strengthen your team to ensure your project is set up for success?

In IPD agreements, the management structure is typically defined in the contract, and project teams are led by managers committed to making “best-for-project” decisions.

These committees have six crucial responsibilities in managing the project:

1. **Develop a clear and common understanding of project values and goals.**
   This is the foundation of an IPD project—clearly defined project values and goals that are determined by all key stakeholders.

2. **Clearly communicate these values and goals to ALL participants.**
   In addition to clearly communicating values with all participants, leaders must appropriately onboard any subs or consultants, as well as continually reinforce the goals and values to the whole team through repetition and recognition.

3. **Create a functional physical and virtual space for co-location.**
   To enhance performance, digital networks, collaboration systems and other elements must be established up front.

4. **Define the necessary project teams/select team members.**
   Teams should be diverse, cross-functional and have different viewpoints and perspectives. Not only does this diversity provide more information to inform the design, the tension between perspectives stimulates greater creativity.

5. **Provide training and mentoring for project teams.**
   Training and mentoring should address three task performance issues: level and coordination of member effort; appropriateness of the task and performance strategies the team is using; and degree to which the team leverages all of its members’ knowledge and skills.

6. **Monitor and adjust team dynamics as needed.**
   The team’s strengths and weaknesses, including conflicting personalities, should be reviewed and addressed to minimize negative impacts.

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**Team dynamics can make or break a project.**

Managing groups of diverse people from a wide range of disciplines and companies requires deep commitment and understanding of how to create, support and nurture them to deliver a successful project through a high-performing team.
Sutter Health Eden Medical Center

CASTRO VALLEY, CA—11-PARTY INTEGRATED FORM OF AGREEMENT

To design and build the Sutter Health Eden Medical Center (SHEMC) replacement hospital, 11 companies formed an IPD partnership. The partner companies’ leaders committed from the outset to doing things differently by signing an Integrated Form of Agreement, a clear statement of expectations for the project delivery team, including on-time delivery and a total cost of $309 million.

The stakes were high for all partners—under the contract, they would win or lose together based on overall team performance.

Working together, the integrated team developed a concept, estimated costs and planned for construction within budget and schedule constraints. Creating core teams and clusters, partner company leaders participated in weekly design coordination, cost review and planning meetings, reporting status and expressing any potential threats to the budget or schedule.

The integrated project was delivered within budget, one week ahead of the deadline for California regulatory agency signoff and six weeks ahead of the first patient deadline. The team achieved all the owner’s goals.

What does a truly integrated project organization look like?

- Decisions are made as if all participants were employed by a single organization
- People trust each other and share in leadership duties
- All decisions are based on what’s best for the project
- Project leaders take responsibility for building a strong network of commitments
- Team members create space for innovation by listening to each other in dialogue rather than trying to persuade
- Delivery team members and stakeholders thank each other for discovering problems early on
- New ideas and approaches are welcomed and heard
Real-time access is the cornerstone of collaboration

It only seems logical that all project information should be integrated and readily available by all team members. While the traditional approach often stores information in different formats and different systems, integration requires real-time access to the latest information regarding project scope, cost, schedule and quality. Without it, team leaders are flying blind.

Integrated information—IPD’s neural system—should embody five characteristics:

1. **Use common language**—protocols, naming and interoperability standards are clear and understood by all
2. **Be readily accessible**—available in real time and ideally stored in a data library
3. **Be unique and reusable**—reflects the needs of all project users and is structured to contain info required by all stakeholders
4. **Have a source of truth**—allows the user to determine its reliability
5. **Be aggregated from cross-functional sources**—multidisciplinary input provides current and accurate representation of the project

How can integrated information be achieved?

- **Common language & standards**: Agreement on organization, standards and protocols for creating and sharing information early on is key
- **BIM & visualization tools**: Representation of all disciplines in a single model helps everyone understand the dependencies of their work on other disciplines
- **Cost & budget tracking dashboard**: Provides near real-time information so the team can make informed decisions toward reaching the target cost

To learn more about integrated project information and how to implement it on your next project, read Chapter 10 in the book, *Integrating Project Delivery*. 
Aligning owner goals and team outcomes

The only way to deliver a high-performance building is to understand and define the values that will drive it. As such, this is the most important step in the integration process.

While some owner objectives are immeasurable, there must be some agreed-upon objectives in place to measure and track performance. A highly valuable building design considers both cost and income of a facility when making decisions that affect design, construction, operation and use.

How can metrics drive outcomes?

The team must:

- **Agree** on how to measure the value they are creating for the owner
- **Prioritize** stakeholder goals and connect them to design solutions
- **Seek** alternatives from stakeholders
- **Align** how they’ll produce value
- **Execute** continuous commissioning to measure production and progress at every step along the way
- **Use dashboards** and other tools to track metrics in real time so the team can assess and adjust as needed
Palo Alto Medical Foundation (PAMF) 
Mountain View Center

MOUNTAIN VIEW, CA—BIM, 4D SIMULATION
DRIVE ZERO IN-FIELD CONFLICTS FOR MEDICAL COMPLEX

Change orders in the field can add up to lost time and expensive rework. When planning the design and construction of this state-of-the-art, 250,000-sq.-ft. medical office building, DPR, its design partners and the owner enlisted the help of MEP and fire-protection subcontractors experienced in BIM.

With ambitious goals of limiting reciprocally interdependent work during construction and avoiding rework, the team used BIM and 4D simulation to sequence the MEP work, then broke the site into quadrants and identified the installation sequence for each. Most of the materials were prefabricated and delivered just in time to further enhance efficiencies.

The team’s efforts paid off—only two of 233 requests for information were related to field conflict, and zero change orders were issued due to field conflicts. The trades finished their work ahead of schedule and enhanced this part of the project by approximately 20 percent.

Managing controllable factors for the win

Examples of things that can be controlled for better outcomes include:

- Percentage of MEP systems fabricated off site
- Number of change orders due to conflicts during construction
- Hours lost due to safety incidents
- Percent of budget items within a certain range of budgeted costs
- RFIs due to conflicts in construction
- Rework hours compared to total hours
- Meeting participation
- Level of development (LOD) of BIM per discipline
- Using 3D and 4D models for constraint identification
Ensuring all team members are doing the right things at the right time

Project teams are always producing a mountain of information, whether it’s about design, procurement, quality, schedule, turnover, etc. All of this information is necessary for the safe production of a high-quality, high-performing building.

The question is whether the right people are doing the right thing at the right time. If not, time and money are being wasted. Producing precisely what the downstream customer needs when they need it is the goal of Lean production management. While this sounds straightforward, it can only be achieved when people work together as an integrated, aligned team.

Effective production management requires managers to help team members plan and manage their work as follows:

1. **Plan work as a team, not for the team.** Ask the doers to become planners/doers.

2. **Develop a clear and common understanding.** Every individual on a team is both a customer and a supplier. Everyone is responsible for clearly describing what they need and understanding what they will be providing. Both parties must agree on what will be delivered and when. It can’t be dictated.

3. **Create a big picture strategy.** Develop an end-to-end plan showing when big decisions and chunks of work need to be completed.

4. **Next, develop the plan.** All those involved in each big chunk of work should analyze the requirements and develop a clear plan for how they will make the work flow—pull-planning backwards from key milestones and gathering the information, materials and resources needed to complete work. This enables the people responsible to look ahead to identify and remove roadblocks.

5. **Daily Huddle.** Managers or foremen need to talk daily about workflow and any problems their teams encountered. They also commit to the work their team will start or complete. Each manager should answer the three questions used in a Daily Scrum meeting, a timed 15-minute meeting where the team synchronizes activities and creates a plan for the next 24 hours:
   - What have you done since yesterday?
   - What are you planning to do by tomorrow?
   - Do you have any problems preventing you from accomplishing your goal?
Co-location is the execution of work by key team members in a single physical location, often referred to as the “Big Room.” While the cost of relocating team members from across the country (or even globe) to a single space, providing travel and hotel accommodations and more, can be significant, the result is a better building at a lower cost.

While having the whole team co-locate isn’t always feasible, major design decisions, logistics and production planning should occur in the “co-lo.”

Co-location is worth the effort and costs because it:

- Radically reduces time to make an informed decision
- Improves accuracy of communication through direct discussion and feedback
- Increases creativity through the collision of different perspectives and ideas
- Provides designers with a fuller understanding of design consequences and alternatives
- Supports a common understanding of values, goals and project status
- Improves project management by making work visible
- Strengthens relationships among team members
- Supports decision-making approaches like integrated concurrent engineering
- Improves virtual communication that follows co-located work
- Provides a location for visual management controls

For more tips on how to establish and manage co-location for successful integrated concurrent engineering, see Chapter 14 in the book, Integrating Project Delivery.
University of California
San Francisco (UCSF)
Medical Center at
Mission Bay

SAN FRANCISCO, CA—‘BIG ROOM’ HELPS DELIVER BIG RESULTS
FOR HEALTHCARE FACILITY

More than 19 different companies partnered to design and build an 878,000-sq.-ft. facility comprised of three hospitals. Because this facility was a public-sector project, UCSF Medical Center was unable to adopt a multi-party agreement. However, the owner and all parties involved committed to the same level of integration that would be required of a team in a multi-party contract. The team determined collaborating in the same space early on was vital to project success. So the owner and 250 builders, designers, consultants and subcontractors co-located to a 14-acre Integrated Center for Design and Construction (ICDC) during the design phase. There, they established ground rules for working together and metrics for accountability.

Co-location resulted in more efficient decision-making while keeping everyone focused on the project goals. As a result, the complex hospital facility was completed eight days ahead of schedule, even though the project required $55 million in scope changes, none of which impacted the budget or schedule for an on-time opening.

A major benefit of having the team in a single location is the ability to add integrated concurrent engineering, or ICE, sessions. Rather than the consecutive design activities of traditional methods, big design decisions are made simultaneously—significantly accelerating the evaluation of design alternatives and decisions.

For a deeper dive into co-locating best practices, read “Making the Big Room Better” by Integrating Project Delivery co-author, Atul Khanzode.
Fostering faster, more efficient decisions

While simulation and visualization may be “nice-to-haves” for traditional projects, they are non-negotiables for integrating delivery on a project. Here’s why:

1. **BIM and simulation tools empower teams to make informed decisions** on hard trade-offs, so the value is maximized within the constraints of a project.

2. **BIM enables rapid feedback**, presenting an unprecedented opportunity to incorporate knowledge and experience while ensuring design stays true to values and goals.

**BIM and simulation tools drive better outcomes allowing teams to:**

- Analyze sequencing and logistics
- Model the cost of construction
- Optimize design and construction solutions
- Simulate safety performance
- Run traffic simulations
- Model energy use
- Optimize life cycle cost
- Minimize carbon footprint
Autodesk tasked DPR and its design partners with designing and building Autodesk’s new 45,000-sq.-ft. corporate office using integrated project delivery (IPD).

Leveraging the latest Autodesk simulation software, the team used BIM to inform design decisions, avoid costly reworks and increase efficiencies. From project estimating to 3D clash detection and 4D simulations for MEP sequencing, simulation played a key role in successful completion of the project.

The highly complex project was completed in only 22 weeks and achieved LEED-CI Platinum certification. Sustainability goals were also achieved, including recycling 95 percent of all construction waste.

To learn more about how to implement BIM and other visualization tools on your next project, download the whitepaper “Getting the Most Out of BIM: The Secret Guide to VDC Apps.”
Setting ground rules for delivering the best possible outcome

Contracts may not be fun to discuss, but they are key to setting up your integrated project up for success. From how risks and rewards will be handled to decision-making processes and even establishing a separate legal entity for the project, the IPD agreement is layered, complex and necessary to deliver a high-performance building. An IPD contract is designed to provide the structures that allow for the other IPD elements in the simple framework to function effectively.

Components include:

- **Jointly shared risk and reward**: embodies the project goals and creates consequences for success or failure tied to their achievement
- **Group responsibility for overall project outcome**: puts control in the hands of the project participants and makes them responsible for total project outcome, not just their performance
- **Reduced individual liability**: limits liability among team members, which helps them feel more secure and collaborative and enables trust and innovation
- **Group incentivization**: stimulates behaviors that increase creativity, improve productivity, reduce waste and lead to better outcomes, whether measured by value aesthetics, functionality or sustainability

How can this be achieved?

**At the very least, a full IPD contract should clearly outline:**

- Early involvement of key participants
- Risk allocation
- Joint project management
- Joint sharing of risk/reward
- Joint validation of targets/goals

To learn more about the various types of IPD contracts, questions to ask during a negotiation workshop and additional resources for IPD agreements, read Chapter 16 in the book, *Integrating Project Delivery*. 

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There’s more to the contract story

In addition to the elements outlined, several other factors must be addressed in an IPD agreement:

- Will the agreement be a **multiparty or polyparty** contract?

- Will subcontractors and consultants be added via **sub-agreement or joining** agreement?

- Will standard IPD contract forms such as ConsensusDOCS or AIA C195 Series be used, or will you use a **custom agreement** like the Sutter Health Integrated Form of Agreement (IFOA)?

- Which **business model** will be used to manage the project and its incentive structure?

An IPD agreement is a different approach designed to promote owner/project delivery team accountability, shared governance and risk/reward, information sharing, and collaboration. Be sure to consult with an attorney who specializes in such agreements when negotiating a contract or holding a contracting workshop.
The road to high performance

Executing a highly integrated project is a significant undertaking requiring buy-in from all key stakeholders, continuous collaboration and hands-on owner involvement. However, the result is well worth the effort—a high-performing building designed and built with the owner, occupants and environment in mind.

The simple framework, developed by Martin Fischer, Howard Ashcraft, Dean Reed and Atul Khanzode, is more than a theory. It’s a model that has been put into practice for the last several years by industry leaders to deliver the best possible outcomes.

Now it’s your turn. And it all starts here.

About the authors:

**Martin Fischer** is a professor of civil and environmental engineering at Stanford University and serves as the director of the Center for Integrated Facility Engineering (CIFE).

**Howard Ashcraft** is a Fellow of the American College of Construction Lawyers and the Canadian College of Construction Lawyers (hon.), a member of the AIA California Council (hon.), and an adjunct professor of civil and environmental engineering at Stanford University.

**Dean Reed** is an advocate, organizer and educator for lean and integrated project delivery at **DPR Construction**.

**Atul Khanzode** leads Technology & Innovation for **DPR Construction**, where he assists project teams in implementing lean construction and virtual design and construction (VDC) methods.