CERC

# Moving Toward a Comprehensive Project Delivery Toolbox

**Prof. Giovanni C. Migliaccio**

Executive Director, UW Center for Education and Research in Construction

# Outline and References

Topics

- The UW Center for Education and Research in Construction
- The status of project delivery in the US
- Major models for delivering projects and trend of adoption
- Final Remarks

References


- More info on CERC: www.cerc.be.uw.edu
- Migliaccio, G. C. and Holm, L.A. (2018). ***Introduction to Construction Project Engineering***, Routledge, Chapters 4 & 5.
- Minchin, E., Migliaccio, G.C., et al. (2014). ***Design Management Guide for Design-Build and Construction Manager/General Contractor Projects***, NCHRP Report 787. Washington, DC: TRB.

# Center for Education and Research in Construction (CERC)

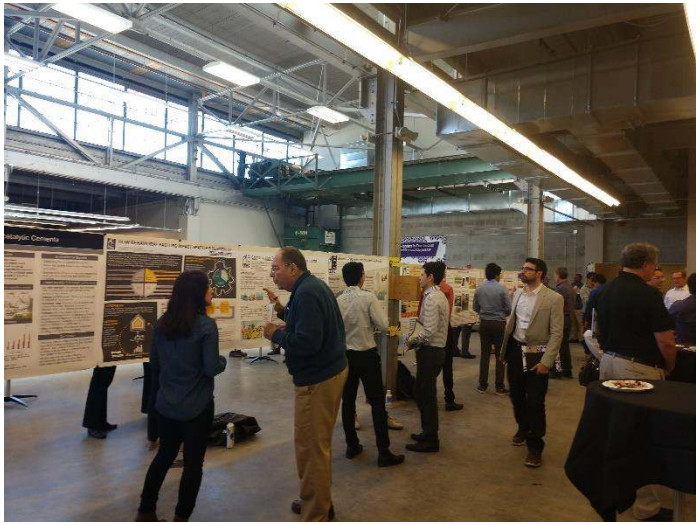
- **Leadership & Operations**
  - Dr. Giovanni C. Migliaccio, Director
  - Dr. Ken-Yu Lin, Associate Director
  - Ms. Debbie Underwood, Op. Specialist
- **Facilities**
  - Labs, Classrooms, Offices

□ **Annual Conference**

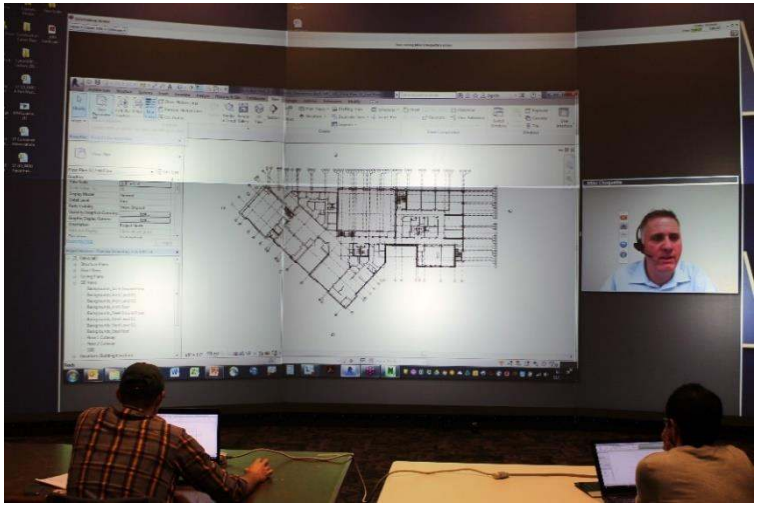
□ **Professional Education**

□ **Specialty Labs**

# CERC Annual Conference

# CERC Facilities



# CERC Labs – Summary

- **Project Management and Delivery (PMD) Lab – Migliaccio & Aziz**
  - **Transportation Research Board:** Design Management on Design-Build and Construction Manager/General Contractor Projects
- **Safety and Health Advancement through Research and Education (SHARE) Lab – Lin & Migliaccio**
  - **OSHA:** Developing Fall Protection Training Materials for Non-English Speaking and Illiterate Construction Workers
- **Energy & Sustainability in Construction (ESC) Lab - Lee**
  - **Department of Energy:** Impact of energy benchmarking and disclosure on office building performance and marketability
- **Lean Construction Research (LCR) Lab - Kim**
  - **City of Seoul:** Lean Implementation for Seoul Metro
- **Communication, Technology and Organizational Practices (CTOP) Lab – Dossick and Osburn**
  - **Port of Seattle:** Development of BIM Processes and Standards

# CERC – PMD Lab

- **Project Management and Delivery (PMD) Lab**
  - **Pactrans Transportation Centre – Prof. Ahmed Abdel Aziz**
    - Analysis of Roadway Safety under Alternative Project Delivery Systems
  - **CM Department – Prof. Ahmed Abdel Aziz**
    - Achieving Public Agency Goals in PPPs using Innovative Payment Mechanisms
  - **Transportation Research Board – Prof. Giovanni Migliaccio**
    - Successful Communication, Cooperation, and Coordination Strategies Between Transportation Agencies and Tribal Communities
    - Design Management on Design-Build and Construction Manager/General Contractor Projects
    - Sustainable Highway Construction Practices
  - **World Bank – Prof. Giovanni Migliaccio**
    - Implementation of climate-smart capital investment planning and validation of conceptual cost estimating and project development processes for cities of Kampala, Entebbe, Fort Portal, Lira, Mbale, and Gulu
  - **Washington DOT – Prof. Giovanni Migliaccio**
    - Building Asset Management: An Exploratory Case Study

# CERC – SHARE Lab

- **Safety and Health Advancement through Research and Education (SHARE) Lab**
  - **OSHA – Profs. Ken-Yu Lin and Giovanni Migliaccio**
    - Developing Fall Protection Training Materials for Non-English Speaking and Illiterate Construction Workers
  - **Skanska USA Buildings – Prof. Giovanni Migliaccio**
    - Field Study of Physiological Status Monitoring (PSM) Technologies
  - **National Science Foundation – Prof. Ken-Yu Lin**
    - Virtual Construction Simulator: Developing An Experiential Learning Simulation Game For Improved Learning of Construction Engineering and Management Concepts
    - Educating a Competitive, Cyberinfrastructure Savvy Engineering and Construction Taskforce

# CERC – ESC Lab

- **Energy & Sustainability in Construction (ESC) Lab**
  - **Department of Energy– Prof. Chris Lee**
    - Impact of energy benchmarking and disclosure on office building performance and marketability
  - **University of Washington – Prof. Chris Lee**
    - Campus-wide solar planning
    - Feasibility of vehicle electrification for UW fleet using solar
  - **Oregon Department of Environmental Quality – Prof. Chris Lee**
    - Developing a Life Cycle Assessment (LCA) model for the mechanical and electrical systems of office buildings in Pacific Northwest
  - **WA State L&I – Prof. Yong-Woo Kim & Prof. Chris Lee**
    - Lean and Safety Practices

# CERC – LCR Lab

- **Lean Construction Research (LCR) Lab**
  - **Construction Industry Institute – Prof. Yong-Woo Kim**
    - Lean Implementation Strategy
    - Integrated Project Delivery System
  - **WA State L&I – Prof. Yong-Woo Kim & Prof. Chris Lee**
    - Lean and Safety Practices
  - **UW CPD – Prof. Yong-Woo Kim**
    - Construction Specification for Lean Construction
  - **City of Seoul – Prof. Yong-Woo Kim**
    - Lean Implementation for Seoul Metro
  - **U.S. DOT – Prof. Yong-Woo Kim**
    - Project Organization for Integrated Delivery

# CERC – CTOP Lab

- **Communication, Technology and Organizational Practices (CTOP) Lab**
  - **Port of Seattle – Prof. Carrie Dossick**
    - Development of BIM Processes and Standards
  - **Sound Transit – Prof. Carrie Dossick**
    - Record Modeling Specification –DECM
    - Project Data Exchange Strategies for ST OPS-DECM

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# Moving Toward a Comprehensive Project Delivery Toolbox

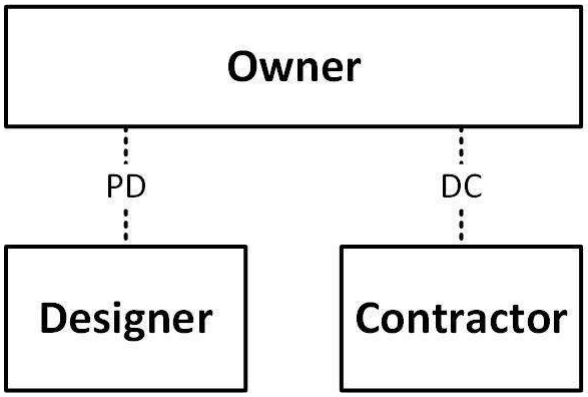
**Prof. Giovanni C. Migliaccio**

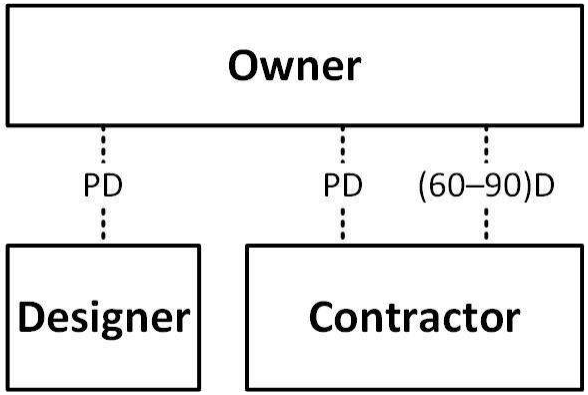
Executive Director, UW Center for Education and Research in Construction

# Project Delivery

- Built environment projects
  - Similar lifecycle
  - Same types of participants
- Phases may overlap and participants may interact differently depending on the owner's approach to deliver a project.
- Main features of project delivery
  - Project delivery method (PDM)
  - Procurement (e.g., Low Bid, Best Value, etc.)
  - Contracting (e.g. Lump sum, Cost plus w/wo GMP, etc.)

# Delivery vs. Procurement vs. Contracting




- Delivery Method
  - Define framework geometry and timing of relationships
- Procurement
  - Define how the owner will decide which entity will fill each box
- Contracting
  - Define what the selected entity will be doing, how will be paid, etc.

# Delivery vs. Procurement vs. Contracting

- The project delivery method selected by a project owner identifies the overall framework for delivering its project

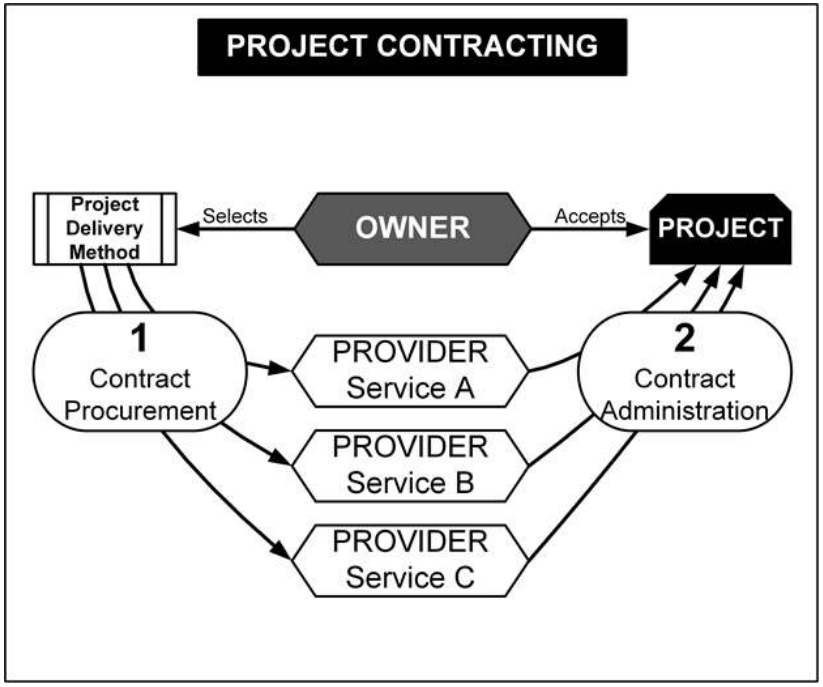
- Procurement and contracting are two additional and necessary aspects of project delivery that would affect the project execution.
  - *Procurement* is the act of purchasing external services and materials necessary to deliver a project.
    - Note: Anytime a project participant needs materials or services, he or she will initiate procurement to select another project participant who will provide them.
  - *Contracting* is the process of establishing a contractual relationship for services and materials through the development of a written agreement expressing the expectations, responsibilities, and protections of each party.
    - Note: Contracting for construction services is substantially different from contracting for design and consulting services.

# The Status of Project Delivery in the US

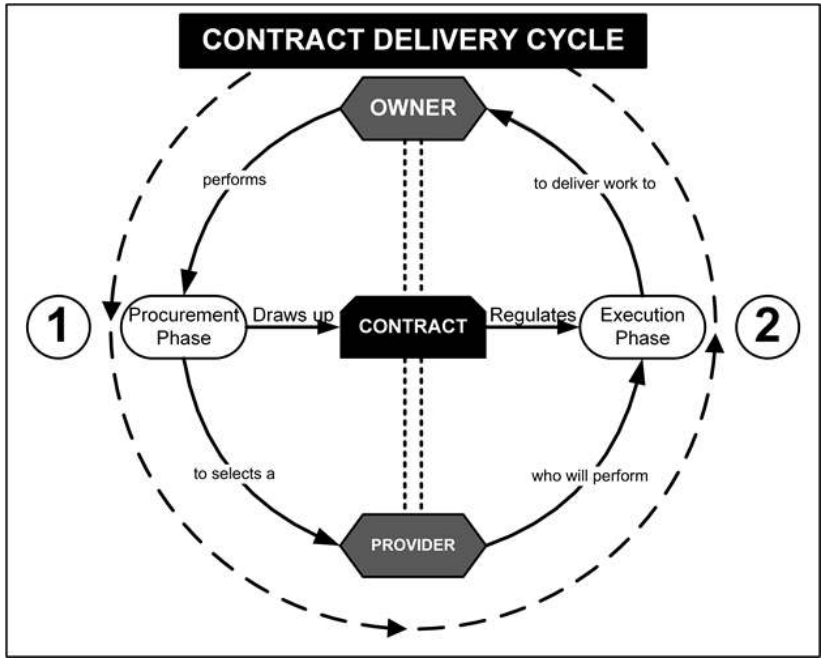
- Approaches used for delivering capital projects have significantly proliferated worldwide
- Both private organizations and public agencies have added several project delivery methods to their project delivery toolbox, such as
  - Construction Management at Risk,
  - Design-Build, and
  - Integrated Project Delivery.
- Market share of each method widely varies geographically, by owner type and across industry sectors
- There is **not a one-size-fits all method**: i.e. No single method can allow sophisticated owners to optimally achieve their project objectives
- **A comprehensive project delivery toolbox provides for options** necessary to match a project's objectives and constraints to the right delivery method

# Project Contracting

## Project Level




## Contract Level



# Owner's Approaches to Project Delivery

- **Option No.1: Self perform / Force Account**
  - Direct performance of construction work using labor, equipment, materials, and supplies furnished by owner and used under its direct control
  - Direct hire of craft workers
  - Used usually only for work in military operations or emergency/maintenance operations
- **Option No.2: Contracting**
  - Hire other entities (i.e. designers and/or contractors)
  - Follow a specific **project delivery method**
  - Most common approach for construction projects

*Note: Prime contractors and subcontractors may also have these options as long as they are allowed by the project owner.*

# What is a project delivery method?

- **"…a project delivery method […] defines the relationships, roles, and responsibilities of project team members and the sequence of activities required to complete a project"** (Gibson & Walewski 2001; pp.1)

- Simply stated, a project delivery method (PDM) is the approach for managing the delivery of a project.

- It is an owner's responsibility to select a PDM as well as the corresponding procurement and contracting approaches

# Project Delivery Methods - Market Share

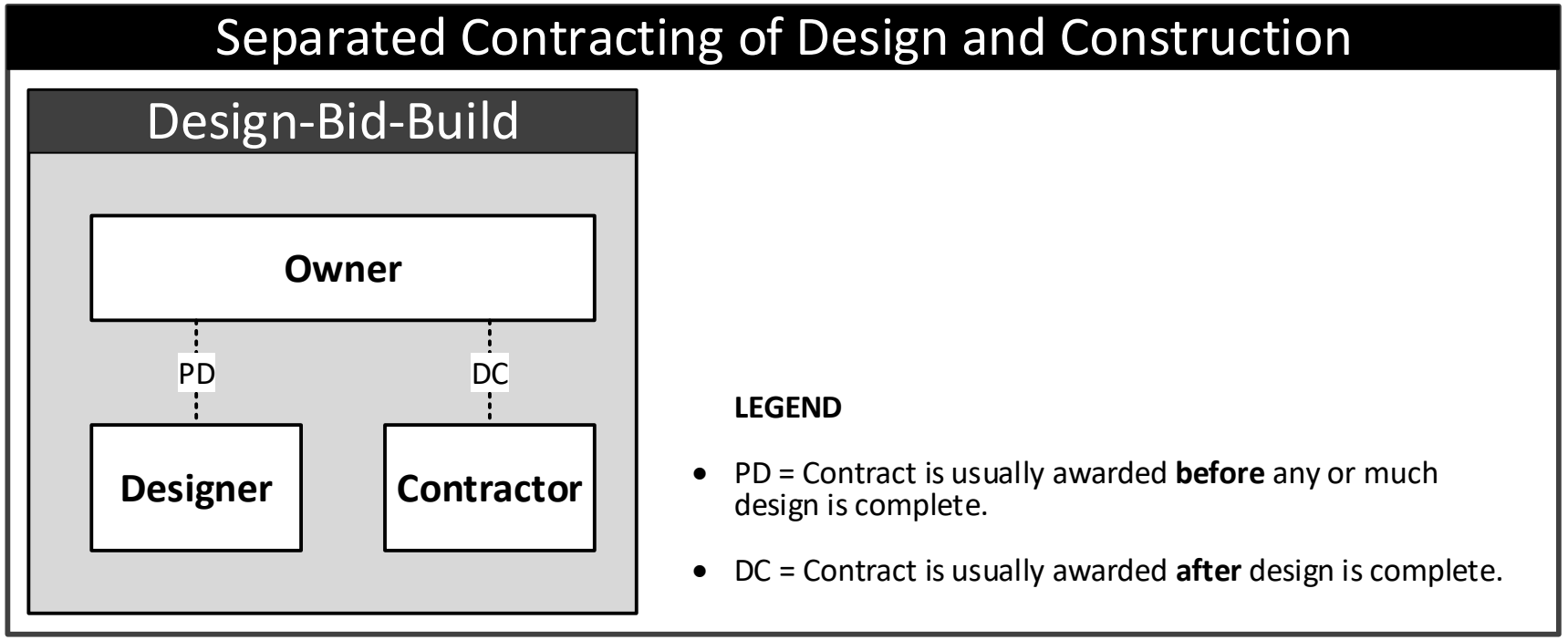
- It depends from the industry sector
  - Building vs. transportation
  - Industrial vs. utilities
  - Public vs. Private

- Building sector
  - Design-Bid-Build (DBB)
  - Design-Build (DB)
  - Construction Manager at Risk (CMR)
  - Integrated Project Delivery (IPD)

# PDM Classification

- **Separated Contracting of Design and Construction Services**
  - Design-bid-build (DBB)
  - Construction Management at Risk (CMR)
- **Combined Contracting of Design and Construction Services**
  - Design-build (DB)
  - Integrated Project Delivery (IPD)
- **Beyond Design and Construction**
  - Design-build-maintain
  - Design-build-operate-transfer
  - Design-build-finance-operate

# Design-Bid-Build



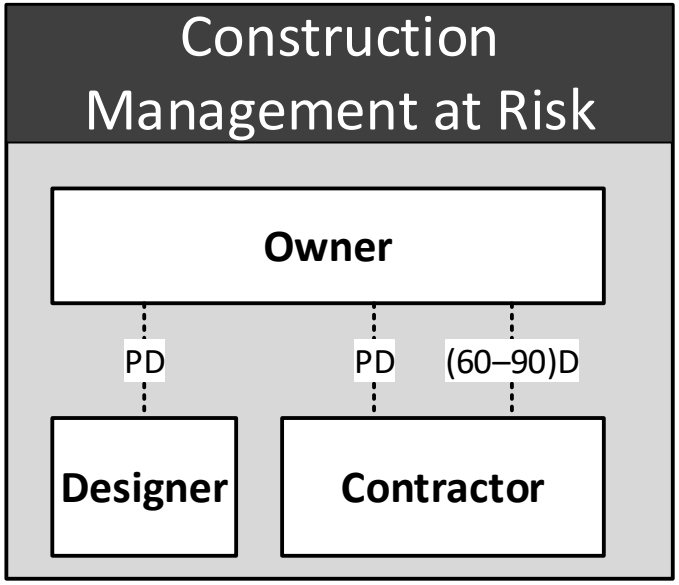
# Design-Bid-Build (DBB)

- Design and construction services are delivered to the project separately and sequentially:
  - the owner designs the project with in-house staff or enters in an early contract with a design firm that will produce a design package to be used as the basis for pricing construction services
  - construction contractors are asked to review and price the project based on the design.
    - Note: In the public sector, this review and pricing phase is called the bid phase as laws for public work projects often require construction contracts to be awarded to the lowest bidder.

- Design and construction contracts are usually timed in a sequential fashion
  - the construction company that will build the project is usually brought on board once most of the design decisions have been made.
- Also known as "***the traditional method***"

# Construction Management at Risk

## Separated Contracting of Design and Construction




**LEGEND**

- PD = Contract is usually awarded **before** any or much design is complete.
- (60–90) D = Contract is usually awarded when 60% to 90%of design is complete.

Note: Sometimes, there are not two contracts, but an amendment to the initial contract to set price, and allocate other risks.

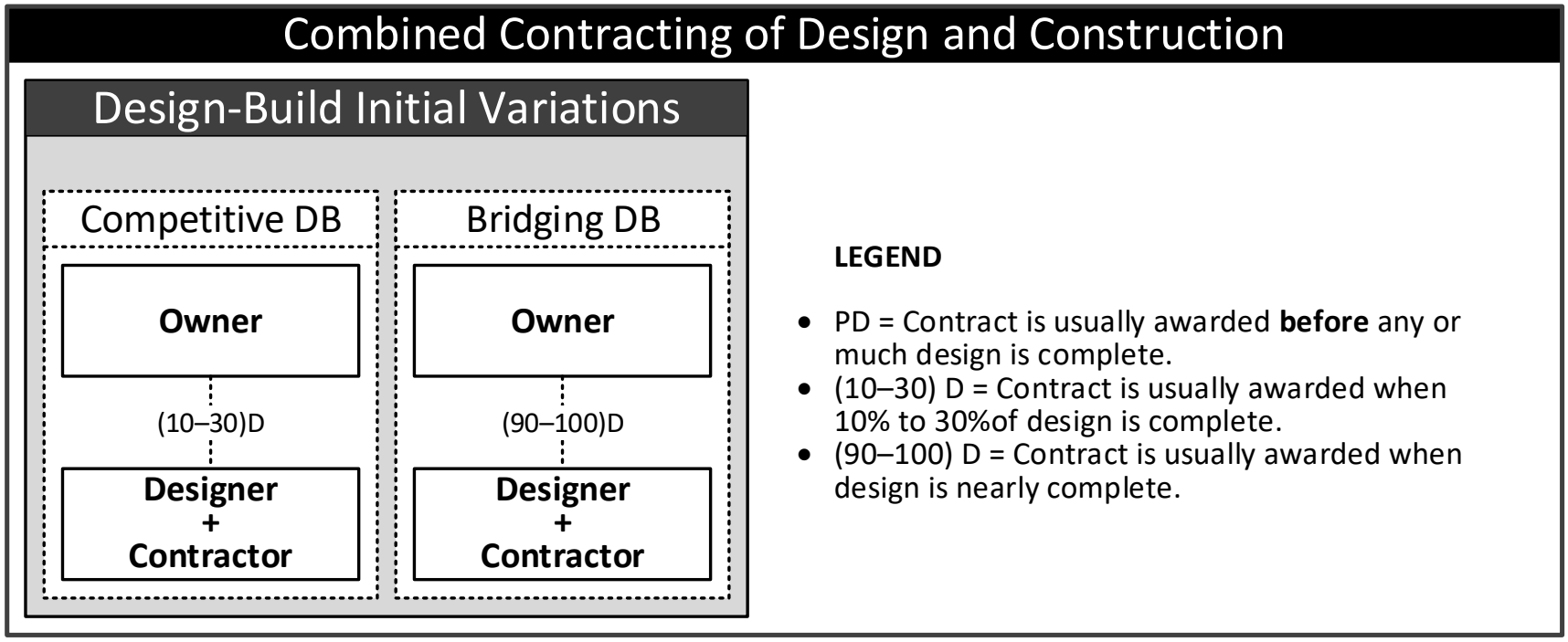
# Construction Management at Risk (CMR)

- The owner contracts separately for design and construction services, which is similar to DBB.
- The contractor is retained early on to review and comment on the design before it is finalized
- Two-steps:
  - Early pre-construction
  - Construction and late pre-construction (usually starting at 60-90% design complete)
- Also known as
  - General Contractor as a Construction Manager (GC/CM) → Washington state
  - Construction Manager as a General Contractor (CM/GC) → elsewhere in the U.S. and in the heavy civil sector

# Construction Management at Risk (CMR)

- Under CMR a firm
  - "acts as [a] consultant to the owner in the predesign and design phases, but as the legal equivalent of a general contractor during the construction phase. When a CM is bound to a price, either fixed or a GMP, the most fundamental character of the relationship is changed" as defined by the Construction Management Association of America (CMAA 2017).
- This change in role occurs when the CMR assumes a risk by committing to deliver the project according to the contractual requirements typical of a construction contract between an Owner and a General Contractor.
- Once the role changes, the Owner-CMR relationship changes as the construction manager begins to protect themselves.

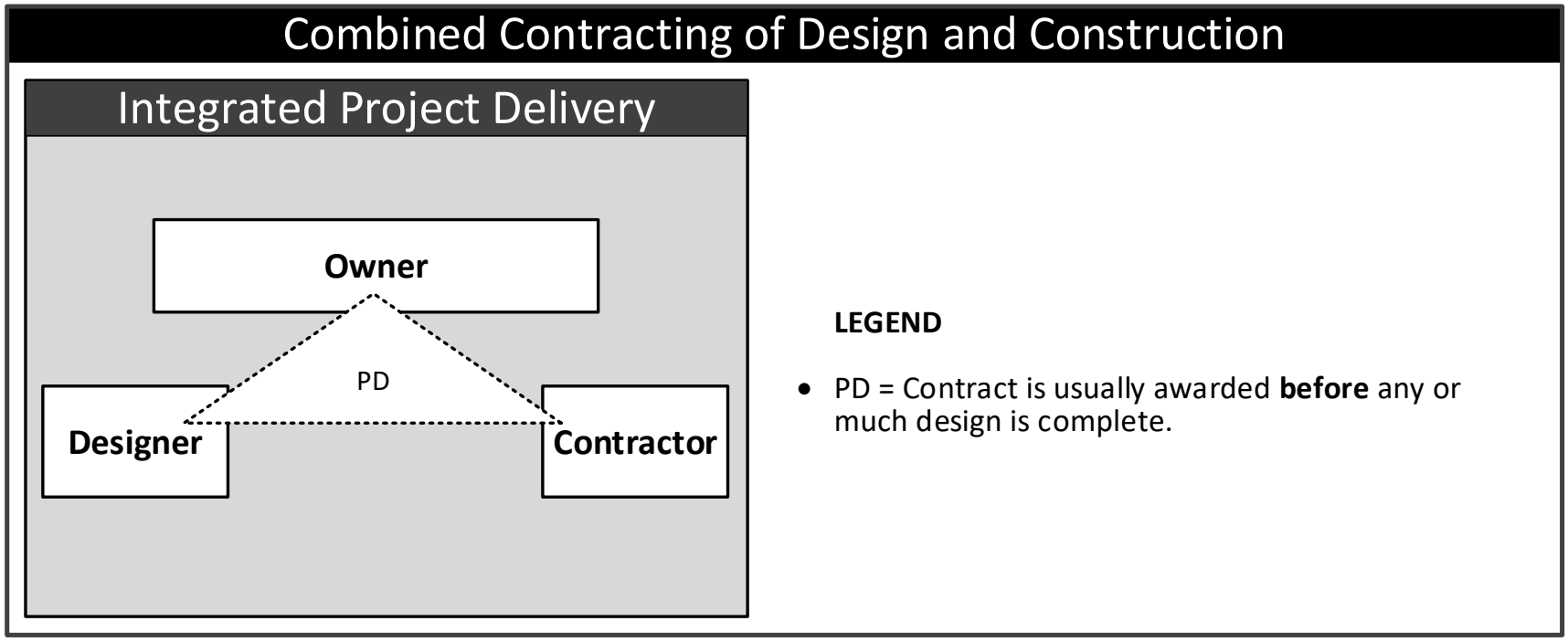
# Design-Build



# Design-Build (DB)

- The owner enters into a single contract with an entity that will design and build the project
- This contract will combine design and construction services
- Design-builder entity acts as the single point of responsibility with the owner
- Design-builder may be a joint-venture between, mostly construction, firms
- Different variations
  - Competitive DB
  - Bridging DB
  - Progressive DB (2 step approach similar to CMR)
  - Integrated DB (2 step approach similar to CMR + with incentive mechanisms similar to IPD)

# Integrated Project Delivery



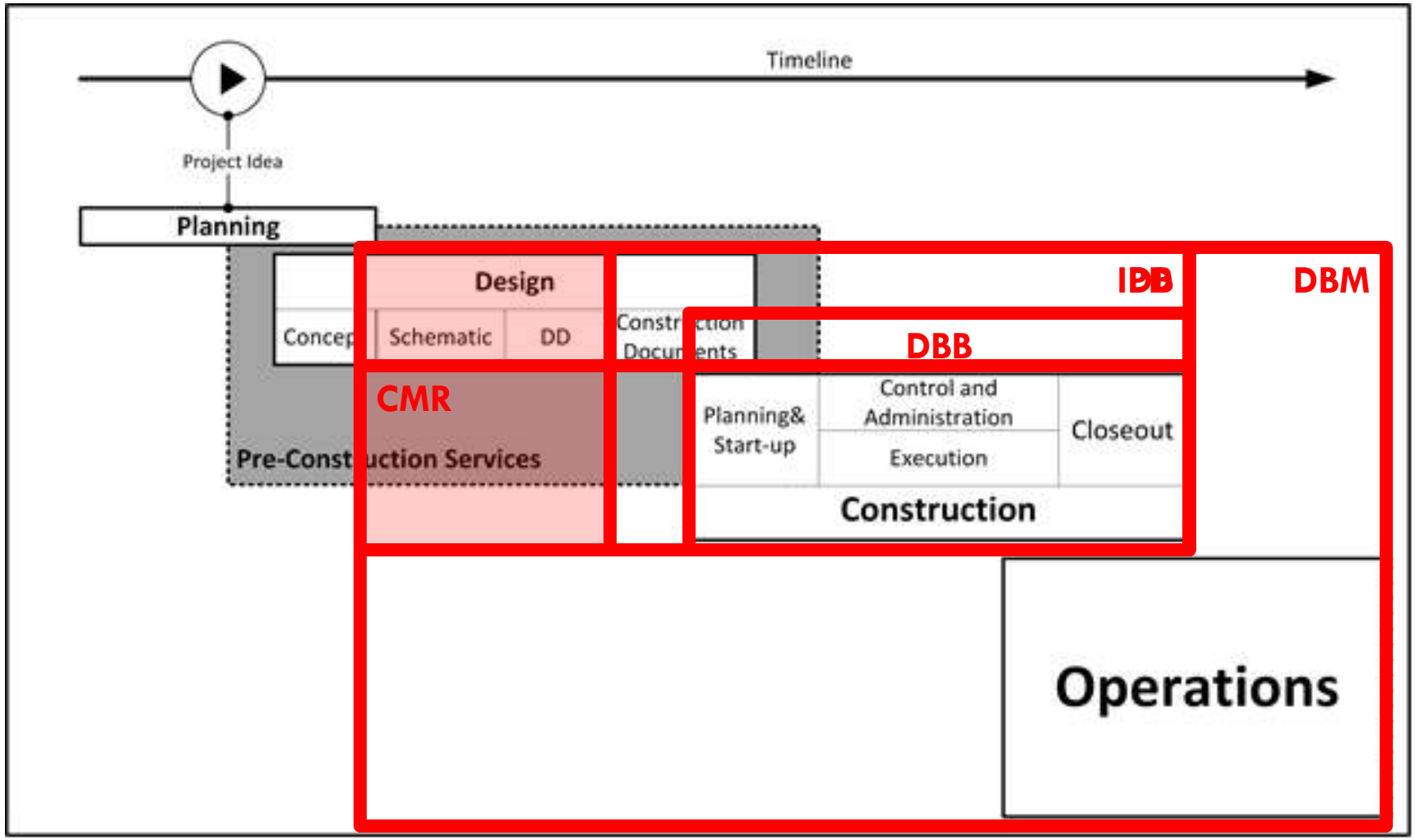
# Integrated Project Delivery (IPD)

*[…] a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction* (AIA 2007; backcover)

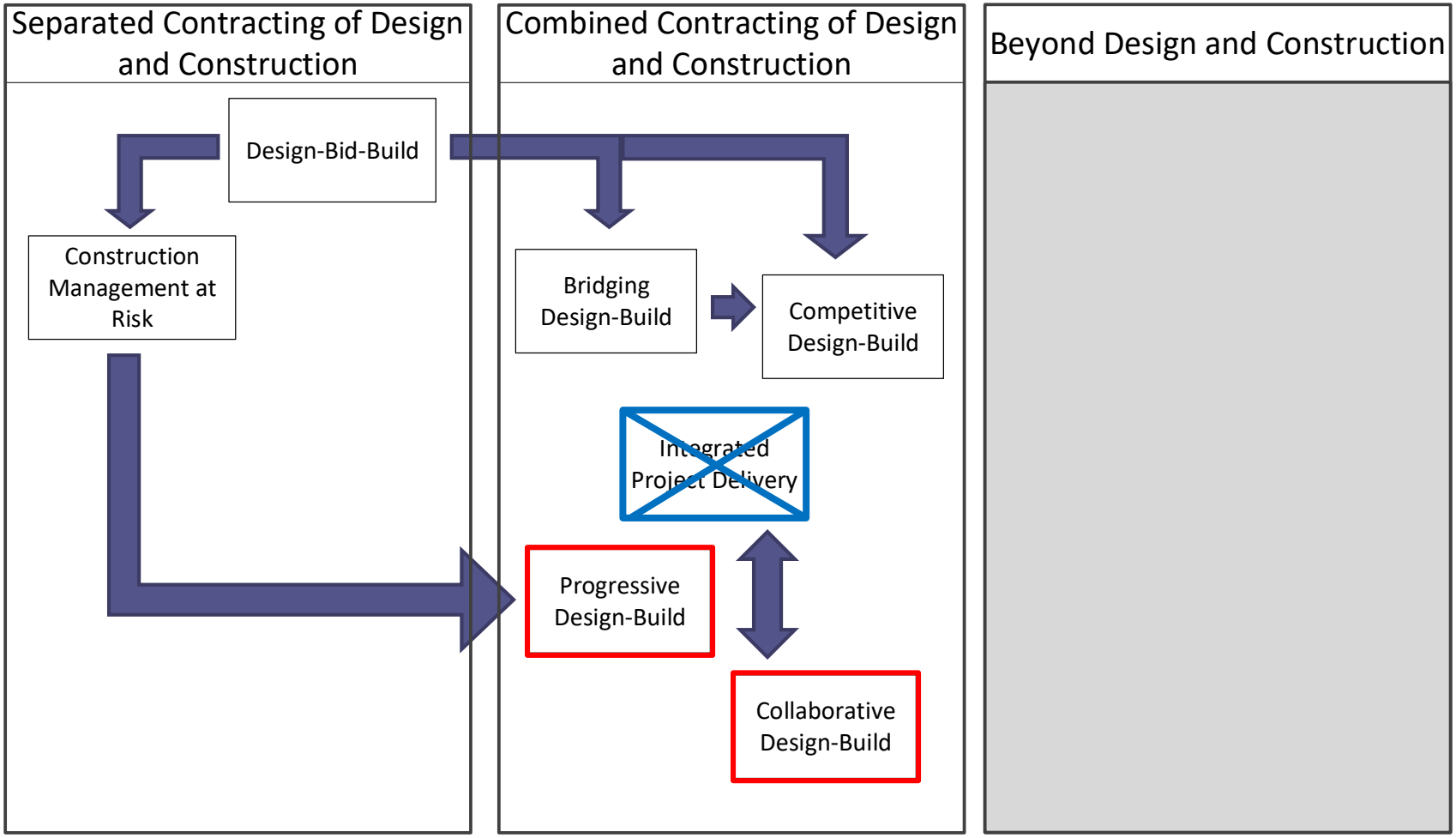
- IPD substantially differs from all the other project delivery methods in the fact it relies on one multi-party contractual agreement.

- **At a minimum contractual parties include the three main parties**, the owner, the designer, and the general contractor
  - but can **sometimes incorporate additional parties**, such as specialty designers and contractors, or vendors

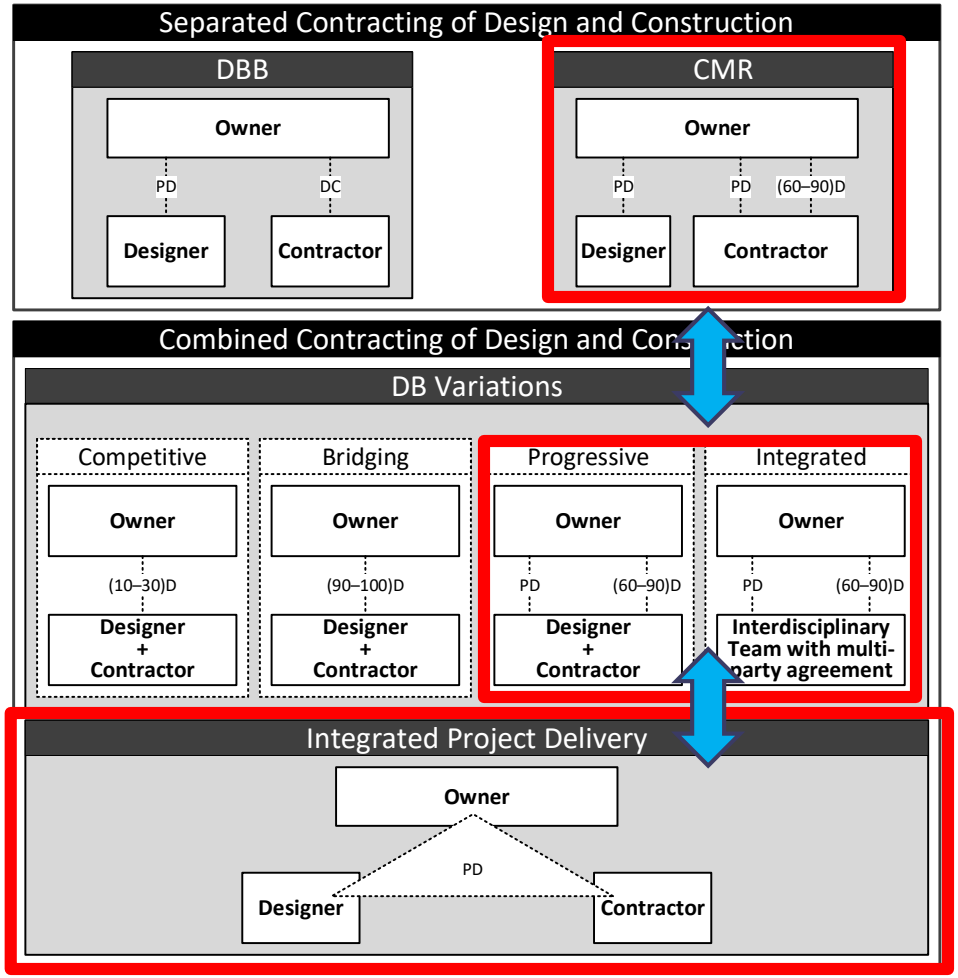
# PDM vs. Project Life



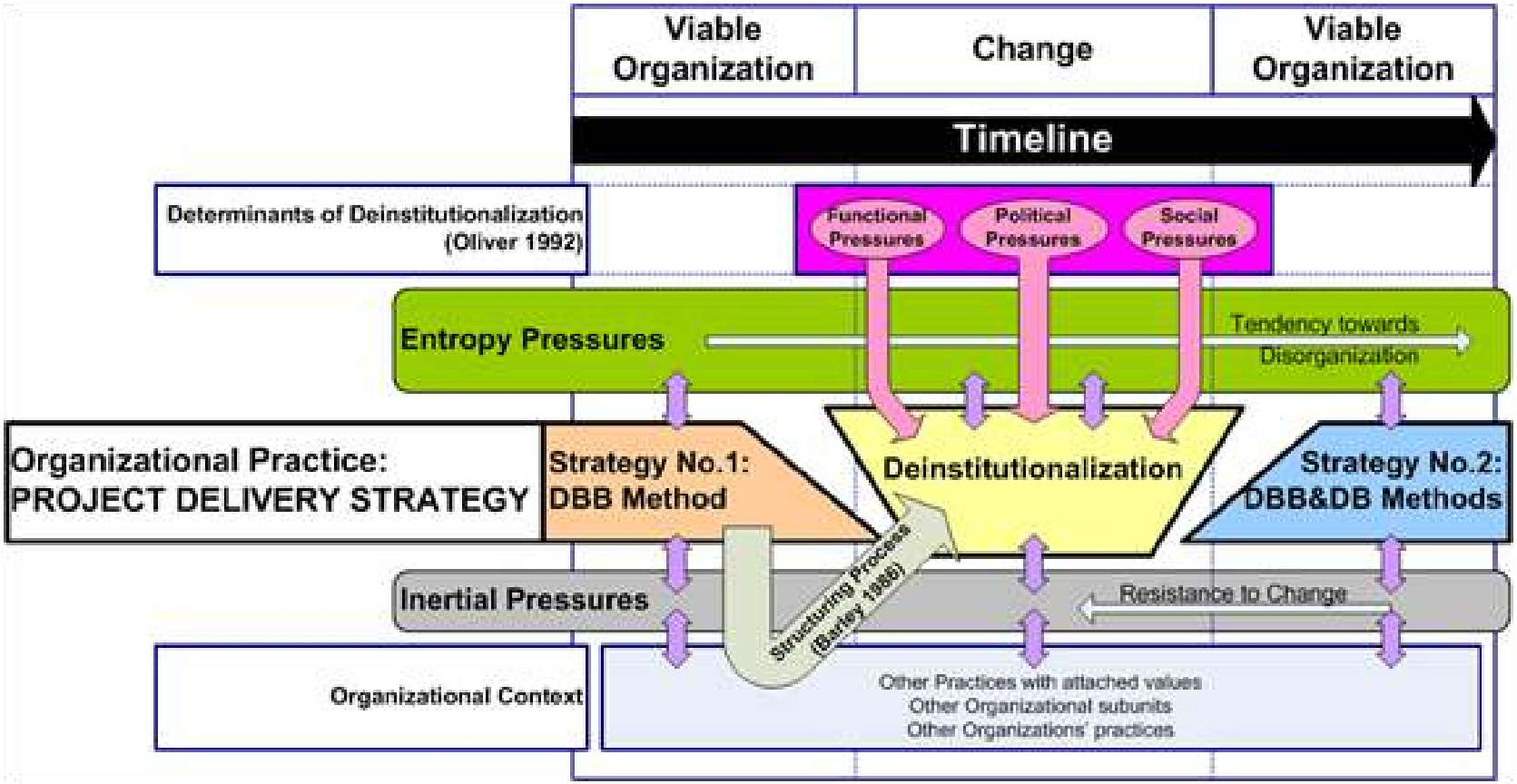
# Comprehensive Project Delivery Toolbox



# The PDM Family gets bigger

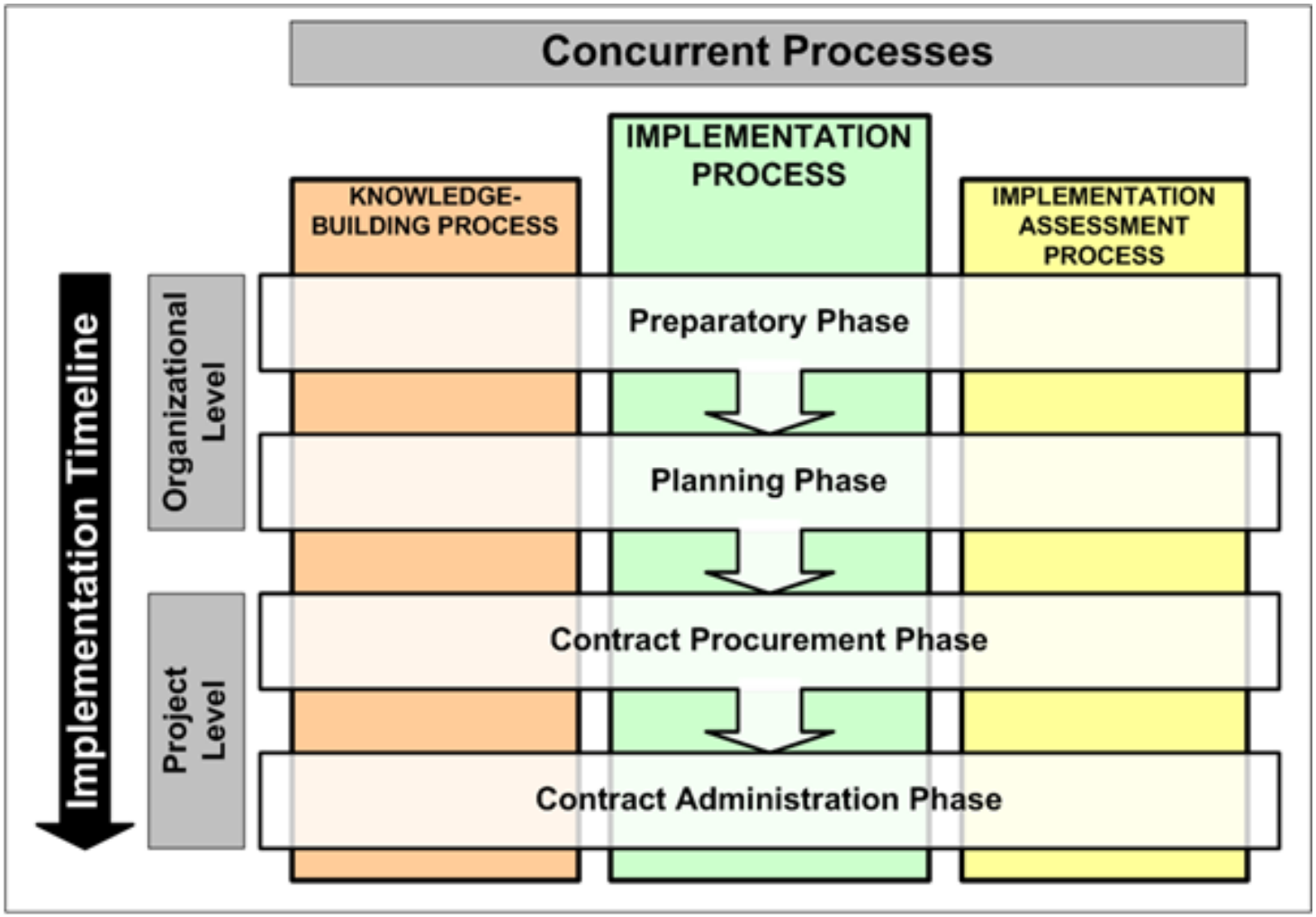


# Changing Project Delivery Strategy: Add to the Toolbox




Migliaccio, G.C., Gibson, G.E., and O'Connor J.T., (2008). Changing Project Delivery Strategy: An Implementation Framework. *SAGE Journal of Public Works: Management and Policy*, 12(3), 483-502.

# Changing Project Delivery Strategy: Add to the Toolbox




Migliaccio, G.C., Gibson, G.E., and O'Connor J.T., (2008). Changing Project Delivery Strategy: An Implementation Framework. *SAGE Journal of Public Works: Management and Policy*, 12(3), 483-502.


REPORT 787

# Guide for Design Management on Design-Build and Construction Manager/ General Contractor Projects

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Minchin, E., Migliaccio, G.C., et al. (2014). ***Design Management Guide for Design-Build and Construction Manager/General Contractor Projects***, NCHRP Report 787. Washington, DC: TRB.

# Final Remarks

- No single method can allow sophisticated owners to optimally achieve their project objectives for all their projects
- A comprehensive project delivery toolbox is usually necessary to match a project's objectives and constraints to the right delivery method
- Adopting a new approach to delivery projects requires significant organizational changes
  - Modifications to work processes
  - Revision of existing organizational structures.
- This process of adaptation encompass many different aspects of the organization's interests and require significant efforts.

# Final Remarks

- CMR/PDB/CDB/IPD mutate an organization's delivery DNA by
  - Changing cultural setting toward collaboration
  - Educating parties to achieve flexibility
  - Encouraging and facilitating innovation
  - Acting as a necessary building block toward a level of maturity in project delivery
  - Opening the door to other approaches that rely on collaboration, flexibility and innovation

# Questions ?

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