Advanced Work Packaging (AWP) as emerging planning approach to improve project performance

Case studies from the industrial construction sector

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Agenda

- AWP Concepts
- Research Gap and Objective
- Methodology: Multiple Case Studies
- Findings: AWP and Project Performance
- Conclusions

Background

70% of industrial projects exceed 10% variation from expected cost and schedule values (CII, 2012).

Traditional planning processes are not reliable to deal with current projects complexity and uncertainty (e.g. Gibson et al., 2006).

Among them, Work-Packaging concepts are extensively used, but:

- Obsolete to manage current projects (Choo, 1999).
- Lack of focus on initial project planning (Kim and Ibbs, 1995).

Since 2009, CII RT272 and RT319 aimed at re-collecting and defining current work-packaging best practices.

A Long Research Journey!

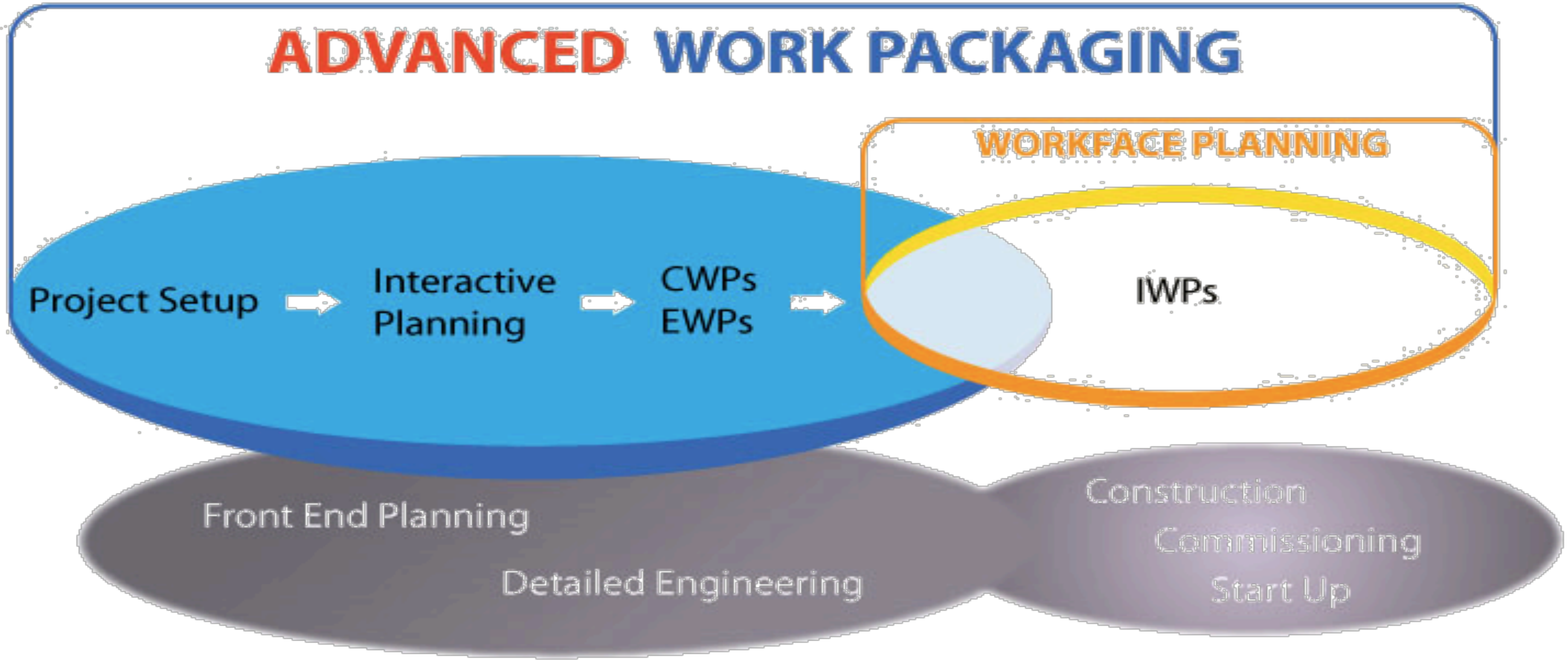
RT272 Phase I (09-11) *Process* → **RT272 Phase II (11-13)** *Implementation* → **RT319 (14-15)** *Validation*

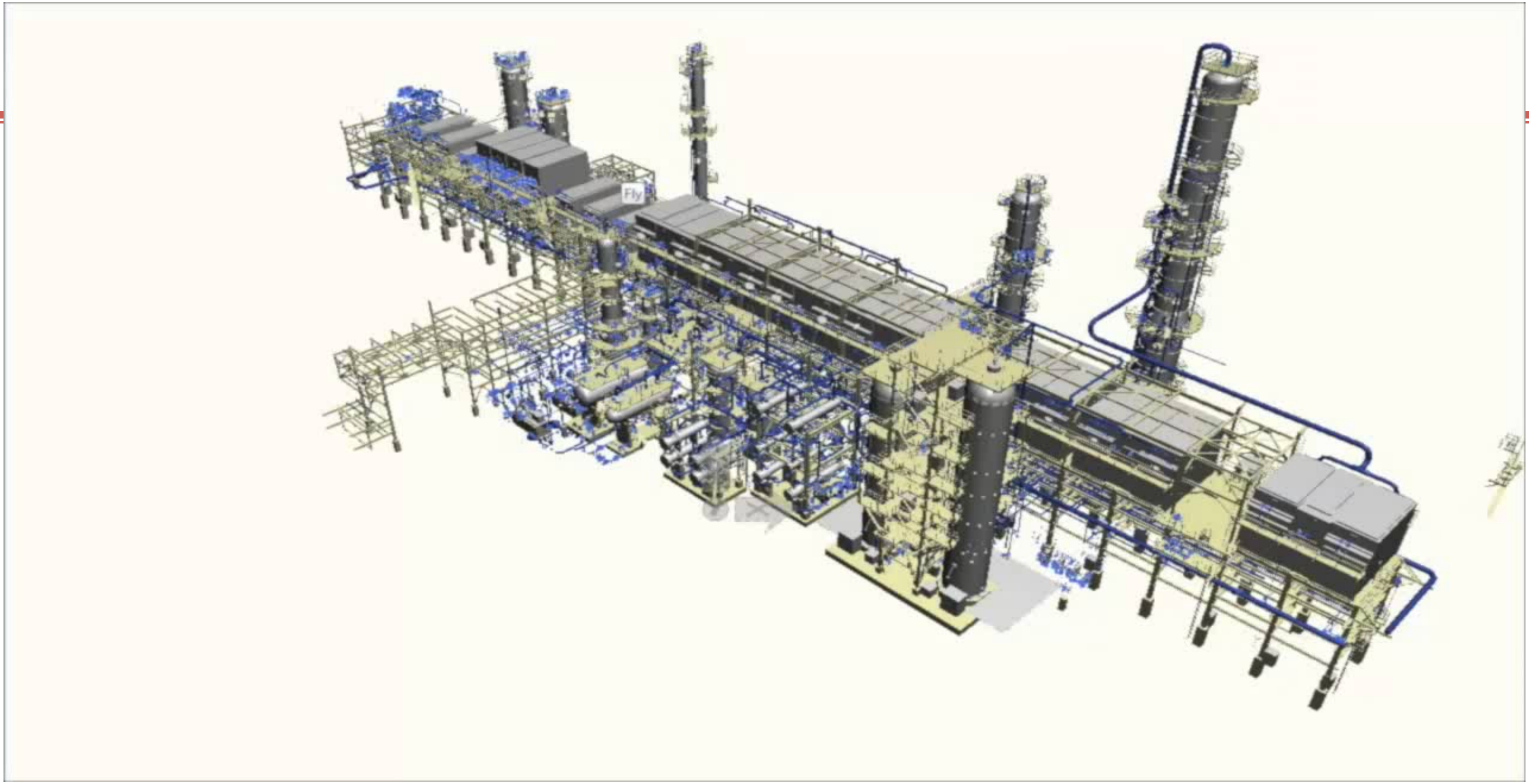
Steve Autry, *ConocoPhillips*

Michael Bankes, *Fluor*
Michael Bankes, *SNC-Lavalin*
Jim Blevins, *Pathfinder*
Doug House, *Zachry Industrial Inc.*
Roy Burnette, *CH2M HILL*
Keith Critzer, *ExxonMobil*
Joel Gray, *Conway*
Robin Mikaelsson, *Bentley Systems*
Olfa Hamdi, *The University of Texas at Austin*
Bill O'Brien, *The University of Texas at Austin*
Ken Kohl, *GE Power & Water*
Fernanda Leite, *The University of Texas at Austin*
José LaRota, *Southern Company*
Fernanda Leite, *The University of Texas at Austin*

Robin Mikaelsson, *Bentley Systems*
Bill O'Brien, *The University of Texas at Austin*
Bryan Parsons, *KBR*
Sean Pellegrino, *Chevron*
Jim Rammell, *Wood Group Mustang*
Lloyd Rankin, *Ascension Systems*
Yogesh Srivastava, *North West Redwater Partnership*
Glen Warren, *Retired - COAA*
Stan Stasek, *DTE Energy*
Jim Rammell, *Mustang*
Jim Vicknair, *WorleyParsons*
Glen Warren, *COAA*

What is Advanced Work Packaging?





CWP- Construction Work Packages

EWP- Engineering Work Packages   IWP- Installation Work Packages

Research Gap & Objective

Various scholars advocated a closer connection between theory and practice in project management (e.g. Howell and Koskela, 2002).

→ **AWP still requires further analysis and empirical validation.**

Research Objectives:

- Provide in-depth insights on the AWP implementation process.
- Explore the impact of AWP on key project performance dimensions (cost, schedule, quality, safety).

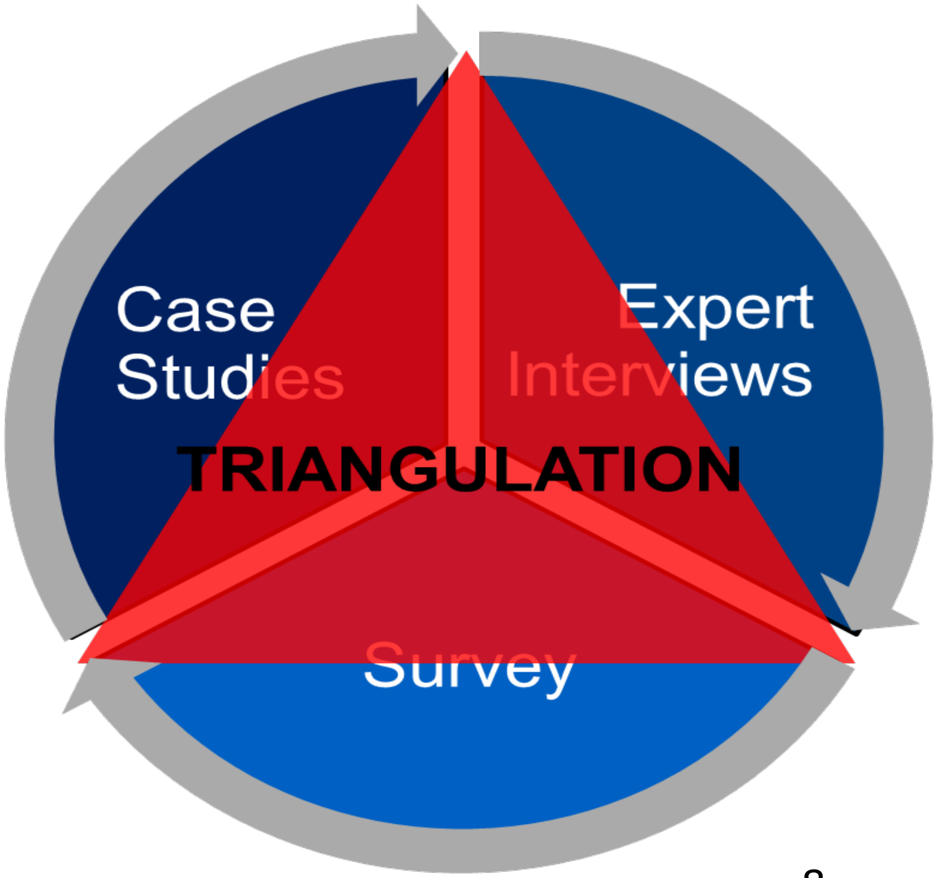
Triangulation of Evidence

1. Identify AWP Maturity Levels
2. Validate AWP Benefits

Case Studies
- Methods of AWP Implementation
- AWP Benefits & Lessons Learned

Expert Interviews
- Support Case Study Analysis
- Focus on Specific AWP Processes

Survey
- Statistical Validation
- AWP and Project Predictability



Cross-Validated Results!

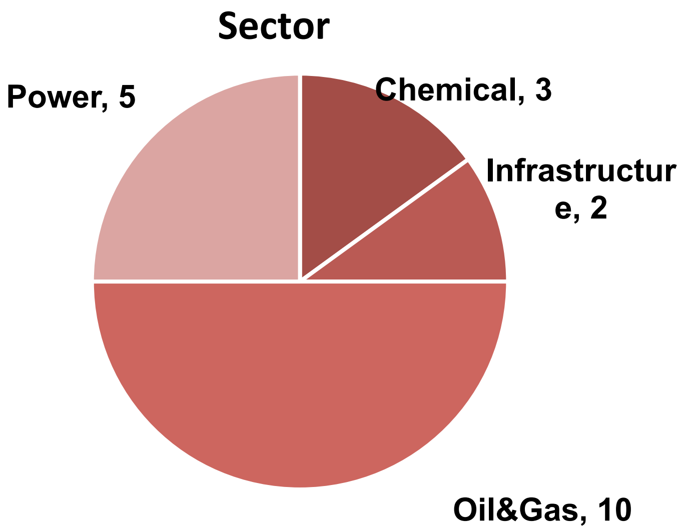
Case Studies

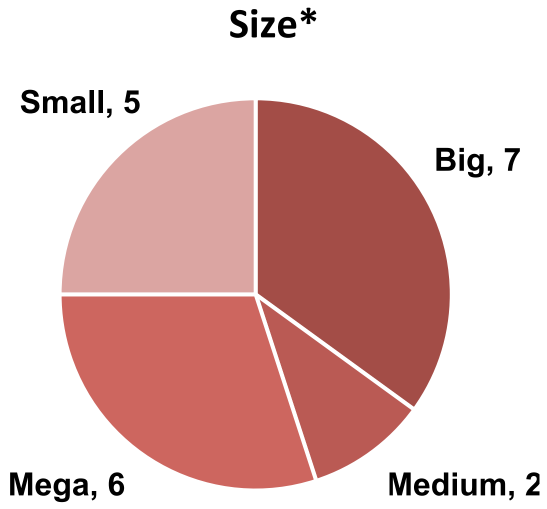
Objective:

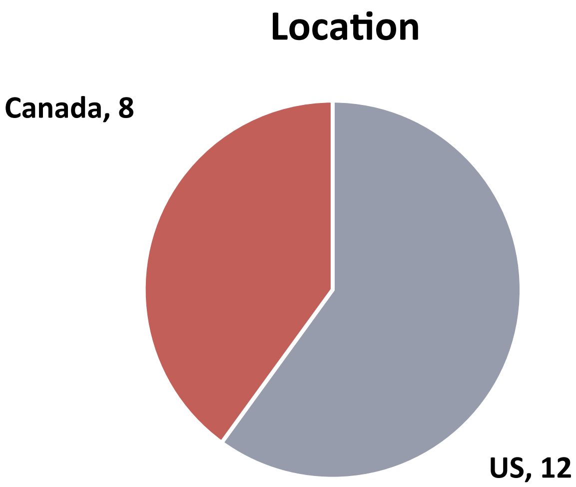
In-depth Results on AWP Benefits

- 20 Case Studies and 52 Interviewees.
- Different industrial sectors and project sizes.
- Documented AWP benefits, challenges, and lessons learned.

***Size (million USD):**
Small: < 5
Medium: btw. 5 and 50
Big: btw. 50 and 500
Mega: > 500

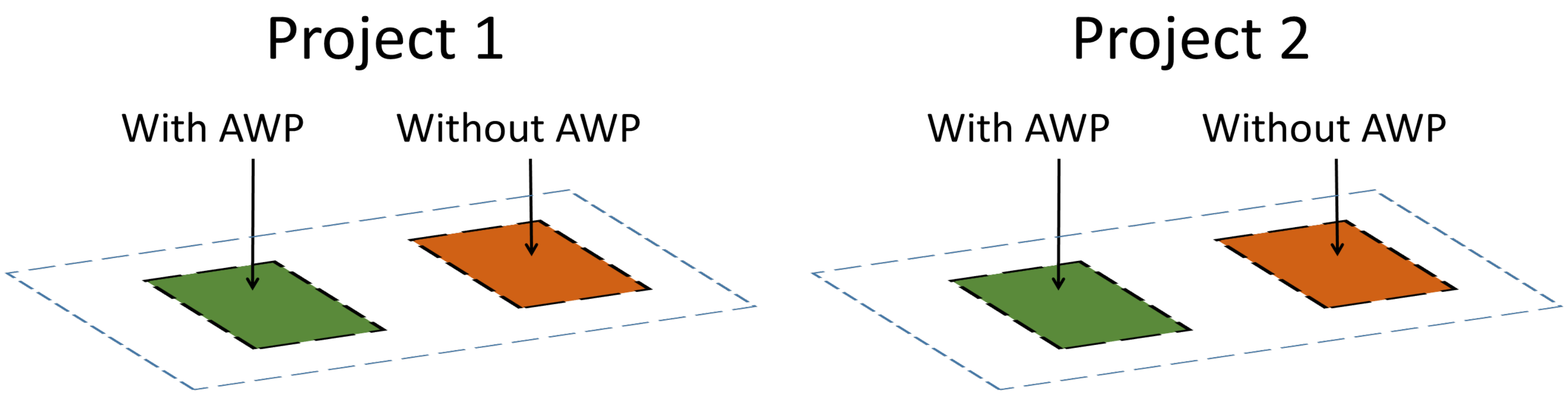






Research Methodology

Two case Studies selected to **isolate** the impact of AWP on project performance:



Same Project Scope
Same Companies
Contiguous Sites
Performed in parallel
AWP is the main difference!

To enhance results validity and reliability:

- Consult multiple informants to achieve triangulation (Gibbert et al., 2008).
- Obtain feedback from each interviewee (Creswell and Miller, 2000).

Case Study 1 – Description

Characteristics:

- TIC: $8 million USD
- Construction hours: 80.000
- Sector: Oil & Gas (wells expansion)
- Contract: Time and Materials

Owner, Engineering, and Contractor are integrated since FEED:

- Include constructability principles
- Define AWP procedures, role, and responsibilities

CWPs Area → **EWPs** Discipline → **IWPs** CON + TURNOVER

Case Study 1 – Findings

Performance	Without AWP	With AWP
Cost	On-budget	$750.000 below budget
Schedule	On schedule	5 days early
Quality	2% weld reject rate	0% weld reject rate
Safety	1 lost time incident	0 lost time incident

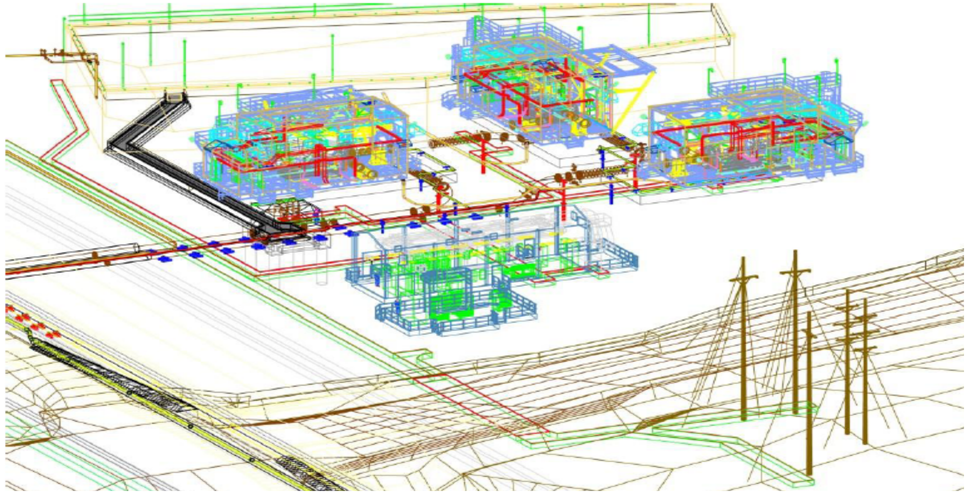
Project Control:

- Held weekly meeting based on IWP progress
- Incorporate lessons learned after IWPs completion

Case Study 2 – Description

Characteristics:

- TIC: $400 million CAD
- Construction hours: 1 million
- Sector: Infrastructure (dykes and disposal area)
- Contract: Time and Materials



Early engagement resulted in effective constraint minimization

IT integration based on AWP (planning, procurement, execution processes)

CWPs
Area

→

EWPs
Discipline

→

IWPs
1 shift – 1 crew

Case Study 2 – Findings

Performance	Without-AWP	With-AWP
Cost	$100.000 over budget	$40 million savings (10% TIC)
Schedule	3 months delay	On schedule
Quality	RFIs paralyzing operations	RFIs solved before operations
Safety	12 lost time incidents	0 lost time incident
Productivity	n/a	25% higher

Process Control:

- Update plans on a daily basis
- Payment structure aligned with AWP deliverable

Common Implementation Traits

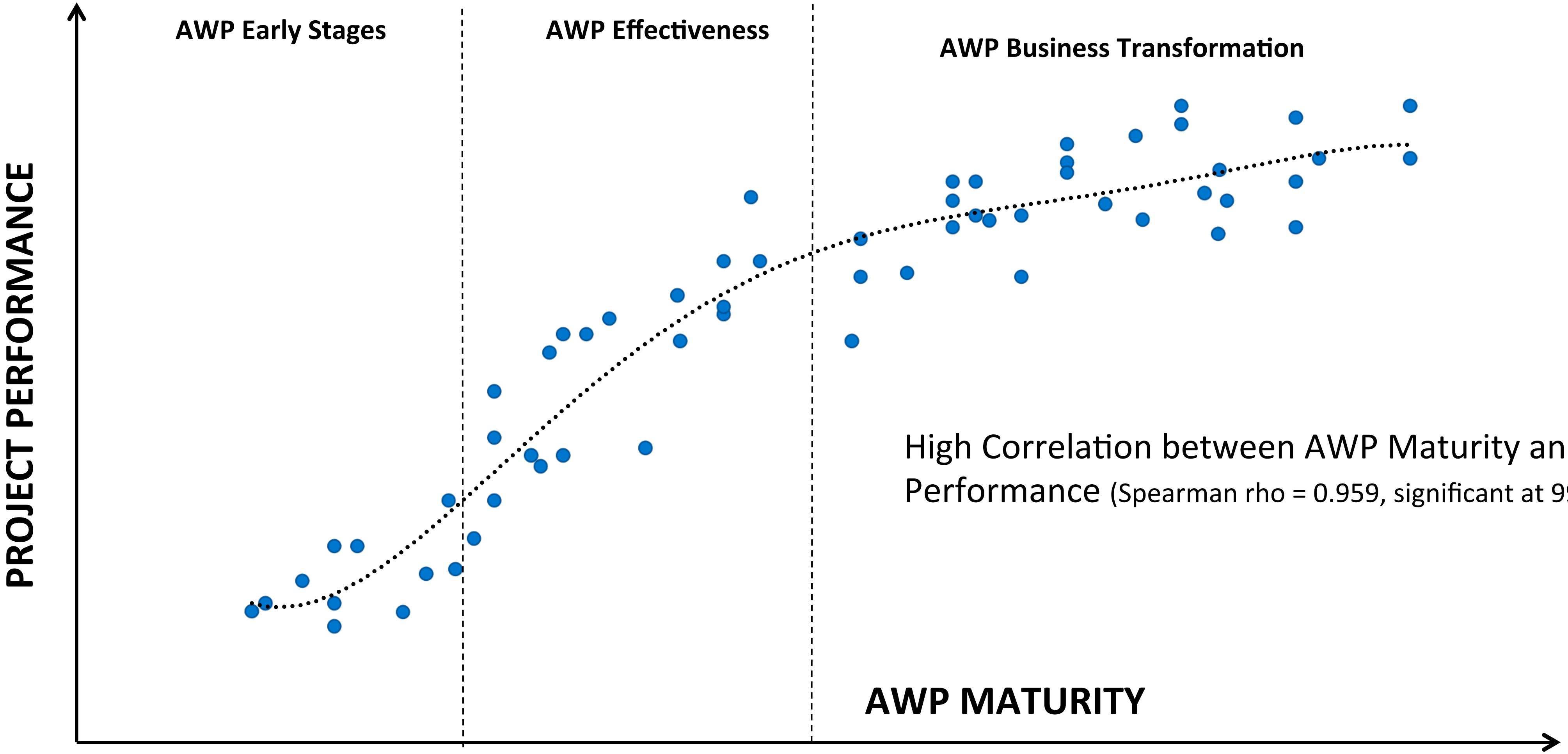
“Ancillary” Benefits:

- Project Predictability (in terms of cost, time, and quality).
- Integration between Disciplines (CON, ENG, PRO).
- Accountability of construction crews.

Challenges:

- Achieve Buy-in and Commitment (from top-management to crews).
- Reduce Change Inertia (systematic training & change mgmt process).
- Project control based on AWP deliverable.

Further Evidence: AWP Maturity Results



High Correlation between AWP Maturity and Project Performance (Spearman rho = 0.959, significant at 99% confidence level)

Overall Findings

The projects adopting AWP performed better (safety, cost, schedule, quality).

- 25% improvement in productivity
- 10% reduction in TIC
- Improved rework, quality, safety
- Improved alignment
- Improved contractor profitability

However… AWP requires hard-work and commitment!

- Deploy systematic and integrated planning since FEED.
- Identify and solve project constraints before mobilization.
- Deliver plans to support construction activities.

Thank you!