4-6 October, Nationals Park, Washington DC

Dr. Bahadir Barbarosoglu
Ben Milner

The Implementation of Project Controls and Digital Twin

Project Controls EXPO
Washington, DC - USA

(W)www.projectcontrolexpo.com/usa (M) +44 (0) 203 883 1386 (E)usa@projectcontrolexpo.com

2022

Project Controls

Key to success

- **Facilitates collaboration**: People, processes, and tools
- **Improves compliance**: Quality, scope, budget, and schedule
- **Brings methodical use**: Resources and techniques
- **Bridges processes**: Planning, tracking, analyzing, identification, and validation
- **Supports project management**: Timely decision-making with accurate information
- **Evaluates variances**: Plan vs Actual
- **Measures performance**: Against success criteria

Linesight

Project Controls EXPO
Washington, DC - USA

Project Controls Metrics

- Standardized and agreed-upon metrics
  - Prevent
    - Misperception
    - Miscommunication
    - Unrecoverable damages
  - Help
    - Diagnose current status
    - Predict future performance
    - Drive sound decisions
    - Positively impact performance

Linesight

Project Controls EXPO
Washington, DC - USA

Project Controls

- Diagnostic
  - Efficiency/Productivity Index
  - Schedule Variance
  - Cost Variance
  - Unit Rate
  - Procurement Cost Variance
  - Baseline Execution Index
  - Number of Critical and Near-Critical Paths
- Predictive
  - Variance-at-Completion
  - Estimate-at-Completion
  - Estimate-to-Complete
  - to-Complete-Performance Index
- Diagnostic & Predictive
  - Cost Performance index
  - Schedule performance index

Project Controls Metrics

Considerations in determining and tailoring key project controls metrics

- Project size
- Owner and contractor resources
- Third party capabilities
- Information exchange quality and frequency
- Existing cross-organizational practices

Project Controls Enablers

Effective project controls cannot be achieved without

- Agile change management
- Robust earned value management
- Realistic baseline
- Constraint analysis
- Proper resource allocation
- Accurate progress monitoring
- Clear scope definition
- Well-structured work breakdown structure aligned with goals and scope
- Supportive project management plans (e.g. risk, communication, stakeholder etc.)

Project Controls Barriers

Common barriers to effective project controls include but are not limited to

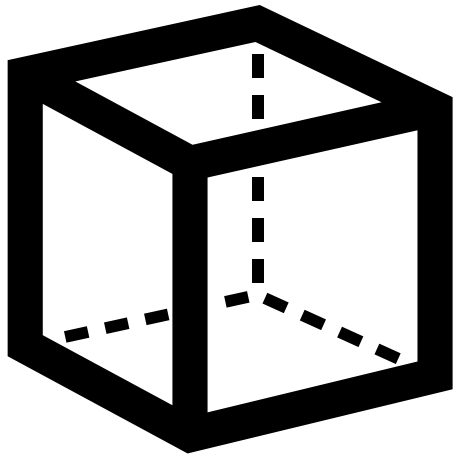
- Lack of skilled professionals
- Unstandardized systems
- Ambiguity in contract
- Lack of communication and commitment
- Unclear roles, goals, and objectives

Tools & Techniques BIM

Project Controls Tools & Techniques

One-dimensional
- Schedule-centric
- Cost-centric

Multi-dimensional
- Data-driven & design-centric
- Integrated earned value analysis
- nD, BIM, Digital twin, AR, VR, IoT, AI



Linesight

Project Controls EXPO
Washington, DC - USA

Building Information Modeling

Helps integration and analysis

Improves Collaboration: Multi-phase - life cycle management

Widely Applicable: Individual structure - integrated infrastructure - smart cities

Helps Solve Problems

Streamlines Processes: by virtual prototyping

Facilitates Data Management: data access, storage, and maintenance

Establishes a Communication Tool: single-source of truth for all stakeholders

Exceeds Information Beyond 3D: schedule (4D) and cost (5D)

4D Project Controls

Schedule: 3D modeling incorporating logic elements
Preconstruction: development of schedule in relation to BIM
Construction: implementation for control
Stakeholder Involvement: engagement is highest during precon. and construction
Improvement: productivity, communication, information accuracy and confidence
Shared Common Understanding: standard on the project for success

Linesight

Project Controls EXPO
Washington, DC - USA

5D Project Controls

Schedule incorporated into both cost and 3D model
Cost incorporated into both schedule and 3D model (added element)
CPI can be misunderstood, inaccurate baseline
What-If Scenarios can be accurately run with cost/schedule to maximize quality output
Maximize Cost Management: Efficiency & Accuracy - Integrated Cost and Schedule
Improve WBS & CBS: must be developed from the beginning

Project Controls Current Status & Trends

- **2D Drawings and Analog Specifications**: Industry Standard
- **BIM**: often not defined standard
- **Technology Available:**
  - AR: (Augmented Reality)
  - VR: (Virtual Reality)
  - IoT: (Internet of Things)
  - AI: (Artificial Intelligence)
- **Address Mismanagement of Data**
- **Digital Twin Approach: Two Way Communication**

Digital Twin

Digital Twin Approach

- Real Time
- Virtual Replica
- Single Source of Truth
- Integration of 3D - 5D Controls
- Implementation
  - Plan
  - Monitor
  - Control Progress
  - Forecast
  - Manage Risk
  - Improve Common Communication

Linesight

Project Controls EXPO
Washington, DC - USA

Digital Twin by Data Exchange

Digital Twin Classification	Data Exchange between Physical and Virtual Assets
Digital Model	No automated communication
Digital Shadow	One-way communication
Digital Twin	Two-way communication

Digital Twin Classification	Data Maturity and Transformation
Descriptive Twin	Contains editable design and construction data
Informative Twin	Contains additional operational and sensory data
Predictive Twin	Analyzes data to gain insight
Comprehensive Twin	Simulates what-if scenarios
Autonomous Twin	Learns and acts autonomously

Discussion & Recommendations

Discussion on Current Markets

- Projects more complex than ever
- Projects have more constraints than ever
- Trends 4D & 5D technology
- Two-Way Communication
- Growing Expectations

Linesight

Project Controls EXPO
Washington, DC - USA

Recommendations for Implementation

- **Identify Practices** cross-organizational
- **Establish Standards** metrics
- **Continual Training** interpret controls data
- **Maintain Clear Goals** scope, roles and responsibilities
- **Consistent Controls** lifecycle
- **Use Optimum Controls** SWOT of alternatives
- **Design-Centric & Data-Driven Controls** UBS, WBS, CBS
- **Flexibility** project focused
- **Proactive Approach** people and controls

THANK YOU

Linesight

Project Controls EXPO
Washington, DC - USA