independent project analysis, inc.





Best Scheduling Practices

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November 9, 2004

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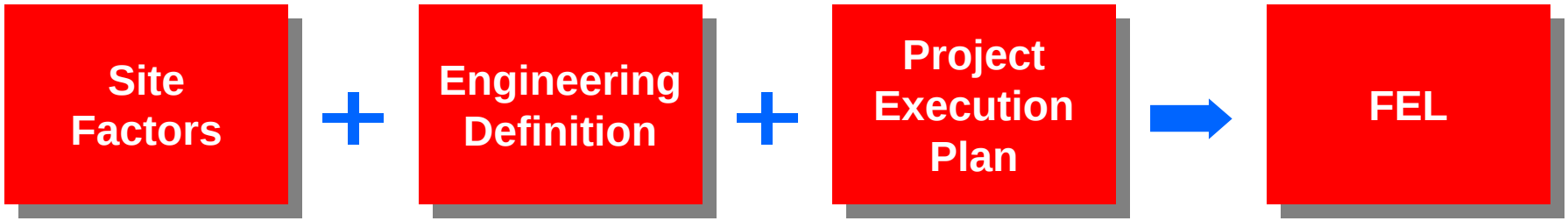
Outline

- ***Background***
- **Definitive Project Schedule**
  - **Comprehensive**
  - **Based on sound scheduling techniques**
  - **Resource-loaded**
  - **Used as a control tool**
  - **Applied to all contract types**
- **Conclusions and Recommendations**

What Practices Really Matter?

- **The quality and completeness of the Front-End Loading (FEL) prior to the start of execution**
- **Integration of the project team around:**
  - **The business purpose of the project**
  - **Team roles and responsibilities**
- **The timely and effective use of Value Improving Practices**

Front-End Loading Measurement



- Equipment layout
- Soils data
- Environmental requirements
- Health & Safety requirements

- Engineering tasks
  - Detailed scope
  - Feedstock/product properties
  - Program Definition
    - Space Planning
    - Adjacencies
  - PFDs
  - H&MBs
  - P&IDs
  - One-line elec. diagrams
  - Major equipment specs
  - Cost estimate
- Participation/buy-in of:
  - Operations
  - Maintenance
  - Business

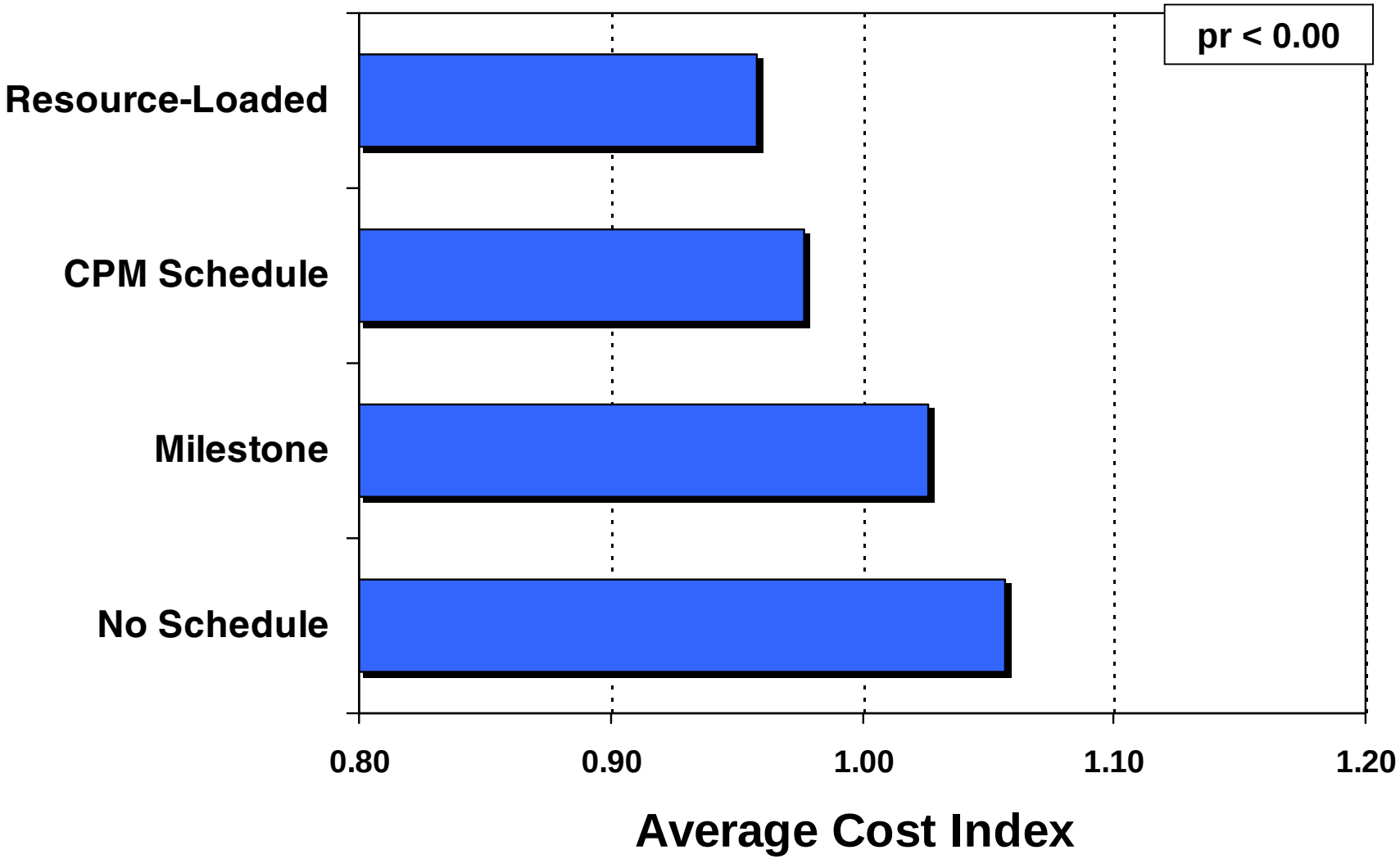
- Contracting strategy
  - Who
  - How
- Team participants & roles
- Integrated schedule
  - Critical path items
  - Identification of shutdowns for tie-ins
  - Overtime requirements
- Plans
  - Commissioning
  - Validation
  - Startup
  - Operation
  - Manpower
  - Quality assurance
- Cost/schedule controls

Schedule Definition Is a Key PEP Element

- Provides a framework for planning the project
- Identifies critical activities, relationships, and constraints
- Functions as a communication tool
- Provides a tool for controlling the project
- Provides the platform for integrating cost and schedule estimates
- Pulls different PEP elements into a single model

Cost Index Analysis

Schedule Definition Drives Cost Performance

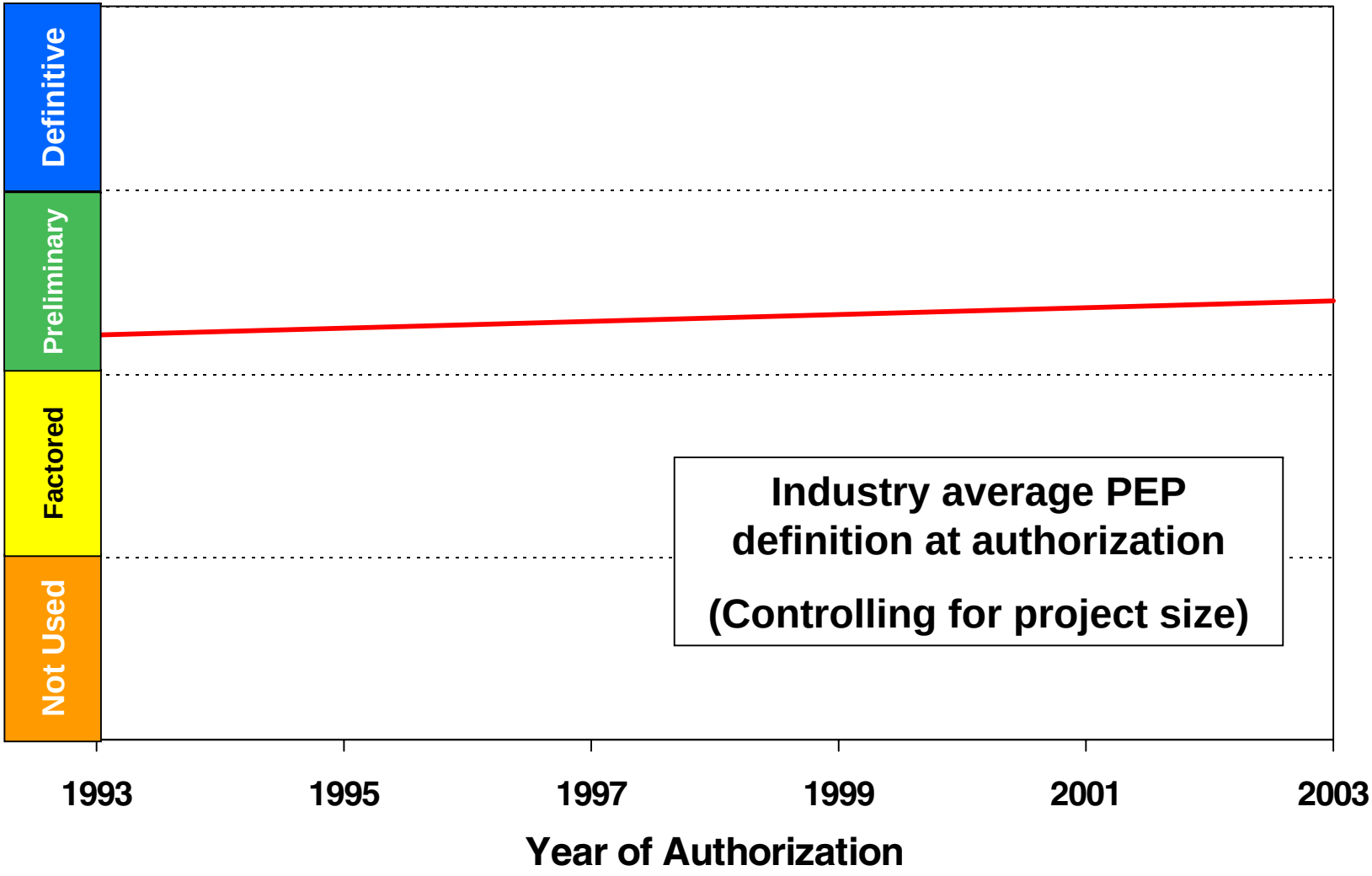


Other Project Outcomes

- **Schedule definition at authorization is also correlated with other key project outcomes:**
  - **Execution schedule performance**
  - **Cost growth**
  - **Schedule slip**
  - **Construction productivity**
- **Relationships are independent of other key project drivers.**
- **Relationships hold for both large and small projects.**

If Project Scheduling Is So Important ...

Why Such Slow Improvement?



New Data Collection Elements

- **Started collecting electronic schedule files in June 2000:**
  - **Pacesetter and prospective project evaluations**
  - **MS Project®, Primavera P3®, Primavera SureTrak®**
- **Introduced new workbook questions in 2001:**
  - **Provide additional data to support schedule definition rating**
  - **Data are collected as part of every project interview**

Cut to the Chase:
What Does a Well-Defined Schedule Look Like?

Results are based on combination of sources and analysis techniques:

- **Evaluation of individual schedules**
- **Statistical analysis of data**
- **Discussions with project teams**
- **Application of fundamental scheduling practices and theory**

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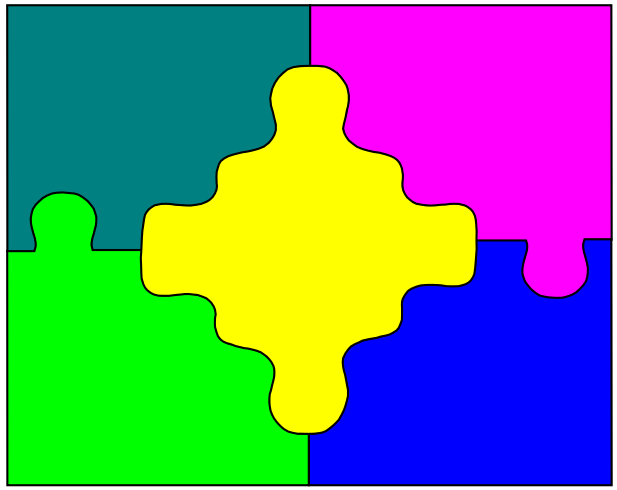
Definitive Project Schedule:
Comprehensive

A project schedule should cover the entire project scope and life-cycle and include sufficient detail to reflect the project's execution plan.

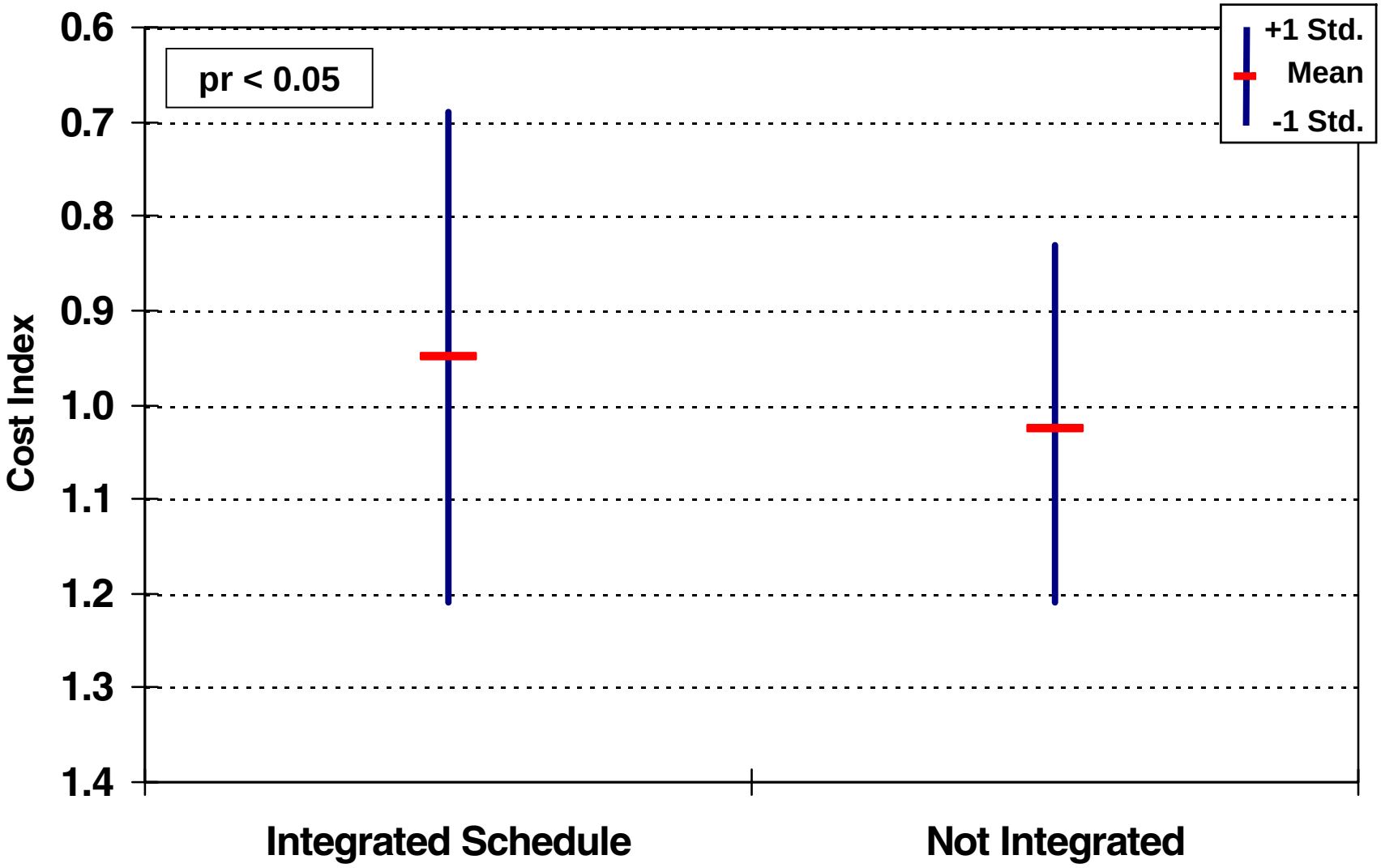


Integrated Schedules

- **Integrates all project phases into a single master schedule:**
  - **Definition, detailed engineering, procurement, construction, shutdown/turnaround, and commissioning and startup**
- **Only 40 percent of project schedules include all applicable project phases:**
  - **Many are missing FEL, shutdown/turnaround, or commissioning and startup**

Integrated Schedules

Correlated With Cost Performance

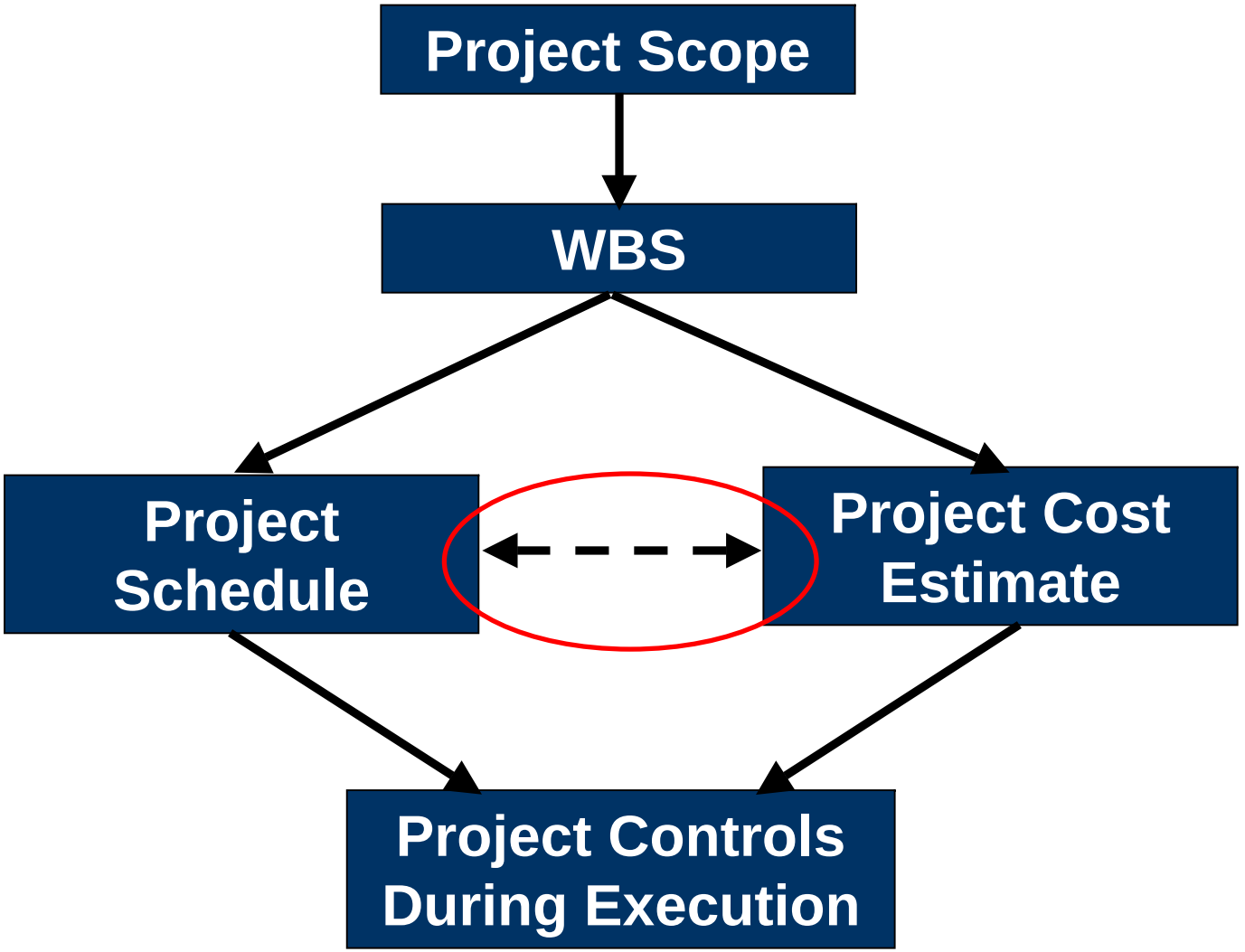


Level of Detail

- **Each phase should be detailed enough to show specific activities and transitions**
- **Specific elements to consider include:**
  - **Project definition activities and system requirements**
  - **Specific engineering design activities and milestones**
  - **Activities regarding major equipment purchases**
  - **Design packages issued to construction**
  - **Construction activities, milestones, and interfaces**
  - **Turnover of specific systems, commissioning and startup activities**

Classic Approach

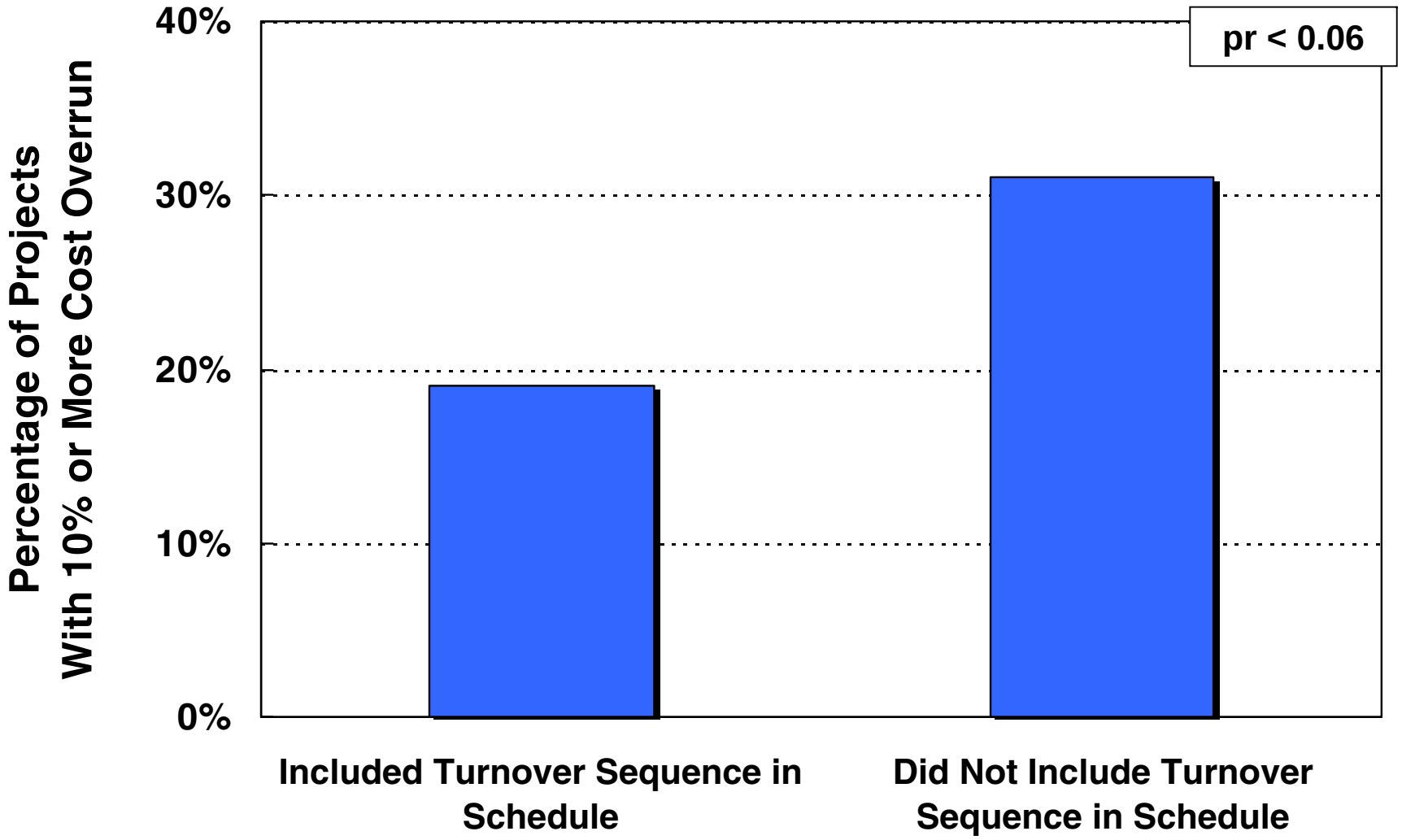
Schedule and Cost Developed Around WBS



Reflects Planned Approach

- Authorization process
- Contracting approach
- Design and construction packages
- Plans for work calendar, shift work, and overtime
- Turnaround/shutdown coordination
- Turnover sequence
- Commissioning and startup plan

Scheduling Turnover Sequence
Reduces Risk of Serious Overrun

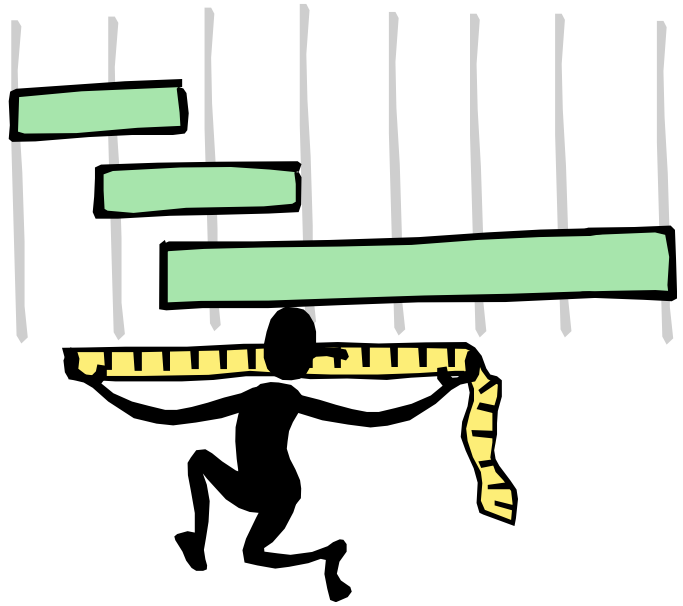


Reviewed With Core Project Team

- **Schedules should be reviewed with core project team to support buy-in to the plan.**
- **Review also provides a check for accuracy and feasibility.**
- **25 percent of schedules are not reviewed by the team.**
  - **Lack of review is correlated with higher cost growth.**
- **This review provides an easy opportunity to improve the schedule.**

Definitive Project Schedule:
Based on Sound Scheduling Techniques

Project schedule should be based on the application of modern scheduling techniques.



Industry Practices

- **Only 55 percent of schedules are based on CPM:**
  - **Activity dates and project duration based on network calculation**
  - **Clear critical path**
- **Remainder are high-level milestone schedules using a loose network of activities.**
- **Almost 8 percent of projects are authorized with no schedule of any type.**

Activity Float

- **Activity float is used to identify the critical path and near-critical paths:**
  - **Excessive float indicates logic errors**
  - **Excessive float also indicates lack of analysis to ensure schedule activity dates match plans**
- **Many schedules include high levels of activity float:**
  - **Teams are simply managing to early dates**
  - **Reduces usefulness of CPM technique**
  - **Major problem when fighting contractor claims**

Network Design

- Tie all activities together into a complete network.
- Limit use of activity constraints
  - Excessive use of constraints results in logic errors.
  - Source of problems as the schedule is updated with actual progress.
- Specify multiple work calendars to model planned workweek and amount of overtime and shift work.

Definitive Project Schedule:
Resource Loaded

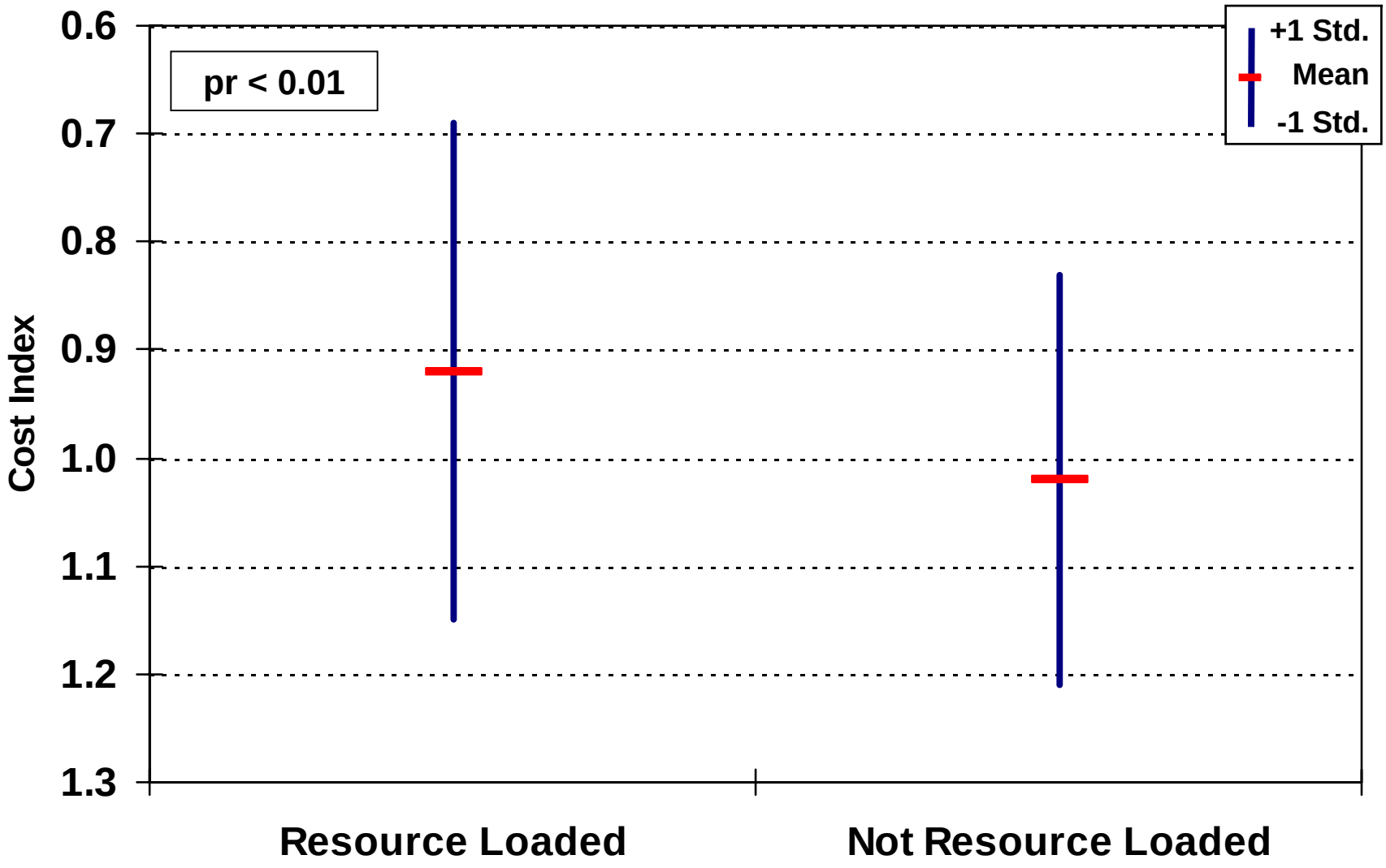
Critical project resources are loaded into the schedule using appropriate units of measure

Why Resource Load Schedules?

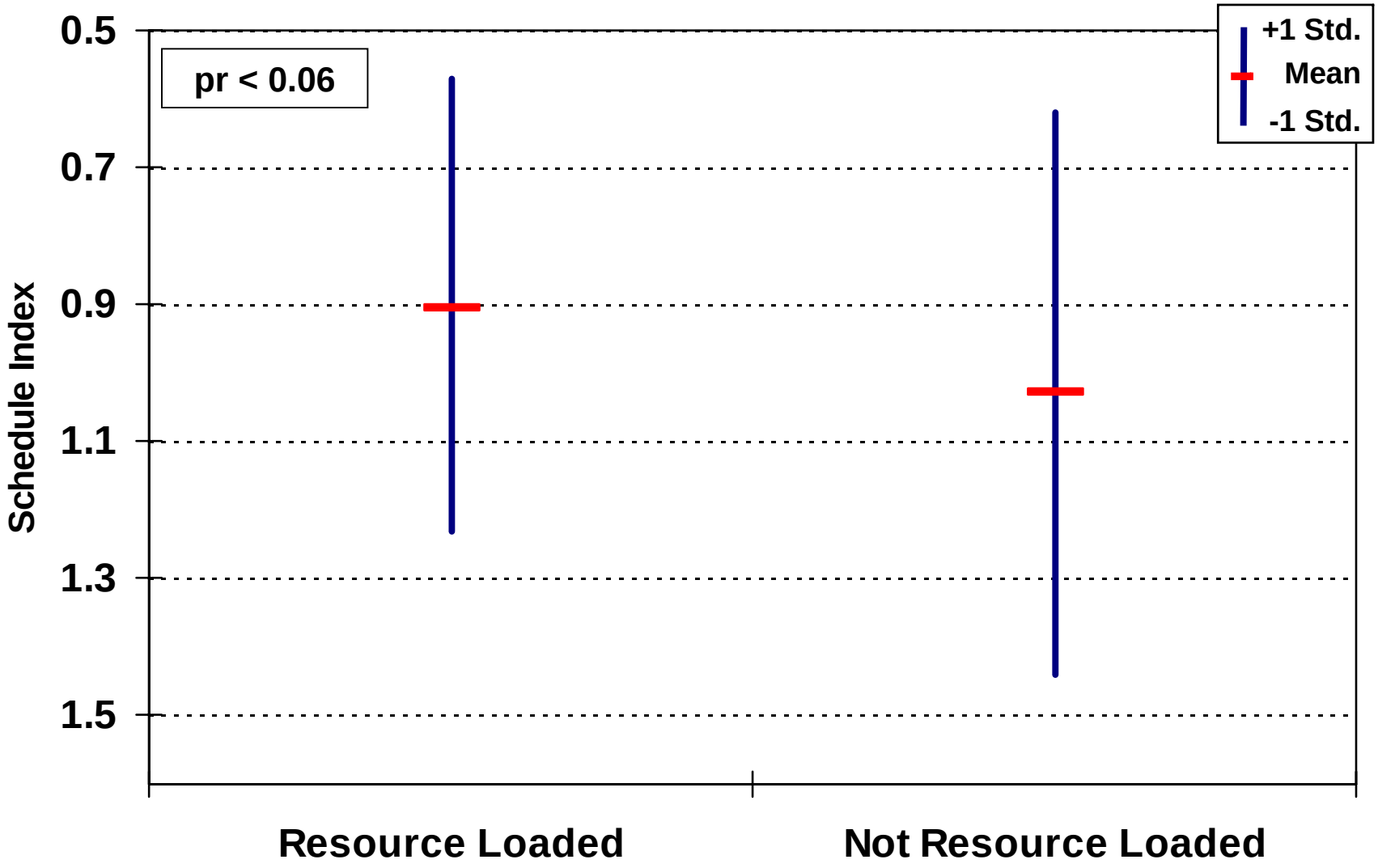
- **Basically, you do not know if the planned approach, schedule, and cost are feasible until you evaluate a resource-loaded schedule**
- **Resource-loading helps to validate approach**
  - **Ensures alignment between cost estimate and schedule**
  - **Enables evaluation of peak labor**
  - **Provides model for resource leveling**
  - **Focuses team on the critical resources**
  - **Aids in portfolio management**

Resource Loading

Correlated With Cost Performance



Resource Loading
… and With Schedule Performance

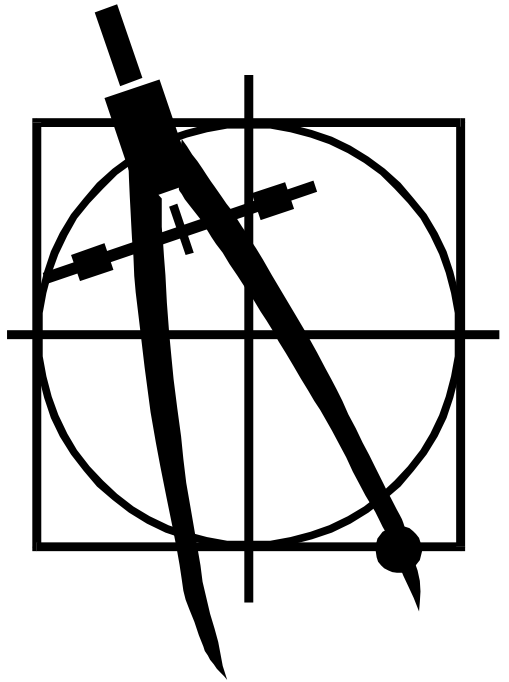


Resource Loading Approach

- **Focus on the key resources that drive project cost and schedule:**
  - **Which resources represent the highest costs, may be in short supply, may experience congestion, need active management during execution?**
- **Load labor resources to the discipline or craft level.**
- **Load project budget to generate accurate cash flow.**

Definitive Project Schedule:
Used as a Control Tool

The project schedule should be continuously updated and maintained as a control tool throughout the project life.



Industry Practice

- **IPA's Project Control Index measures the level of project controls applied to projects:**
  - **Active owner project controls, physical progressing, and frequent reports are drivers of success.**
- **Most schedules are abandoned at some point during the execution phase:**
  - **Project teams cannot conduct variance analyses without updated schedules.**
  - **No historical data are available for use on future projects.**
  - **Schedule history will be missing in event of claims.**

Definitive Project Schedule:
Applied to All Contract Types

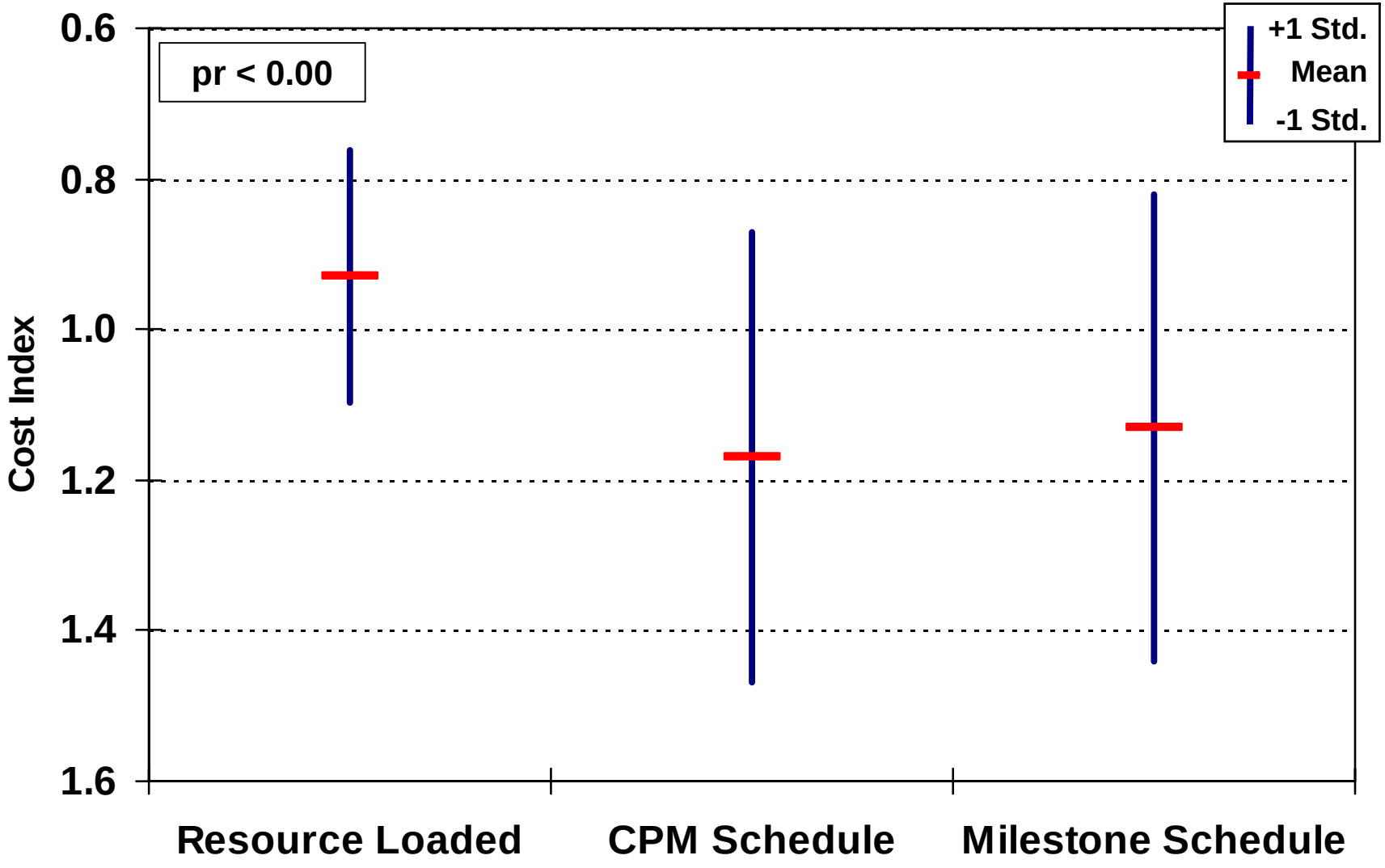
- **"My project is lump-sum EPC. I don't need to do a schedule, it is the contractor's responsibility."**
  - **Lump-sum EPC projects typically have less well-defined schedules at authorization.**
- **Previous IPA research shows:**
  - **Lump-sum EPC projects typically have higher costs.**
  - **Outcomes are extremely sensitive to levels of definition.**

Why Bother for EPC Lump-Sum?

- **Shifting risk to the contractor does not compensate for the lack of definition at authorization.**
- **EPC contractor typically does not manage all phases.**
- **Many of these lump-sum projects also include other scope elements that must be integrated efficiently.**
- **Provides cross check with the cost estimate.**
- **Facilitates constructability reviews.**
- **Provides a tool to check the validity of the contractor's schedule.**

Cost Index Analysis

Schedule Definition for Lump-Sum EPC



So What Is Reasonable?

Develop a master project schedule independent of the contractor in support of authorization.

- **Reflect level of data used to build cost estimate.**
- **Resource load with most critical resources onto summary bars.**
- **Focus on transitions from FEL to execution and turnover from execution to commissioning and startup.**
- **Build in key deliverables and interfaces required by owner.**

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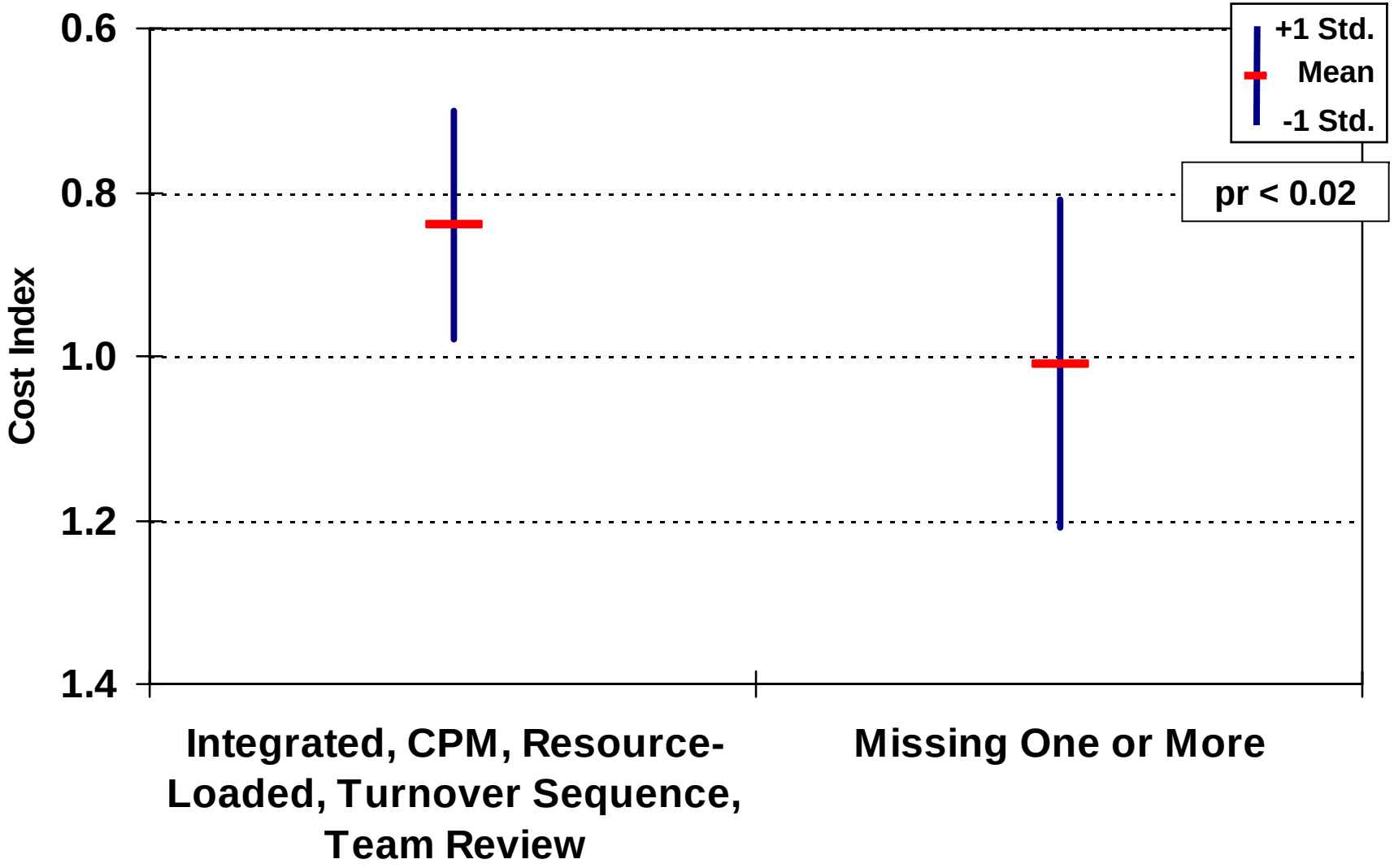
Conclusions

So what does a well-defined project schedule look like?

- **Comprehensive**
- **Based on a sound application of network scheduling techniques**
- **Resource loaded with critical resources**
- **Applied to all project types and contracting formats**
- **Used as a tool for project controls and historical record**

Cost Index Analysis

Great vs. the Rest



Benefits of Investing the Effort

- **Only 6 percent of recently completed projects met all five criteria.**
- **However, data show a significant difference in cost performance for these few projects.**
- **Data also show directional improvement for other outcomes:**
  - **Schedule slip**
  - **Cost growth**

Recommendations

- **Actively drive the planning process and ensure the participation of key team members.**
- **Build planning and scheduling core competency within your organizations.**
- **Use the project schedule for:**
  - **Planning and communicating during FEL**
  - **Project control during execution**
  - **Recording historical data for future projects**
- **Don't do it just to get the "score" from IPA!**