



Teams, Contracts, and Incentives

Their Roles in Successful Projects

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Key Questions

- **How do delivery systems and contracting strategies affect project performance?**
 - **Does whole-project (EPC) lump-sum deliver value to owners?**
 - **What is the role of cost and schedule incentives?**
- **What is the role of Team Integration on project performance?**
- **Are conclusions generalizable to different types of projects?**



Outline

- *Contracting approaches to projects in process industries*
 - EPC Lump-sum v. Alternatives
 - Effectiveness of Incentives
 - Role of Team Integration
- Delivery approaches in facilities (buildings)
- Conclusions



The Contracting Strategy Problem

- There are strongly held, diametrically opposed, beliefs about the relative merits different approaches to contracting in the process industries
- In general, these beliefs are without benefit of data
- Unlike facilities construction, there are no clear trends in process industry approaches:
 - EPC Lump-sum
 - Long-term alliances
 - “One-off” alliances
 - Incentivized reimbursable contracts
 - Mixed reimbursable engineering with fixed price construction



Overview of Data Set

- 518 projects over \$5MM from 36 companies
- All are process projects authorized since 1992
- Commodity and Specialty Chemicals, Consumer Products, Pharmaceuticals, Petroleum Refining
- Investment range \$5MM to \$1500MM, average \$57MM, median \$25MM
- Median time for execution is 19 months with median cycle time of 28 months
- Average authorization date of 2Q 1994
- Includes projects from Americas, Europe, and Asia
- Average new technology content of five percent

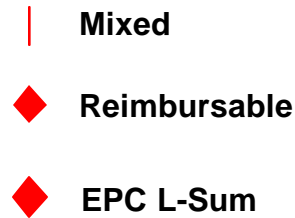
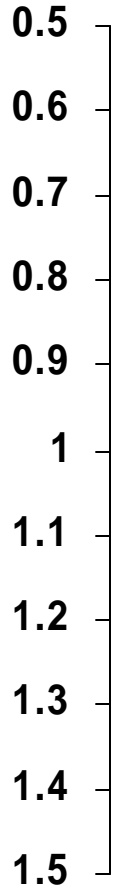


Contract Approaches Examined

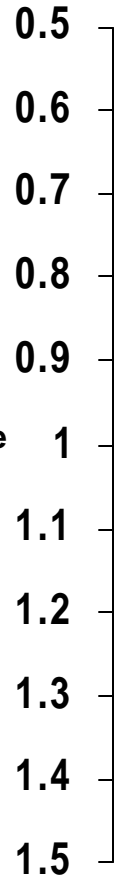
- **EPC Lump-sum:** detailed engineering, procurement and construction performed on a fixed price basis by same firm or consortium
- **Reimbursable:** all work performed on a cost-plus fee or cost-plus incentive fee basis
- **Mixed:** engineering & procurement performed on a reimbursable basis with predominantly fixed-price construction

Contract Type Affects Results

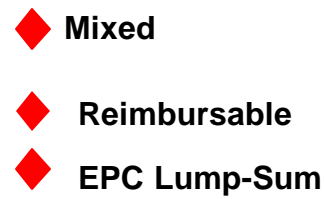
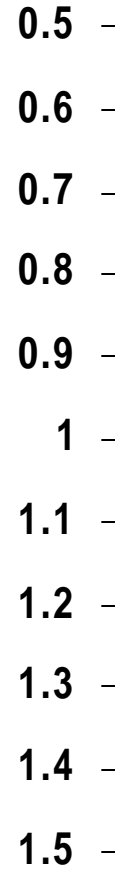
Cost Index



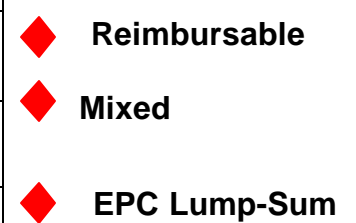
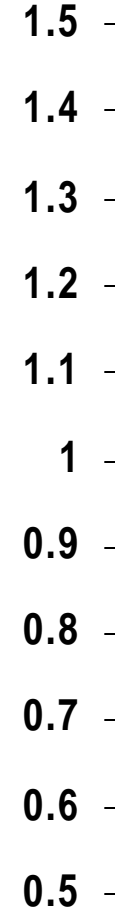
Schedule Index



Cycle Time



Operability Index



Projects authorized after 1992



Contracting Strategy Results

- **The typical EPC lump-sum is significantly more expensive than average**
- **Reimbursable engineering followed by any form of fixed price construction (the "mixed strategy") is the most cost-effective approach**
- **Although Mixed strategy execution time is longer, the cycle time is shortest**
- **EPC lump-sum carries a heavy operability penalty**
- **On average the Mixed strategy appears best and EPC lump-sum worst**



Why Are Lump-sum EPCs Usually More Expensive?

- EPC lump-sums seek to transfer project cost risk from the owner to the contractor
- Theory is that because contractors are leading the execution, they should be better able to manage the execution risks, yielding an efficient result
- Problem is that contractors are not easily able to bear equity risks; a substantial loss on a project jeopardizes the firm's earnings or even survival
- Therefore, contractors will almost always bid on a higher than 50/50 basis (except when in financial trouble)
- The larger the project, the higher the risk premium



Should Owners Avoid EPC Lump-Sum?

- **Highly standardized (“package”) plants with competition can often be bid lump-sum with little penalty**
 - **Watch for unusual conditions, e.g., footprint constraints**
 - **Tie-ins and integration with existing plant might be contracted separately**
- **Sometimes EPC lump-sum is an effective technique to reduce unnecessary change. (But team integration and discipline are better!)**
- **During periods of rapidly increasing project work-load, lump-sum can help leverage owner resources**



Other Considerations

- **Lump-sums with Asian, especially Japanese contractors, have sometimes been bargains**
 - **Large Asian contractors pool risk and had large banks providing cheap capital**
 - **Some Asian contractors were underbidding for “strategic” reasons**
- **Reimbursable contracts imply owner cost and schedule control -- if you can't provide the controls personnel, lump sum is the preferred method**
- **Remember: the penalties for EPC lump-sum procurement increase rapidly with poor definition**



Outline

- **Delivery approaches to projects in manufacturing**
 - **EPC Lump-sum v. Alternatives**
 - ***Effectiveness of Incentives***
 - **Role of Team Integration**
- **Delivery approaches in facilities (buildings)**
- **Conclusions**



The Role of Incentives

- **Engineering incentives were amounts paid to the engineering contractor according to a formula for results versus targets**
- **Construction incentives were paid to the construction contractor(s)**
- **"Both" are projects in which incentives were provided to both the engineering and construction contractors or to a single EPC contractor for overall cost and schedule results**
- **Too few contracts contained meaningful provisions for operability incentives to be examined**

Incentives and Performance

**Cost
Index**

0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

**No Effect
on Cost**

**Schedule
Index**

0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

**No Effect
on Schedule**

Cycle Time

0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

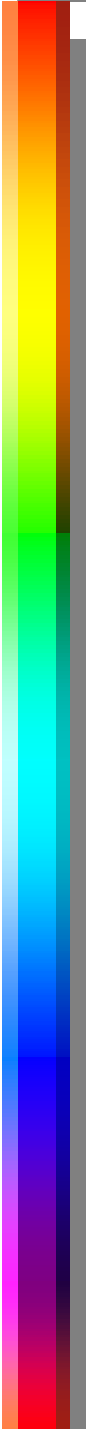
**No Effect
on Cycle Time**

**Operability
Index**

1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5

◆ **No Engineering
Incentives**
◆ **Used Engineeri
Incentives**

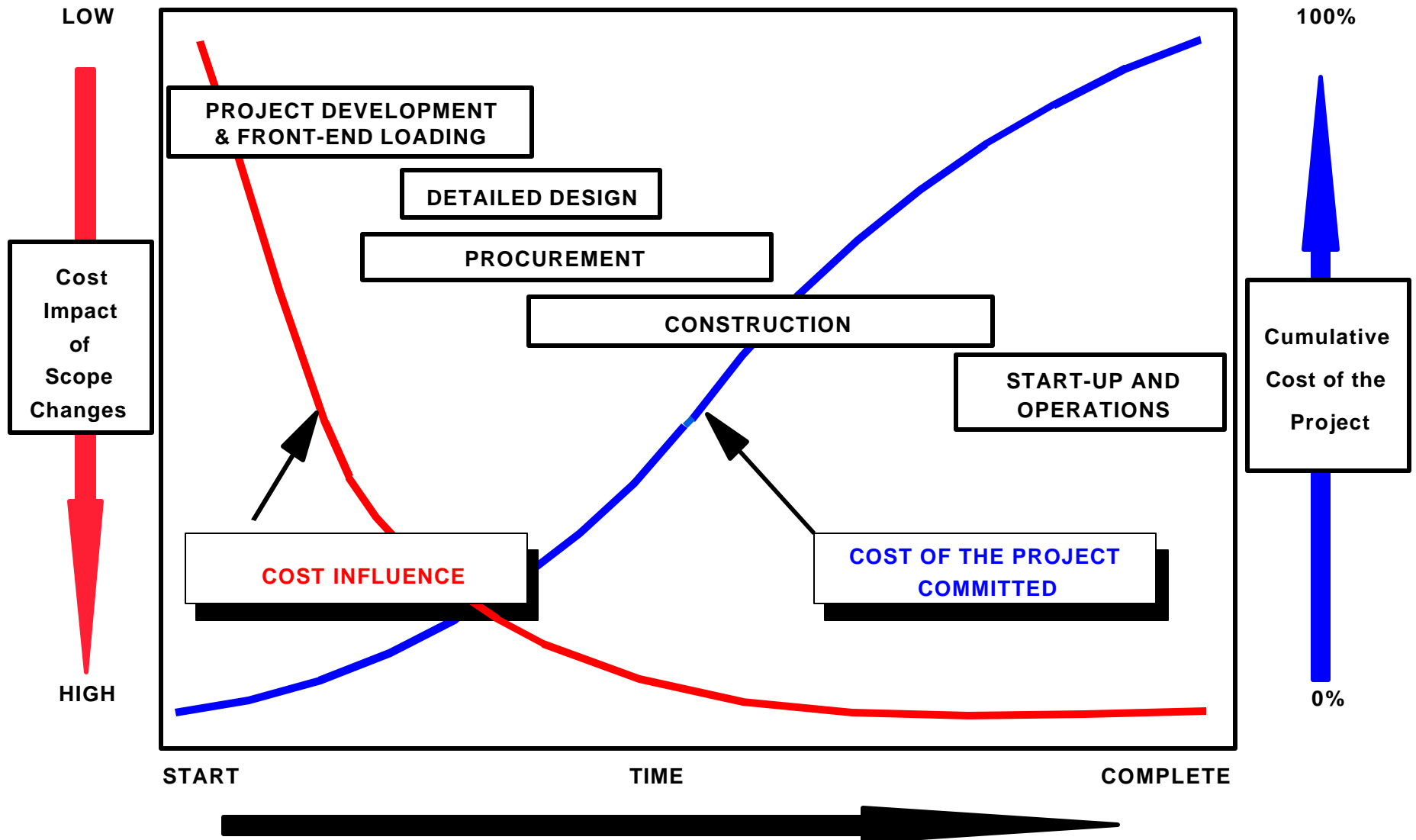
**Using all PES
database projects
authorized after
1992*



The Illogic of “All Fee at Risk”

- **Incentives around cost and schedule are usually set when the project is 30-60 percent engineering complete**
- **Contractors seek an average margin (fee) of about 5-7 percent on typical projects**
- **Most gainsharing arrangements split incentives 50/50 or 60/40 to contractor(s)**
- **This implies significant underruns of cost and often schedule to achieve a normal fee for contractors**
- **Which implies that the “influence curve” is nonsense, the contractors will do everything possible to overestimate the job, or the contractor is going to get stiffed**

The Cost Influence Curve Suggests That Large Decreases in Real Cost Are Not Likely in Execution





If You Incentivize, Ask...

- **Exactly, whose behavior you are seeking to change?**
- **How will that change mechanism work?**
- **Are monetary incentives really necessary to get engineers to do a good job?**
- **Will engineers withhold good ideas unless their firm gets an incentive?**
- **Are there ways that the purpose of the incentive can be “gamed,” e.g., high estimates?**
- **Do the incentives/penalties cause “management-to-the-incentives” rather than the project?**



Conclusions About Incentives

- **Use of incentive contracting has no statistically reliable effect on cost, execution time, or cycle time although directionally the results are poorer rather than better**
- **The use of incentives for engineering is strongly associated with poorer operability of facilities**
- **This conclusion holds for “one-off” alliances as well**
- **The use of incentives as currently practiced should be reconsidered**
- **Incentives are not working for either owners or contractors!**



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Integrated Project Teams

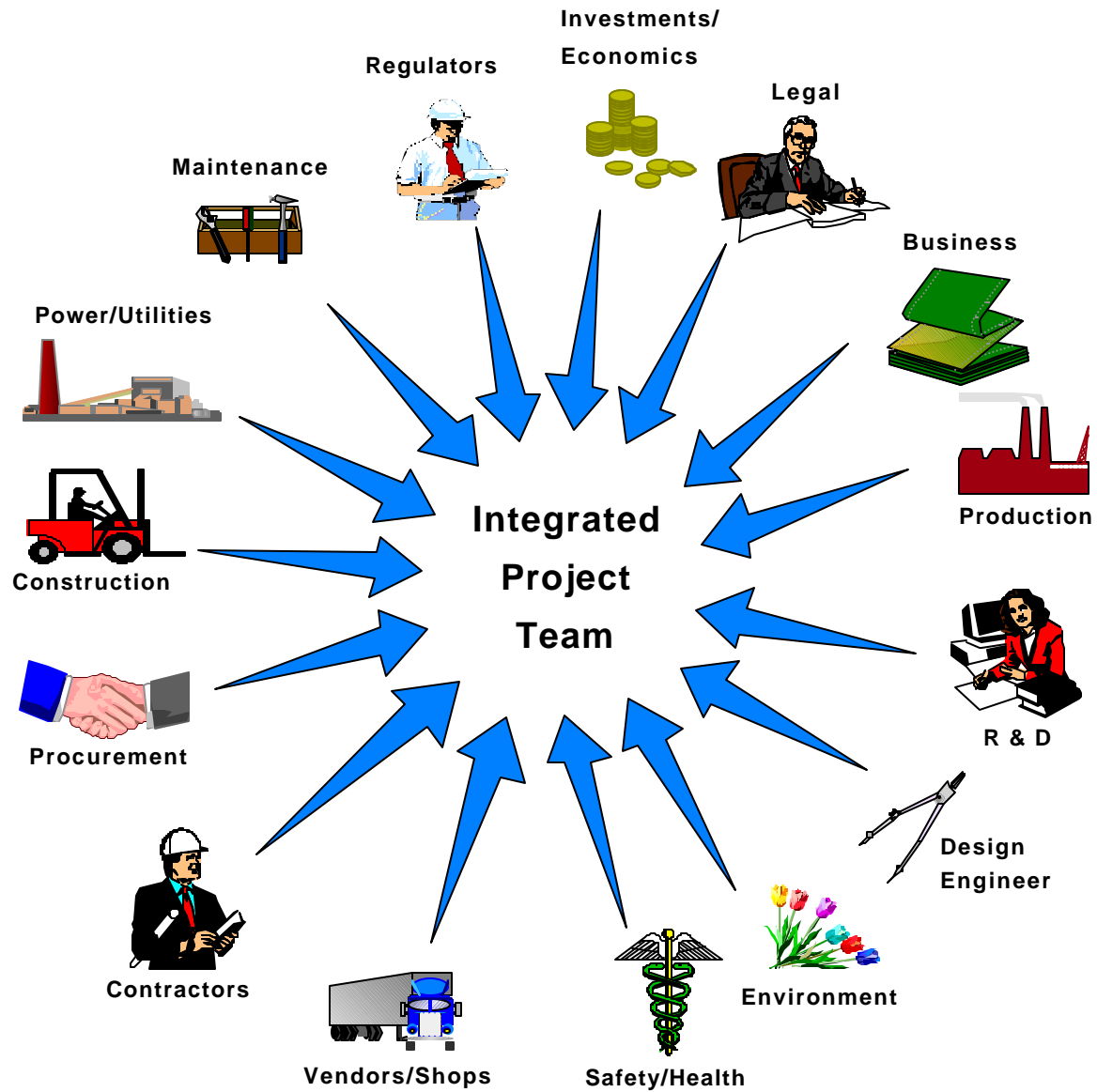
Definition of an Integrated Project Team

- An Integrated Project Team (IPT) is a team of full or part-time representatives of the following areas (but are not limited to):
 - Business
 - R&D (as needed)
 - Engineering
 - Construction
 - Maintenance
 - Operations/manufacturing
 - Health and Safety (as needed)
 - Environmental (as needed)
 - Contractors and key vendors

- These representatives are identified prior to project authorization and have specific responsibilities that are defined and understood by all team members

- These representatives have authority to make decisions for the function they are representing and provide functional input to the project manager

Project Teams



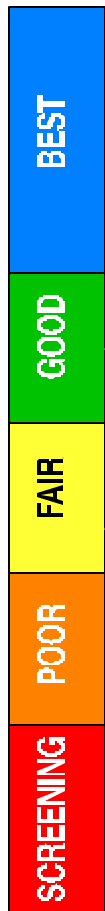
Integrated Teams Result in Better FEL and Better Overall Performance

FEL Index

Cost Index

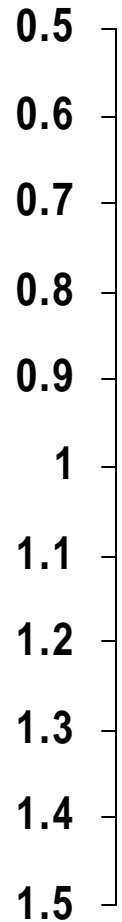
Schedule Index

Operability Index



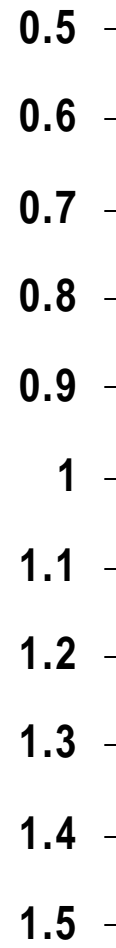
◆ Integrated Teams

◆ Non-Integrated Teams



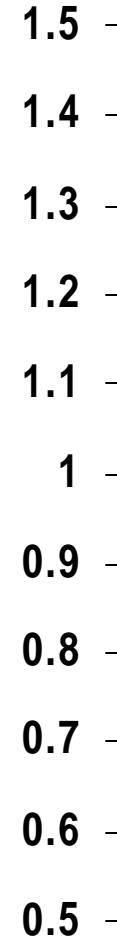
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◆ Non-Integrated Teams

**Using all PES database projects authorized after 1992*



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