Lean Thinking and Target Value Design: Overcoming the Hurdle of First Cost

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It is a curious thing to observe how almost all patients lie with their faces turned to the light, exactly as plants always make their way towards the light; a patient will even complain that it gives him pain lying on that side.

"Then why do you lie on that side?" [I ask]. He does not know—but we do.

It is because it is the side towards the window.

What is Evidence-Based Design?

Roger Ulrich’s discovery:

Patients recovering after Cholecystectomy between 1972-1981, in a Pennsylvania hospital:

1) Those who saw trees through windows spent less time in hospital than those with views of a brick wall (7.96 days vs. 8.70 days).

2) Those with view of trees took fewer doses of moderate and strong analgesics.

What is Evidence-Based Design?

Example of collective results from meta-analyses
(search by *desired outcome*)

What has already been done wrt EBD?

<table>
<thead>
<tr>
<th>Impact on <em>Patients</em></th>
<th>Impact on <em>Staff</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>↑ sleep</td>
<td>↑ performance of (older) staff</td>
</tr>
<tr>
<td>↓ pain</td>
<td>↑ glare</td>
</tr>
<tr>
<td>↓ agitation</td>
<td>↑ ability to perform nightshift</td>
</tr>
<tr>
<td>↑ satisfaction with stay</td>
<td>↓ agitation</td>
</tr>
<tr>
<td>↓ vitamin D metabolism</td>
<td>↑ job satisfaction</td>
</tr>
<tr>
<td>↓ hyperbilarubinaemia</td>
<td>↓ back pain</td>
</tr>
<tr>
<td>↓ pain medication</td>
<td>↓ time wasted walking</td>
</tr>
<tr>
<td>↓ length of stay</td>
<td>↓ communication with patient</td>
</tr>
<tr>
<td>↓ medical errors</td>
<td>↓ communication between staff</td>
</tr>
<tr>
<td>↓ incidence of aspergillus</td>
<td>↓ stress</td>
</tr>
<tr>
<td>↓ nosocomial infections</td>
<td>↓ fatigue</td>
</tr>
<tr>
<td>↓ transfers between rooms</td>
<td>↑ staff retention</td>
</tr>
<tr>
<td>↓ falls</td>
<td>↓ error prone-ness</td>
</tr>
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Example of collective results from meta-analyses (search by design intervention)

What has already been done wrt EBD?
EBD is being used to convince facility decision-makers that initial capital costs result in long-term cost savings (Berry et al. 2004).

Approximate cost = $12 million

Approximate benefit = $11.5 million

1.04 yrs

Breakdown of Hospital Expenses

- Employee Benefits (8%)
- Professional Fees (6%)
- Medical Supplies (3%)
- Drugs & Pharmaceuticals (5%)
- Food (4%)
- Fuel & Utilities (6%)
- Contracted Services (7%)
- Capital Expenses (6%)
- Other Expenses (5%)

Why is EBD financially important?

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Why is EBD financially important?
Goal:

Help make EBD financially feasible.
enter

TARGET
VALUE
DESIGN
How do we set prices?

What is Target Value Design?


Integrated Project Delivery


Adapted from MSA (2004).
Integrated Project Delivery: Why co-location works

The role of cost sharing

From Clifton et al, *Target Costing: Market-Driven Product Design*, figure 5.2, p. 73

The importance of flexible cost boundaries

## Impact of Target Value Design

Comparison of two similar projects using different project delivery systems

<table>
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<tr>
<th></th>
<th>St. Olaf Fieldhouse</th>
<th>Carleton College Recreation Ctr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion Date</td>
<td>August 2002</td>
<td>April 2000</td>
</tr>
<tr>
<td>Project Duration</td>
<td>14 months</td>
<td>24 months</td>
</tr>
<tr>
<td>Gross Square Feet</td>
<td>114,000</td>
<td>85,414</td>
</tr>
<tr>
<td>Total Cost (incl. A/E &amp; CM fees)</td>
<td>$11,716,836</td>
<td>$13,533,179</td>
</tr>
<tr>
<td>Cost per square foot</td>
<td>$102.79</td>
<td>$158.44</td>
</tr>
</tbody>
</table>


Medical Office Building
3 storey
69,251 SF

Benchmark: $22 M
Target Cost: $18.9 M (approx. 14% below benchmark)
Actual Cost: $17.9 M (approx. 19% below benchmark)

TVD Early experimental results

Enter Target Value Design
California Pacific Medical Center (850,000 SF; 550 beds)

Cathedral Hill Hospital

California Pacific Medical Center is committed to a vision of healthcare for our community that will encompass a new state of the art facility and programs that will fulfill our mission of Clinical Excellence, Education, and Research.

The patient and family experience comes first:

- Patient-focused care
- Private patient rooms
- Accessibility and ease of way-finding
- Comfortable and varied environments
- Healing environments with natural light
- Visitor hospitality lounges on each floor
- Private medical consulting rooms
- Pleasant dining areas
- Awareness of diversity of cultures
- Parking convenience
- Efficient intercampus transfer and mobility
- One stop registration for all OP [operations]
- Easy access to emergency services
- A design that focuses on the patient
- Physician and staff friendly
- Sustainable
- Cost efficient and constructible

Research: The Cathedral Hill Hospital

Integrated Project Delivery: Co-location

Lean Project Delivery

Design Engine
Culture of
Continuous Improvement

Pull Pricing
Pull Scheduling

Relational Contract

Pull Scheduling:
Last Planner ("Big Room") meeting

Pull Pricing:
Target Costing ("Big Room") meeting

Design Engine:
Cluster Group meeting

Design Engine:
Subcommittee meeting

Meetings

Setting the cost target against Market Cost

- $753.19/SF Average Adjusted Market Cost

- $654/SF Allowable Cost

Methodology

Incentive plan to meet Allowable Cost

Incentive plan to reach below Allowable Cost

Contractual motivators

Methodology

Risk Sharing

Risk Sharing

Scope change

Lean Project Delivery

- Increasing the relatedness of members of the design and construction team (the "Integrated Project Delivery Team" or "IPD Team");

- Collaborating throughout design and construction with all members of the IPD Team;

- Planning and managing the Project as a network of commitments;

- Optimizing the Project as a whole, rather than any particular piece;

- Tightly coupling learning with action - Promoting continuous improvement throughout the life of the Project (Kaizen)
Lean Training

Introduction: Lean History, Concepts & Methods

Basic Training
- Value Stream Mapping
- 5S
- Reliable Promising
- Learning from Experiments & Breakdowns
- Choosing by Advantages
- A3 Reports

Lean Project Delivery
- Last Planner Process
- Target Value Design
- Design Management
- Supply Chain Management
- Design of Construction Operations

Lean Management for Supervisors
- Leader Standard Work
- Daily Accountability Process
- Visual Controls
- Developing People
- Leading Change
- Problem Solving and Process Improvement
- Lean Management System
Medical Center
550 Beds
850,000 SF

Average Adjusted Market Cost: $753/SF
Original Estimate: $719/SF
Allowable Cost: $654/SF (13% below market cost; 10% below original estimate)
Target Cost: 15-20% below market cost

Target Value Design: Results

TVD results are being repeated:

• Sutter Medical Center, Castro Valley
• Alta Bates Summit, Medical Center Patient Care Pavilion
• UCSF Medical Center at Mission Bay

--report forthcoming by Stephane Denerolle, from DPR & the P2SL Laboratory at UC Berkeley
Overcoming initial skepticism

Cost performance comparison of collaborative v. non-collaborative delivery methods

Change order performance comparison

Reducible change order performance (%) categorized by project management as “omissions” for CSP versus CMR projects.

### Cost performance on construction projects BEFORE Target Value Design

#### Problematic construction projects (adapted from Forbes and Ahmed 2011, p. 57)

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Budgeted cost ($ millions)</th>
<th>Final Cost ($ millions)</th>
<th>Growth of cost (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanford Nuclear Facility (2001)</td>
<td>715</td>
<td>1,600</td>
<td>120</td>
</tr>
<tr>
<td>Capitol Hill Visitor Center (2008)</td>
<td>265</td>
<td>621</td>
<td>134</td>
</tr>
<tr>
<td>Denver Airport (1995)</td>
<td>1,700</td>
<td>4,800</td>
<td>180</td>
</tr>
<tr>
<td>Boston Big Dig (2005)</td>
<td>2,600</td>
<td>14,600</td>
<td>460</td>
</tr>
</tbody>
</table>

### Cost performance on construction projects AFTER Target Value Design

#### Examples of cost results following Target Value Design exercises on reduction of capital cost (Glenn Ballard, *personal communication*, 2012)

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Market cost ($ millions)</th>
<th>Final Cost ($ millions)</th>
<th>Reduction of cost (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>98,000,000</td>
<td>89,200,000</td>
<td>9.0</td>
</tr>
<tr>
<td>(368,882 SF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project B</td>
<td>13,533,179</td>
<td>11,717,000</td>
<td>13.4</td>
</tr>
<tr>
<td>(114,000 SF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project C</td>
<td>13,600,000</td>
<td>11,200,000</td>
<td>17.6</td>
</tr>
<tr>
<td>(75,362 SF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project D:</td>
<td>22,000,000</td>
<td>17,900,000</td>
<td>18.6</td>
</tr>
<tr>
<td>(230,000 SF)</td>
<td></td>
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</table>
• Target Value Design appears to have the ability to reduce first cost by 15-20%.

• Therefore, if you want to overcome the hurdle of first cost that comes with better quality facilities, consider using Target Value Design.
P2SL Sponsors
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