Introduction to CII Practices
Special Presentation to
American Council for Construction Education
Jacksonville, Florida
20Feb09

Manuel A. Garcia, P.E.
Associate Director
Construction Industry Institute
Session Objectives

• CII & ACCE
• Review
  – CII Practice/ Best Practice Concept
  – CII Best Practices, including
    • Benefits
    • Key Elements
    • Supporting Resources
Professional Development Committee

- Tamlin Antoine, NASA
- Dr. William W. Badger, Arizona State
- James P. Chiarello, Pathfinder
- Robert Hayhurst, Occidental Petroleum
- Dorothy Hellberg, Emerson Process
- Lamonte John, US GSA
- Christopher Maxson, CCC Group
- Patty Nemeth, Fluor
- Henri Ohayon, Bechtel

- Michael R. Peters, Black & Veatch
- Catherine Polito, UT Austin
- Dr. Paul E. Resta, UT Austin
- Jane Todd, Ontario Power
- Dianne Underwood, ConocoPhillips

- Timothy B. Martin, ConocoPhillips-**Co chair**
- Dr. P. Karen Vacca, Washington Division of URS-**Co chair**

- Manuel A. Garcia, CII
What is CII?

- A consortium of leading owners, contractors & suppliers, and academia working to improve the constructed project and the capital investment process.

- A research unit of the Cockrell School of Engineering at The University of Texas at Austin
## Construction Industry Institute - Owner Members

<table>
<thead>
<tr>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott</td>
</tr>
<tr>
<td>The AES Corporation</td>
</tr>
<tr>
<td>Air Products and Chemicals</td>
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<tr>
<td>Alcoa</td>
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<td>Ameren Corporation</td>
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<tr>
<td>Amgen Inc.</td>
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<td>American Transmission Co.</td>
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<td>Bristol-Myers Squibb Co.</td>
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<td>Cargill, Inc.</td>
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<tr>
<td>Chevron</td>
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<td>Codelco-Chile</td>
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<td>DFW International Airport</td>
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<td>The Dow Chemical Co.</td>
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<td>DuPont</td>
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<td>Eastman Chemical Co.</td>
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<td>International Paper</td>
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<td>Kaiser Permanente</td>
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<td>Marathon Oil Corporation</td>
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<td>NASA</td>
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<td>NAVFAC</td>
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<td>The Procter &amp; Gamble Co.</td>
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<td>Rohm and Haas Company</td>
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<td>Southern Company</td>
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<td>Sunoco, Inc.</td>
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<td>Tennessee Valley Authority</td>
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<td>Tyson Foods, Inc.</td>
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<td>U.S. Architect of the Capitol</td>
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<tr>
<td>U.S. Army Corps of Engineers</td>
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<td>U.S. Dept. of Commerce/ NIST/BFRL</td>
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<td>U.S. Dept. of Energy</td>
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<td>U.S. Dept. of Health &amp; Human Services</td>
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<td>U.S. Dept. of State</td>
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<tr>
<td>U.S. General Services Administration</td>
</tr>
<tr>
<td>U.S. Steel</td>
</tr>
<tr>
<td>Vale</td>
</tr>
</tbody>
</table>
Construction Industry Institute - Contractor Members

Adolfson & Peterson Construction
Aker Solutions
Alstom Power Inc.
AMEC, Inc.
Atkins Faithful & Gould
Autodesk, Inc.
AZCO INC.
Baker Concrete Construction
Barton Malow Company
Bateman Engineering N.V.
Bechtel Group, Inc.
BIS Frucon Industrial Svcs.
Black & Veatch
Bowen Engineering Corp.
Burns & McDonnell
CB&I
CCC Group, Inc.
CDI Engineering Solutions
CH2M HILL
CSA Group
Day & Zimmermann
dck Worldwide LLC
Dresser-Rand Company
Emerson Process Mgt.
Entech Solar, Inc.
Fluor Corporation
Foster Wheeler USA Corp.
Grinaker-LTA/E+PC
Gross Mechanical Contractors
GS Engineering & Construction
Hargrove and Associates, Inc.
Hill International, Inc.
Hilti Corporation
Jacobs
JMJ Associates Inc.
KBR
Kiewit Power Construction
Lauren Eng. & Constructors
M. A. Mortenson Company
McDermott International, Inc.
Mustang
Oracle USA, Inc.
Parsons
Pathfinder LLC
Pegasus Global Holdings
R. J. Mycka, Inc.
S&B Engineers and Constructors, Ltd.
The Shaw Group Inc.
Siemens Energy, Inc.
SNC-Lavalin Inc.
Technip
URS Corporation
Victaulic Company
Walbridge
The Weitz Company, Inc.
WorleyParsons
Zachry
Zurich
Universities involved in CII Research 1983-2008

University of Alabama
Arizona State University
Auburn University
Bucknell University
Carnegie Mellon University
University of Cincinnati
Clemson University
University of Colorado-Boulder
Colorado State University
Columbia University
University of California-Berkeley
East Carolina University
University of Florida
Georgia Institute of Technology
University of Houston
University of Illinois
Iowa State University
University of Kansas
University of Kentucky
Lehigh University
University of Maryland
University of Michigan
Mississippi State University
University of New Mexico
North Carolina State University
North Dakota State University
Oklahoma State University
Oregon State University
The Pennsylvania State University
University of Pittsburgh
Purdue University
Polytechnic University
San Diego State University
San Jose State University
Stanford University
State University of New York-Albany
Vanderbilt University
Virginia Polytechnic Institute and State University
Texas A&M University

The University of Texas at Austin

University of Washington
University of Waterloo
University of Wisconsin-Madison
Worcester Polytechnic Institute
CII Mission

• Enhance business effectiveness and sustainability of the capital facility life cycle
CII History

- Established as a recommendation from The Business Roundtable CICE Project to address:
  - construction research
  - fragmentation of the industry
- Founded in 1983 by 28 companies; Now 116 members
- First to bring research to the engineering-construction world
- First industry-government-academic research collaboration for the constructed project
The Owner’s experience…
Cost Growth (Owner)

CII Best Practice Usage
(Best Practice Index)

Note: Average Budget 44 Million, submitted after 2002 (n=127)
Schedule Growth (Owner)

![Graph showing schedule growth with a trend line and data points. The graph indicates a decrease in schedule growth as CII Best Practice Usage increases, with a notable 28.8% decrease at the robust implementation level.]

Note: Average Planned Duration 131 weeks, submitted after 2002 (n=155)
The Contractor’s experience...
Value of CII Best Practices
(CII Contractors)

CII Best Practice Usage
(Best Practice Index)

Note: Average Budget = 58 Million, submitted after 2002 (n=81)
Value of CII Best Practices (CII Contractors)

Note: Average Planned Duration=109 weeks, submitted after 2002 (n=81)
CII Database

- 1,646 projects
- Worth > $76 Billion
- Large & Small Projects Combined
The Construction Industry Today

- 5% of U. S. GDP
- 11.7 million workers - 8% of nation’s workforce
- Affects nearly every aspect of U. S. economy
- Vital engine for economic growth
Industry Trends

- Workforce & Human Capability
- Project Delivery
- Corporate Strategy
- Technology & Innovation
- Markets & Demand Drivers
- Social & Political Influences
What Business Environment Changes Impact Our Workforce?

CII 2007 Survey Results

- Skill Shortage: 41%
- Business Growth: 21%
- Hiring Needs: 13%
- Changing Processes: 5%
- Staff Demographics: 8%
- Other: 12%
Organizations Struggle to Prepare Workforces to Meet Growth Demands

Source: Softscape – Results from past three “State of the Global Talent Nation” surveys of HR professionals

- 2006: 64% Not Adequately Prepared
- 2007: 86% Not Adequately Prepared
- 2008: 94% Not Adequately Prepared
CII Research Topic Completions

6 More Topics Completing In 2008

27 New Topics In Last 5 Years
Benefits of CII in ACCE Curriculum

• Students grounded on proven construction management methods.

• Graduates ready for next learning phase

• CII research findings relevant to all industry sectors, owners, contractors

• Will give students exposure to wide range of construction projects
ACCE Institutions Collaborating With The CII Professional Development Committee

- Arizona State University
- Auburn University
- East Carolina University
- Georgia Institute of Technology
- Georgia Southern University
- Mesa State College
- North Carolina A & T State University
- Purdue University
- San Diego State University
- Southern Illinois University
- Texas A&M University
- The University of Texas at Austin
- University of Florida
- University of Washington
- Virginia Polytechnic Institute and State University
- Washington State University
ACCE Institutions- CII Issued Pubs in 2007

- Arizona State University
- Clemson University
- Colorado State University
- Florida International University
- Georgia Institute of Technology
- Michigan State University
- North Dakota State University
- Northern Kentucky University
- Oregon State University
- Penn State University
- Purdue University
- San Diego State University
- Southern Polytechnic State
- Stanford University
- Texas A&M University
- University of California-Berkeley
- University of Cincinnati
- University of Southern Mississippi
- University of Washington
- University of Wisconsin
- Virginia Polytechnic Institute
- Wentworth Institute of Technology
The Next 25 Years…

• Transformation to a truly global economy
• Explosion in technology
• Distance no longer a constraint
• Communication is instantaneous
• Resources traded on a global scale
• Visual communications overcome language barriers
• Complexities continue to grow

Will Our Students Be Ready?
2008 Modules

Module 1: Safety

Module 2: Constructability

Module 3: Materials Management

Module 4: Scope Control & Change Management

Module 5: Front-End Planning & PDRI

Module 6: Project Health Assessment

Module 7: Benchmarking and Metrics, Assessment Practices
New CII Recognition of Academic Partners

CII Distinguished Professor Award

• Recognizes faculty at graduate/undergraduate programs incorporating CII published research findings in courses they teach.

CII Curriculum Partner Award

• Recognizes graduate/undergraduate programs that incorporate published CII research findings in their curricula.
Want to get involved?

• Contact me with your dream CII course
• CII will review your plan
• Facilitate material as appropriate
• Your peers are doing it!
Session Objectives

• CII & ACCE

• Review
  – CII Practice/ Best Practice Concept
  – CII Best Practices, including
    • Benefits
    • Key Elements
    • Supporting Resources
## CII Practices (CII Best Practice Candidates)

### Project Planning Phase
- Attract and Maintain Skilled Workers
- Automated Identification
- Effective Use of Global Engineering Workforce
- Environmental Remediation Management
- Equitable Risk Allocation
- International Project Risk Assessment
- Leader Selection
- Modularization/Preassembly
- Organizational Work Structure
- Project Delivery and Contract Strategies
- Project Security
- Project Teams
- Technology Implementation
- Value Management
- Work Process Simulation

### Design/ Construction/ Startup Phases
- Craft Productivity Practices
- Design for Maintainability
- Design for Safety
- Engineering Productivity Measurement
- Piping Design

### Project Life
- Cost & Schedule Control
- Employee Incentives
- Fully Integrated and Automated Project Processes (FIAPP)
- Management of Education & Training
- Managing Workers’ Compensation
- Project Health Assessment
- Small Projects Execution

*New or updated!*

- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
CII Best Practices

Project Planning Phase
• Alignment 2005
• Partnering
• Pre-Project Planning 2009
• Team Building

Design Phase
• Constructability 2006
• Materials Management

Construction/Startup Phase
• Planning for Startup
• Zero Accidents Techniques 2006

Project Life Cycle
• Benchmarking & Metrics 2004
• Change Management
• Disputes Prevention
• Implementation of CII Research 2007
• Lessons Learned 2007
• Quality Management 2005

Updated!
Where do CII Practices & Best Practices fit in the project cycle?

Everywhere!
Opportunity for Influence

Level of Influence

Major Influence
Rapidly Decreasing Influence
Low Influence

Project Life Cycle

Conceptual Analysis and R&D
Pre-Project Planning
Basic Data and Scoping
Project Authorization
Production Engineering and Procurement
Construction
Engineering Complete
Turnover and Start-up

Influence
Commitment $$
• Questions?
CII Best Practices

Project Planning Phase
• Partnering
• Alignment of Project Objectives
• Pre-Project Planning
• Disputes Resolution
• Team Building

Design Phase
• Change Management & Scope Control
• Constructability
• Materials Management

Construction/Startup Phase
• Planning for Start-Up
• Zero Accidents Techniques

Project Life Cycle
• Benchmarking
• Implementation of CII Research
• Lessons Learned
• Quality Management
Partnering

- Project specific partnering
  - Project objectives focused; short term.
- Strategic alliances
  - Enterprise objectives focused; long term
Partnering

Partnering ToolKit, IR 102-2

• Proactive management process

• Integrates & optimizes value-added services of each party to best achieve business objectives of all parties within the relationship.

• Promotes use of common values and honorable business practices.
Benefits of Partnering

• Efficiency improvements from working together.
• Reduced costs for all from effective resource utilization.
• Increased opportunity for innovation.
• Promotes continuous improvement.
• Improved profits (value) for all parties.
• Attitude change from adversarial to cooperative, from self-centered to team-focused, from win/lose to win/win.
<table>
<thead>
<tr>
<th>Category</th>
<th>Result Area</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Total Project Cost (TPC)</td>
<td>10% reduction</td>
</tr>
<tr>
<td></td>
<td>Construction Administration</td>
<td>24% reduction</td>
</tr>
<tr>
<td></td>
<td>Marketing</td>
<td>50% reduction</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>$10 per hour reduction</td>
</tr>
<tr>
<td></td>
<td>Value Engineering</td>
<td>337% increase</td>
</tr>
<tr>
<td></td>
<td>Claims (% of TPC)</td>
<td>87% reduction</td>
</tr>
<tr>
<td></td>
<td>Profitability</td>
<td>25% increase</td>
</tr>
<tr>
<td>Schedule</td>
<td>Overall Project</td>
<td>20% reduction</td>
</tr>
<tr>
<td></td>
<td>Schedule Changes</td>
<td>48% reduction</td>
</tr>
<tr>
<td></td>
<td>Schedule Compliance</td>
<td>Increased from 85% to 100%</td>
</tr>
<tr>
<td>Safety</td>
<td>Hours without lost time accidents</td>
<td>3 million vs. 48,000 industry standard</td>
</tr>
<tr>
<td></td>
<td>Lost work days</td>
<td>4 vs. 6.8 industry standard</td>
</tr>
<tr>
<td></td>
<td>Number of doctor cases</td>
<td>74% reduction</td>
</tr>
<tr>
<td></td>
<td>Safety rating</td>
<td>5% of national average</td>
</tr>
<tr>
<td>Quality</td>
<td>Rework</td>
<td>50% reduction</td>
</tr>
<tr>
<td></td>
<td>Change orders</td>
<td>80% reduction</td>
</tr>
<tr>
<td></td>
<td>Direct work rate</td>
<td>42% increase</td>
</tr>
<tr>
<td>Claims</td>
<td>Number of claims</td>
<td>83% reduction</td>
</tr>
<tr>
<td></td>
<td>Projects with claims</td>
<td>68% reduction</td>
</tr>
<tr>
<td>Other</td>
<td>Job satisfaction</td>
<td>30% improvement</td>
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</table>
## The Partnering Process

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
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</thead>
<tbody>
<tr>
<td>Owner’s Internal Alignment</td>
<td>Partner Selection</td>
<td>Partnering Relationship Alignment</td>
<td>Project Alignment</td>
<td>Work Process Alignment</td>
</tr>
</tbody>
</table>

- **Phase 1**: Owner’s Internal Alignment
  - Identify Business Drivers
  - Evaluate Partnering
  - Prepare and Align

- **Phase 2**: Partner Selection
  - Select Optimum Partner

- **Phase 3**: Partnering Relationship Alignment
  - Align Objectives
  - Develop Measures
  - Develop Reward System

- **Phase 4**: Project Alignment
  - Develop “Win / Win” Objectives
  - Reward Accomplishment of Objectives

- **Phase 5**: Work Process Alignment
  - Establish Intraproject Goals
  - Establish Processes to Support Measures
CII Implementation Resources

- Education Modules
  - EM102-21

- Continuing Education
  - Pending Interest

- Online Education
  - CT16-CT19

- Registered Education Providers
  - YES

- Community of Practice
  - YES
Alignment

- Projects participants working in harmony to develop and meet a uniformly defined and understood set of project objectives.
Alignment

• Alignment During Pre-Project Planning, IR113-3.

• Project Objective Setting, RS12-1, Second Edition
Benefits of Alignment

• Ensures that participants are working toward a common goal.
## Alignment Index vs. Performance Analysis
(from recent Research Team 213 data)

<table>
<thead>
<tr>
<th>Performance</th>
<th>Less than Median</th>
<th>Greater than Median</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost</strong></td>
<td>3.3% over budget</td>
<td>6.5% below budget</td>
</tr>
<tr>
<td></td>
<td>(N=30)</td>
<td>(N=34)</td>
</tr>
<tr>
<td><strong>Schedule</strong></td>
<td>24.5% behind schedule</td>
<td>8.4% behind schedule</td>
</tr>
<tr>
<td></td>
<td>(N=33)</td>
<td>(N=35)</td>
</tr>
<tr>
<td><strong>Change orders</strong></td>
<td>8.2% of budget</td>
<td>7.6% of budget</td>
</tr>
<tr>
<td></td>
<td>(N=26)</td>
<td>(N=27)</td>
</tr>
</tbody>
</table>

Med. = 7.81

*Alignment During Pre Project Planning*
Elements of Alignment

- Business Planning
- Pre-Project Planning
- Project Execution
- Facility Operation

Top-to-Bottom Alignment
- Executive
- Business
- Project
- Functional

Project Life Cycle Alignment

Cross-Organizational Alignment
Alignment During Pre Project Planning

Pre-Project Planning (PPP) Alignment Thermometer
(Five Steps to Greater Success)

Step 1. Circle the number in the column that best shows your “Level of Agreement” with each of the following statements: Legend: 1 = Strongly Disagree 5 = Strongly Agree

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>LEVEL OF AGREEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 SCORE</td>
</tr>
<tr>
<td>ALIGNMENT ISSUES</td>
<td></td>
</tr>
<tr>
<td>1. Stakeholders are appropriately represented on the Project Team.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>2. Project leadership is defined, effective, and accountable.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>3. The priority between cost, schedule and required project features is clear.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>4. Communication within the team and with stakeholders is open and effective.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>5. Team meetings are timely and productive.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>6. Our team culture fosters trust, honesty, and shared values.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>7. The PPP process includes sufficient funding, schedule and scope to meet our objectives.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>8. Reward and recognition systems promote meeting project objectives.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>9. Teamwork and team building programs are effective.</td>
<td>0 3 5 8 10</td>
</tr>
<tr>
<td>10. Planning tools (e.g., checklists, simulations and work flow diagrams) are effectively used.</td>
<td>0 3 5 8 10</td>
</tr>
</tbody>
</table>

TOTAL SCORE

Step 2. Place the circled number in the Score column. Add the column to obtain your total score.

For more information contact:
Construction Industry Institute (CII)
3925 West Braker Lane
Austin, Texas 78759-5316
(512) 232-3000; Fax (512) 499-8101

References/Additional Resources:
• Pre-Project Planning Handbook, SP39-2
• PDRI, IR113-2
• Alignment Handbook, IR113-3
• Setting Project Objectives, Pub. 12-1

Step 3. Plot your team’s answers in the appropriate column and calculate the Average, Range (high score – low score) and Range ÷ Average.

<table>
<thead>
<tr>
<th>TEAM SCORE</th>
<th>Respondent</th>
<th>Issue</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Calculated Average</th>
<th>Calculated Range</th>
<th>Range/ Average</th>
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</thead>
<tbody>
<tr>
<td>Issue #</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TOTAL</td>
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</tr>
</tbody>
</table>

Step 4. Plot the Average and Range for each question and the Total on the Thermometer.

Step 5. All questions with results in the outer ring require discussion to either improve the situation or to determine why it is not an important issue for this project. A large Range ÷ Average likely indicates an issue for special concern.

Helpful Hints:
• Poll all appropriate stakeholders (including business and operations).
• Poll periodically and keep track of score (team meetings, monthly, quarterly).
• Identify issues for discussion and areas for remedial action.
• Use the results to facilitate/design team building activities.
• Modify questionnaire and substitute project specific issues as required.

Figure 4-2. Alignment Thermometer, page 2 of 2
Alignment of Project Objectives

<table>
<thead>
<tr>
<th>Project Team Member</th>
<th>Project Objectives</th>
<th>Safety</th>
<th>Operating Capacity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner's Project Management Priority Ranking</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Average
Average Difference

Agreement Index = \( \frac{\sum \text{Average Difference}}{\text{Number of Objectives}} \)

Agreement Index = \( \frac{\sum \text{Participant's Average Difference}}{\text{Number of Participants}} \)
CII Implementation Resources

- Education Modules
  - EM113-21

- Continuing Education
  - Course I

- Online Education
  - CT02

- Registered Education Providers
  - YES

- Community of Practice
  - Pending Interest
Definition of Pre-Project Planning

Pre-project planning is also known as:
- Front end loading
- Front end planning
- Feasibility analysis
- Conceptual planning
- Programming/schematic design
- Early project planning

- Defines functions involved in pre-project planning.
- Provides outline to develop specific steps and tools for the pre-project planning of capital projects.
Pre-Project Planning Process

- **Select Team**
- **Draft Charter**
- **Prepare Pre-Project Planning Plan**

**Organize for Pre-Project Planning**

- **Select Project Alternative(s)**
- **Analyze Technology**
- **Evaluate Site(s)**
- **Prepare Conceptual Scopes and Estimates**
- **Evaluate Alternatives**

**Select Project Alternative(s)**

- **Analyze Project Risks**
- **Document Project Scope and Design**
- **Define Project Execution Approach**
- **Establish Project Control Guidelines**
- **Compile Project Definition Package**

**Develop A Project Definition Package**

- **Make Decision**
- **Authorizations Package**
- **Project Definition Package**
- **Decision**
Front End Planning

Front-End Planning Process, IR213-3

• HTML product only available by download
• Latest tools in sequence
• Prompts timely use of tools
• Includes electronic files of templates, checklists, and other tools
Front End Planning

Front-End Planning Process, IR213-2

• HTML product; download only
• Latest tools in sequence
• Prompts timely use of tools
• Files of templates, checklists, other tools
• Includes:
  – IR113-2, *Project Definition Rating Index (PDRI) – Industrial Projects*
  – IR155-2, *PDRI – Buildings Projects*
  – IR113-3, *Alignment During Pre-Project Planning*
  – RS213-1 *Front End Planning: Break the Rules, Pay the Price*
## Front End Planning Process

<table>
<thead>
<tr>
<th>Phase</th>
<th>Initiate Phase</th>
<th>Design and Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility</td>
<td>Generate Options</td>
<td>Feasibility Report</td>
</tr>
<tr>
<td>Concept</td>
<td>Analyze Alternatives</td>
<td>Conceptual Scope and Estimates</td>
</tr>
<tr>
<td></td>
<td>Conceptual Scope and Estimates</td>
<td>Preliminary Design/Eng.</td>
</tr>
<tr>
<td></td>
<td>Evaluate and Select Best Alternatives</td>
<td>Preliminary Des./Eng. Reviews</td>
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<td></td>
<td>Concept Phase Report</td>
<td>PDRI 2i</td>
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<tr>
<td></td>
<td>PDRI 2</td>
<td>Finalize Scope Definition</td>
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<tr>
<td></td>
<td></td>
<td>Cost &amp; Schedule Control Estimates</td>
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<tr>
<td></td>
<td></td>
<td>PDRI 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Project Definition Package</td>
</tr>
</tbody>
</table>

- **Incorporates PDRI checkpoints with target scores**
- **Recognizes role of design in support of the process**
Planning Tools

• PDRI: Project Definition Rating Index, Industrial Projects, Third Edition, IR113-2

• Comprehensive checklist with 70 scope definition elements.

• Identifies level of scope definition, areas for improvement on industrial projects.

Min score 70
Min recommended score 200
Max score 1000
## Appendix B:
Weighted Project Score Sheet

### SECTION I - BASIS OF PROJECT DECISION

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Definition Level</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. MANUFACTURING OBJECTIVES CRITERIA (Maximum Score = 45)</td>
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<tr>
<td>A1. Reliability Philosophy</td>
<td>0 1 2 3 4 5</td>
<td>0 1 5 9 14 20</td>
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<td>A2. Maintenance Philosophy</td>
<td>0 1 2 3 4 5</td>
<td>0 1 3 5 7 9</td>
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<td>A3. Operating Philosophy</td>
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<td>0 1 4 7 12 16</td>
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<td>CATEGORY A TOTAL</td>
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<td></td>
</tr>
<tr>
<td>B. BUSINESS OBJECTIVES (Maximum Score = 213)</td>
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<td></td>
</tr>
<tr>
<td>B1. Products</td>
<td>0 1 2 3 4 5</td>
<td>0 1 11 22 33 50</td>
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<tr>
<td>B2. Market Strategy</td>
<td>0 1 2 3 4 5</td>
<td>0 2 5 10 15 20</td>
</tr>
<tr>
<td>B3. Project Strategy</td>
<td>0 1 2 3 4 5</td>
<td>0 1 5 10 15 20</td>
</tr>
<tr>
<td>B4. Affordability/Feasibility</td>
<td>0 1 2 3 4 5</td>
<td>0 1 4 7 12 16</td>
</tr>
<tr>
<td>B5. Capacities</td>
<td>0 1 2 3 4 5</td>
<td>0 1 4 7 12 16</td>
</tr>
<tr>
<td>B6. Future Expansion Considerations</td>
<td>0 1 2 3 4 5</td>
<td>0 1 4 7 12 16</td>
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<tr>
<td>B7. Expected Project Life Cycle</td>
<td>0 1 2 3 4 5</td>
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<td>B8. Social Issues</td>
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<tr>
<td>C. BASIC DATA RESEARCH (Maximum Score = 94)</td>
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<td>0 1 2 3 4 5</td>
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<tr>
<td>D. PHYSICAL SPECIFICATION (Maximum Score = 120)</td>
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<td>D1. Statement</td>
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<td>D2. Criteria</td>
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<td>D3. Characteristics Available vs. Req'd</td>
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<td>0 2 5 8 12 15 20</td>
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<td>D4. Planning and Demolition Req'mnts</td>
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<td>D5. Lead/Discipline Scope of Work</td>
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<td>D6. Project Schedule</td>
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<td>E. VALUE ENGINEERING (Maximum Score = 27)</td>
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<td>E2. Design &amp; Material Alts. Considered/Rejected</td>
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<td>0 1 2 4 6 8</td>
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<tr>
<td>E3. Design For Constructability Analysis</td>
<td>0 1 2 3 4 5</td>
<td>0 1 2 4 6 8</td>
</tr>
<tr>
<td>CATEGORY E TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION I TOTAL

#### Definition Levels
- 0 = Not Applicable
- 1 = Complete Definition
- 2 = Minor Deficiencies
- 3 = Some Deficiencies
- 4 = Major Deficiencies
- 5 = Incomplete or Poor Definition
Planning Tools


• Comprehensive checklist with 64 scope definition elements.

• Identifies level of scope definition, areas for improvement on building projects.

Min score 71
Min recommended score 200
Max score 1000
IR 113-2 PDRI- Industrial

SECTION I
A. Manufacturing Objectives Criteria
B. Business Objectives
C. Basic Data Research & Development
D. Project Scope
E. Value Engineering

SECTION II
F. Site Information
G. Process/ Mechanical
H. Equipment Scope
I. Civil, Structural & Architectural
J. Infrastructure
K. Instrument & Electrical

SECTION III
L. Procurement Strategy
M. Deliverables
N. Project Control
P. Project Execution Plan

IR 155-2 PDRI- Buildings

SECTION I
A. Business Strategy
B. Owner Philosophies
C. Project Requirements

SECTION II
D. Site Information
E. Building Programming
F. Building/Project Design Parameters
G. Equipment

SECTION III
H. Procurement Strategy
J. Deliverables
K. Project Control
L. Project Execution Plan

Somewhat similar but sub items address different issues!
Recent CII Pre-Project Planning Benefit Data from Research Team 213

- Sample of 609 projects, $37 billion
- Results of good front end planning:
  - Cost: 10 percent less
  - Schedule: 7 percent shorter delivery
  - Changes: 5 percent fewer
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction

- Design/Information Technology
- Pre-Project Planning
- Project Change Management
- Zero Accident Techniques
- Team Building
- Planning for Startup
- Materials Management
- Constructability

Cost Savings

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries

Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Schedule Reduction

High Impact
- Materials Management
- Constructability
- Project Change Management

Medium Impact
- Team Building
- Pre-Project Planning
- Planning for Startup
- Design/Information Technology

Low Impact
- Zero Accident Techniques

Low Impact

Cost Savings

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
CII Implementation Resources

- Education Modules
  - EM39-21

- Continuing Education
  - Course I

- Online Education
  - CT09-CT13

- Registered Education Providers
  - YES

- Community of Practice
  - Pending Interest
Disputes Prevention & Resolution

1. Use of Disputes Review Board

2. Process for addressing disputes in early stages to avoid litigation.

Initial Application

Engineering

Conceptual & Pre Proj. Planning | Basic | Detail

Procurement

Construction

Startup & Commissioning

Operations
Disputes Prevention & Resolution

Disputes Potential Index, SP23-3

• Predicts potential for construction project contract disputes and claims. Based on correlation between certain project factors and occurrence of disputes: Disputes Potential Index (DPI).

• DPI tool produces overall score predicting likelihood of disputes on a given project.

• DPI tool assesses eight areas associated with disputes.

• Describes the use of Disputes Review Boards.
Benefits of Disputes Prevention & Resolution

• Eliminates adversarial positions.
• Promotes trust between participants.
• Helps eliminate disputes.
• Resolves disputes on the project.
• Enhances the progress of the work.
• May result in repeat business.
Dispute Resolution Process

Contractor objects to any decision, action, or order of owner.

Owner considers objection and gives decision.

Either owner or contractor may give written notice and submit any disagreement, claim, or controversy to board.

Decision is final unless either party submits dispute to board.

Decision is submitted to board and hearing is scheduled.

Hearings are held. Board makes written recommendation to parties.

Parties receive board recommendation and respond in writing.

Matter resolved

Accept recommendation

Accept recommendation

Matter resolved

Parties resort to other methods of settlement.

Reject recommendation

Appeal recommendation
<table>
<thead>
<tr>
<th>CII Implementation Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education Modules</strong></td>
</tr>
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<td><strong>Online Education</strong></td>
</tr>
<tr>
<td><strong>Registered Education Providers</strong></td>
</tr>
<tr>
<td><strong>Community of Practice</strong></td>
</tr>
</tbody>
</table>
Team Building

- Project-focused process with team:
  - Shared goals & interdependence,
  - Trust, commitment, accountability,
  - Collaborative problem-solving skills.
Team Building

- Communications Project Assessment Tool (Compass), User’s Guide-IR105-2

- Team Building: Improving Project Performance RS37-1

- Building the Project Team – Participant Handbook EM37-21A
Benefits of Team Building:

- Reducing adversarial relationships, developing trust and team spirit.
- Improving cooperation, cohesiveness, and problem-solving skills.
- Providing alignment of goals and expectations.
- Identifying problems early.
- Shortening schedule.
- Lowering cost.
- Improving safety record.
- Reducing and managing changes.
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction
- Design/Information Technology
- Pre-Project Planning
- Project Change Management
- Zero Accident Techniques
- Planning for Startup
- Team Building
- Constructability
- Materials Management

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries

Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Schedule Reduction

High Impact
- Materials Management
- Constructability

Medium Impact
- Team Building
- Pre-Project Planning
- Design/Information Technology

Low Impact
- Planning for Startup
- Project Change Management
- Zero Accident Techniques

Cost Savings

Low Impact
- Medium Impact
- High Impact

Cost Savings per unit increase of each practice use

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report
Elements of Team Building:

- Culture
  - Leadership
  - Communication
  - Trust and Honesty

- Execution Processes
  - Stakeholders
  - PPP Process
  - Reward and Recog.

- Information
  - Priority between cost, schedule, and features

- Tools
  - Team Meetings
  - Teamwork and Team Building
  - Planning Tools
CII Implementation Resources

- Education Modules
  - EM37-21

- Continuing Education
  - Course I

- Online Education
  - Planned

- Registered Education Providers
  - YES

- Community of Practice
  - Pending Interest
• Questions?
CII Best Practices

Project Planning Phase
- Partnering
- Alignment of Project Objectives
- Pre-Project Planning
- Disputes Resolution
- Team Building

Design Phase
- Change Management & Scope Control
- Constructability
- Materials Management

Construction/Startup Phase
- Planning for Start-Up
- Zero Accidents Techniques

Project Life Cycle
- Benchmarking
- Implementation of CII Research
- Lessons Learned
- Quality Management
Definition of Change Management

The process of incorporating a balanced culture of recognizing, planning & evaluating project changes

Initial Application

Engineering

Conceptual & Pre Proj. Planning | Basic | Detail
---|---|---

Procurement

Construction

Startup & Commissioning

Operations
Change Management

Project Change Management, SP43-1

• Provides

  1. Comprehensive view of agreements & changes.
  2. Recommends practices for effective change management.
  3. Prototype change management system.
Benefits of Change Management

- Increases project safety.
- Reduces cost and schedule.
- Improves job quality.
- Enhances team inter-phase relationships.
- Enables anticipation of project changes and effective corrective actions.
- Provides data for planning future projects.
- Minimizes the number of changes in future projects.
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction
- Design/Information Technology
- Pre-Project Planning
- Planning for Startup
- Team Building
- Constructability
- Zero Accident Techniques
- Materials Management
- Project Change Management

Cost Savings

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries
Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Schedule Reduction

High Impact
- Materials Management
- Constructability
- Project Change Management

Medium Impact
- Team Building
- Pre-Project Planning
- Design/Information Technology

Low Impact
- Planning for Startup
- Zero Accident Techniques

Cost Savings

from BMM2003-4,
Benchmarking and Metrics
Value of Best Practices Report

Cost Savings per unit increase of each practice use
The Change Management Process:

- **Promote a Balanced Change Culture**
  - Encourage beneficial change
  - Discourage detrimental change

- **Recognize Change**
  - Education
  - Communication
  - Documentation
  - Trending

- **Evaluate Change**
  - Elective
  - Required
  - Decide quickly

- **Implement Change**
  - Authorization
  - Documentation
  - Tracking

- **Continuously Improve**
  - Share lessons learned
  - Be prepared to improve
CII Implementation Resources

- Education Modules
  EM113-21

- Continuing Education
  Course I

- Online Education
  CT08

- Registered Education Providers
  YES

- Community of Practice
  Pending Interest
**Definition of Constructability**

The *optimum use of construction knowledge and experience* in planning, design, procurement, and field operations in order to achieve project objectives.
Constructability


• Details milestones required to implement constructability.

• Includes case studies on four real-world projects.
Benefits of Constructability

• Avg. 4.3% reduction in project costs.
• Avg. 7.5% reduction in project schedule.

• Potential to improve:
  • Security, safety, & environmental impact.
  • Project quality.
  • Operability, functionality, and reliability.
  • Project team relationships.
  • Rework and rescheduling on the project.
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction
- Zero Accident Techniques
- Pre-Project Planning
- Design/Information Technology
- Project Change Management
- Team Building
- Planning for Startup
- Constructability
- Materials Management

Cost Savings

from BMM2003-4,
Benchmarking and Metrics
Value of Best Practices Report

Cost Savings per unit increase of each practice use
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries
Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Schedule Reduction
- High Impact
  - Materials Management
- Medium Impact
  - Team Building
  - Pre-Project Planning
  - Design/Information Technology
- Low Impact
  - Planning for Startup
  - Constructability
  - Project Change Management
  - Zero Accident Techniques

Cost Savings
- Low Impact
- Medium Impact
- High Impact

from BMM2003-4,
Benchmarking and Metrics
Value of Best Practices Report

Cost Savings per unit increase of each practice use
The Constructability Process:

1. Understand constructability objectives, methods, concepts, and barriers
2. Perform self-assessment and identify barriers
3. Assess and recognize constructability benefits
4. Develop implementation policy
5. Identify constructability sponsor/champion
6. Establish functional support organization and procedures
7. Develop lessons-learned file
8. Assemble key owner team members
9. Define constructability objectives and measures
10. Select project contracting strategy
11. Secure contractors, vendors, and consultants
12. Develop constructability team
13. Identify and address project barriers
14. Consult applications matrix and lessons-learned file
15. Develop constructability procedures and integrate into project activities
16. Apply constructability concepts and procedures
17. Monitor and evaluate project program effectiveness
18. Document lessons learned
19. Evaluate corporate program effectiveness
20. Modify organization and procedures; update lessons-learned databases

Commit to implementing constructability → Establish corporate constructability program → Obtain constructability capabilities → Plan constructability implementation → Implement constructability → Update corporate program
CII Implementation Resources

- Education Modules: EM-11
- Continuing Education: Course I
- Online Education: CT03-CT06
- Registered Education Providers: YES
- Community of Practice: Pending Interest
Definition of Materials Management

Integrated process for planning & controlling all necessary efforts to

- Specify
- Procure
- Deliver materials & equipment to the job site.
Materials Management


• Guides modern materials management.
• Discusses all aspects of the materials management process.
• Glossary of over 300 terms & post-project evaluation questionnaire.

New research under way - new publications due in 2009!
# Benefits of Materials Management

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Average % Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced bulk supplies</td>
<td>40</td>
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<tr>
<td>Improved supplier performance</td>
<td>24</td>
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<tr>
<td>Cash flow savings</td>
<td>23</td>
</tr>
<tr>
<td>Reduced site storage and handling</td>
<td>21</td>
</tr>
<tr>
<td>Improved craft labor productivity</td>
<td>16</td>
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<tr>
<td>Improved project schedule</td>
<td>16</td>
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<tr>
<td>Reduced management personnel</td>
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<tr>
<td>Reduced risk</td>
<td>5</td>
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</tbody>
</table>
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Design/Information Technology
Pre-Project Planning
Project Change Management

Zero Accident Techniques
Team Building
Planning for Startup

Schedule Reduction

Cost Savings

Low Impact
Medium Impact
High Impact

Constructability
Materials Management

from BMM2003-4, *Benchmarking and Metrics Value of Best Practices Report*
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries

Average Project Cost: $81MM
Average Project Duration: 92 Weeks

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
CII Implementation Resources

- Education Modules
- Continuing Education
- Online Education
- Registered Education Providers
- Community of Practice

EM7-21
Course II
Future Course
YES
Pending Interest
CII Best Practices

**Project Planning Phase**
- Partnering
- Alignment of Project Objectives
- Pre-Project Planning
- Disputes Resolution
- Team Building

**Design Phase**
- Change Management & Scope Control
- Constructability
- Materials Management

**Construction/Startup Phase**
- Planning for Start-Up
- Zero Accidents Techniques

**Project Life Cycle**
- Benchmarking
- Implementation of CII Research
- Lessons Learned
- Quality Management
Planning for Startup

• Planning for the transitional phase between plant construction completion & commercial operations, including:
  – Systems turnover.
  – Check-out of systems.
  – Commissioning of systems.
  – Introduction of feedstocks.
  – Performance testing.
Planning for Startup

Planning for Startup, IR121-2.

• Contains Toolkit with 26 tools to help plan successful startup.

• Details 45 activities that should be noted as part of planning for startup over eight typical phases of a project.

• Includes Startup Planning Model.
Benefits of Planning for Startup

• Provides common objectives & plan for:
  – System turnover, checkout, commissioning & filling.
  – Performance testing.
  – Business unit & plant operations.
  – Owner project management.

• Involves key front-end stakeholders before design is fixed.
  – Project Management, Engineering, Construction
  – Plus Startup Manager, Plant Operations & Maintenance.

• Increased focus on:
  – Cost elements of startup.
  – Estimate accuracy.
  – Meeting commercial operations date.

• Timely & thorough identification of problems & issues during planning phase…before startup activities.
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction
- Design/Information Technology
- Zero Accident Techniques
- Pre-Project Planning
- Project Change Management
- Team Building
- Planning for Starting
- Constructability
- Materials Management

Cost Savings

Cost Savings per unit increase of each practice use

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries

Schedule Reduction

Materials Management
Pre-Project Planning
Design/Information Technology
Zero Accident Techniques

Constructability
Team Building
Project Change Management

Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Cost Savings

Planning for Startup
Low Impact

Medium Impact
Low Impact

High Impact

Low Impact

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
## SuPERTOOL 1-A-2

### Tool 1-A-2: The SuPERTOOL: Startup Planning Evaluation Rating vers. 3.0 (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Act. No.</th>
<th>Planning Activity</th>
<th>No Execution</th>
<th>Minimal Effort</th>
<th>With Deficiencies</th>
<th>With Minor Deficiencies</th>
<th>Thoroughly Executed</th>
<th>Score</th>
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<tbody>
<tr>
<td>1-A</td>
<td>Ensure senior management commitment to SU planning</td>
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<td>3</td>
<td>4</td>
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<td>2-B</td>
<td>Estimate startup costs</td>
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<td>1</td>
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<td>1</td>
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<tr>
<td>2-C</td>
<td>Recognize the impact of startup on project economics</td>
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<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td>2</td>
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<td>3</td>
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<td>2</td>
<td>3</td>
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<td>4</td>
<td>5</td>
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<td>Acquire Operations &amp; Maintenance input</td>
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<td>1</td>
<td>1</td>
<td>3</td>
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<td>Assess startup risks</td>
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<td>Analyze startup incentives</td>
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<td>0</td>
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<td>3-H</td>
<td>Identify startup procurement requirements</td>
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<td>1</td>
<td>2</td>
<td>2</td>
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<td>Refine/update the startup budget &amp; schedule</td>
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<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>Update the Startup Execution Plan</td>
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<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<th>21</th>
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<td>GRAND TOTAL:</td>
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<td></td>
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<td></td>
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</table>
SuPER TOOL 1-A-2

Thorough Planning

SuPER Score

No Planning

WORK IN THIS ZONE

AVOID THIS ZONE

Project Phases

0 10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

Definition, Concept & Feasibility
Front-End Engineering
Detailed Design
Construction
Checkout, Commissioning & Initial Operations
CII Implementation Resources

• Education Modules
  EM121-21

• Continuing Education
  Course I

• Online Education
  CT13-CT14

• Registered Education Providers
  YES

• Community of Practice
  Pending Interest
Definition of Zero Accident Techniques

Techniques that promote a culture that believes that

- all accidents are preventable
- establishes zero accidents as the only acceptable goal.

Initial Application

Engineering

Conceptual & Pre Proj. Planning  Basic  Detail

Procurement

Construction

Startup & Commissioning

Operations
Zero Accidents Techniques

- EM-160 Making Zero Accidents A Reality
- SP32-2 Zero Injury Economics
- RS216-1 Targeted Safety Programs
- RS190-1 The Owners’ Role in Construction Safety
- RS160-1 Safety Plus: Making Zero Accidents A Reality
- RS160a-1 Making Zero Accidents A Reality: Focus on Shutdowns, Turnarounds, and Outages
- RS32-1 Zero Injury Techniques
- RS13-1 Managing Subcontractor Safety
- Video DVD-1 One Too Many
Figure 1-1 Owner Benefit of Practice Use

Respondent Type: Owners
Industry Group: All Industries

Average Project Cost: $62MM
Average Project Duration: 114 Weeks

Schedule Reduction
- Zero Accident Techniques
- Pre-Project Planning
- Project Change Management
- Design/Information Technology
- Team Building
- Planning for Startup
- Constructability
- Materials Management

Low Impact
Medium Impact
High Impact

Low Impact
Medium Impact
High Impact

Cost Savings

from BMM2003-4,
Benchmarking and Metrics
Value of Best Practices Report

Cost Savings per unit increase of each practice use
Figure 1-2 Contractor Benefit of Practice Use

Respondent Type: Contractors
Industry Group: All Industries

Average Project Cost: $81MM
Average Project Duration: 92 Weeks

Schedule Reduction

High Impact
- Materials Management

Medium Impact
- Team Building
- Project Change Management
- Pre-Project Planning
- Design/Information Technology
- Planning for Startup

Low Impact
- Zero Accident Techniques

Cost Savings

from BMM2003-4, Benchmarking and Metrics Value of Best Practices Report

Cost Savings per unit increase of each practice use
TRIR (1989-2007)

*OSHA Construction Division, NAICS 236-238, SIC 15-17

Reflects OSHA Reporting Change
DART (1989-2007)

Year and Work Hours (MM)

*OSHA Construction Division, NAICS 236-238, SIC 15-17

Reflects OSHA Reporting Change
Elements of Zero Accident Techniques

Techniques address:

- Owner’s influence
- Management actions
- Design considerations
- Written programs
- Training
- Role of safety professionals
- Award program effectiveness
- Safety meetings
- Inspections and audits
- Other related issues
CII Implementation Resources

- Education Modules
  EM160-21

- Continuing Education
  Course II

- Online Education
  CT07

- Registered Education Providers
  YES

- Community of Practice
  YES

- Web Seminars
  WS11-01 & 02
• Questions?
CII Best Practices

**Project Planning Phase**
- Partnering
- Alignment of Project Objectives
- Pre-Project Planning
- Disputes Resolution
- Team Building

**Design Phase**
- Change Management & Scope Control
- Constructability
- Materials Management

**Construction/Startup Phase**
- Planning for Start-Up
- Zero Accidents Techniques

**Project Life Cycle**
- Benchmarking
- Implementation of CII Research
- Lessons Learned
- Quality Management
Definition of Benchmarking and Metrics

The systematic process of measuring performance against recognized leaders to determine best practices that lead to superior performance.

Initial Application

Engineering

<table>
<thead>
<tr>
<th>Conceptual &amp; Pre Proj. Planning</th>
<th>Basic</th>
<th>Detail</th>
</tr>
</thead>
</table>

Procurement

Construction

Startup & Commissioning

Operations
Benchmarking

Benchmarking Implementation Toolkit, IR BMM-2

- Introduces the CII Benchmarking & Metrics Program
- “What you measure you improve”
Benefits of CII Benchmarking and Metrics

- Highlights strengths and weakness.
- Allows focus on improvement where needed without wasting scarce resources.
- Avoids making mistakes in project implementation.
- Organizational level benchmarking yields positive bottom line.
- Collaboration among competitors/owners/contractors.
- Provides understanding & focus on most effective practices for greater bottom-line impacts.
The CII Benchmarking Process

Company Leadership
- Decide/Commit to Benchmark as Basis for Improvement
- Commit to Benchmarking and Improvement
- Select Projects for Analysis and Preload/Initiate Project in CII Database

Project Managers
- Initiate Questionnaire During Project Execution
- Review and Act on Interim CII Online Recommendations
- Complete and Submit Questionnaire at Project Close-out

Company Benchmarking Associate
- Commit to Benchmarking Coordination and Attend CII Training
- Validate Questionnaires
- Release Questionnaires to CII

CII Staff, Account Managers, and Committee
- Develop/Improve Metrics, Processes, Policies, and Procedures
- Develop Data Collection & Reporting Tools
- Conduct Training and Feedback Sessions
- Perform Validation Checks, Run Analysis, and Generate Reports
- Provide Input to Research and Implementation

Perform Self-Analysis and Develop Improvement Plan
Owner Performance Improves

Owners Report Improved Project Costs
All Industries Global Data

Owners Report Improved Project Schedules
All Industries Global Data

Owners Report Improved Project Safety
All Industries Global Data

Safety Performance – TRIR

* OSHA Construction Division, SIC 15-17
** Reflects OSHA Reporting Change
Contractor Performance Improves

### Improved Project Cost Performance Reported by Contractors
All Industries Global Data

- **Project Budget Factor**
  - Actual Total Project Cost / Initial Predicted Project Cost

- **Practice Use Index**
  - Increased Use of Best Practices
  - Performance Gap
  - Potential Cost Savings
  - Average project cost savings

#### Improved Project Schedules Reported by Contractors
All Industries Global Data

- **Project Schedule Factor**
  - Actual Total Project Duration / Initial Predicted Project Duration

- **Practice Use Index**
  - Increased Use of Best Practices
  - Performance Gap
  - Potential Schedule Pre-schedule
  - Average project duration

### Improved Project Safety Reported by Contractors
All Industries Global Data

- **Recordable Incidence Rate (IR)**
  - Total Number of Recordable Cases / 200,300 Total Site Work Hours

- **Zero Accident Techniques Practice Use**
  - Increased Use of Zero Accident Techniques
  - Potential Performance Improvement

#### Safety Performance – TRIR

- **Total Recordable Incidence Rate**
  - Year and Work Hours (MMH)

* OSHA Construction Division, SIC 15-17
<table>
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<th>Industry</th>
<th>CII</th>
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Reflects OSHA Reporting Change
Performance

- Change Performance
- Construction Productivity
- Cost Performance
- Engineering Productivity
- Rework Performance
- Safety Performance
- Schedule Performance

Practice Use

- Alignment During Front End Planning
- Automation/Integration Tech
- Benchmarking & Metrics
- Change Management
- Constructability
- Dispute Resolution
- Front End Planning
- Partnering
- Planning for Startup
- Project Delivery & Contract Strategy
- Project Risk Assessment
- Quality Management
- Team Building
- Zero Accident Techniques
Metrics - Small Projects

Performance
• Change Performance
• Construction Productivity
• Cost Performance
• Engineering Productivity
• Safety Performance
• Schedule Performance

Practice Use
• Automation/Integration Tech
• Construction
• Controls
• Design
• Front End Planning
• Organization
• Processes
• Procurement
• Safety, Health & Environment
• Start-Up Planning & Commissioning
1,646 projects
Worth > $76 Billion
Large & Small Projects Combined
CII Implementation Resources

Benchmarking Metrics Committee

Dr. Stephen Mulva
Associate Director
stephen.mulva@mail.utexas.edu

Dr. Jason Dai
Research Engineer
jiukun.dai@engr.utexas.edu

Hong Zhao
Systems Analyst
hong.zhao@engr.utexas.edu

Benchmarking Conferences & Workshops

- Essential for implementation of reliable benchmarking process.
- Updates improvements in the online system
- Explains new metrics & interactive reports
- Delivers annual training needed to stay in tune with improvements
- Ensures greatest benefit from this valuable CII resource.

Contact Frances DeCoux at (512) 232-3000 or f.decoux@mail.utexas.edu
Definition of Implementation of CII Research

Comprehensive and effective use of CII research findings.

Initial Application

Engineering

Conceptual & Pre Proj. Planning | Basic | Detail
---|---|---
Procurement
Construction
Startup & Commissioning
Operations
Implementation of CII Research

Implementation Model + Knowledge Structure Guide, IR 166-2

CII Best Practices Guide, 2\textsuperscript{nd} Edition, IR 166-3

Implementation Planning Model: Steps to Success, IR246-2
IR 166-2
Implementation Model + Knowledge Structure Guide

• Provides a “Jump Start Kit.”

• Use CII Implementation Model to drive your implementation program.

• Use the CII Knowledge Structure to identify CII Best Practices to adapt within your organization.
IR 166-2 The Implementation Model

Celebrate Success
Measure Results
Product Implementation
Products Training
Product Champions/Review Boards
Implementation Plan and Goals
Self Audit
Corporate Implementation Champion
Corporate Commitment

CII Products
CII Support
Benefit/Cost Data
IR 166-3
CII Best Practices Guide

- All 14 Practices Described.

- Assesses Implementation Level of a Best Practice.

- Benefits of Using Each Best Practice.

- List of CII References for Each Best Practice.
IR246-2
Implementation Planning Model: Steps to Success

- Focuses on the development of an implementation plan.
- This research effort builds upon the Implementation Pyramid in IR166-2.
- Primarily focuses on expansion of the fourth level of the pyramid: “Implementation Plan and Goals.”
- The Staircase Implementation Model introduces phased steps to implementation for successful implementation.
- Recommended by the CII Implementation Strategy Committee
IR246-2...10 Stages to Success

Needs Analysis

Management Buy-in

Establish Steps (Chapter 3)

Adapt Matrix (Chapter 3)

Diagram Rings:
1 – No Implementation
2 – Implementation Plan
3 – Start Implementation
4 – Partial Implementation
5 – Near Implementation
6 – Full Implementation

Perform Change Audit (Chapter 5)

Communicate Plan (Chapter 4)

Develop Plan (Chapter 4)

Perform Step Evaluations (Chapter 6)

Implement Tasks/Plan (Chapter 4)

Communicate Plan

Benchmark

Needs Analysis

Management Buy-in

Establish Steps (Chapter 3)

Adapt Matrix (Chapter 3)

Diagram Rings:
1 – No Implementation
2 – Implementation Plan
3 – Start Implementation
4 – Partial Implementation
5 – Near Implementation
6 – Full Implementation

Perform Change Audit (Chapter 5)

Communicate Plan (Chapter 4)

Develop Plan (Chapter 4)

Perform Step Evaluations (Chapter 6)

Implement Tasks/Plan (Chapter 4)

Communicate Plan

Benchmark
Benefits of Implementing CII Research

• Improves performance in
  – Safety.
  – Quality.
  – Schedule.
  – Budget/cost.
  – Other targeted goals.

• Improved work processes & enhanced owner/contractor communications.

• Increased operational efficiency & competitive position.

• Enhanced professional development.
Owner Performance Improves

Owners Report Improved Project Costs
All Industries Global Data

Owners Report Improved Project Safety
All Industries Global Data

Owners Report Improved Project Schedules
All Industries Global Data

Safety Performance – TRIR

1 OSHA Construction Division, BIC 15-17

Owners Reflects OSHA Reporting Change
Contractor Performance Improves

**Improved Project Cost Performance Reported by Contractors**

- **All Industries Global Data**

**Improved Project Schedules Reported by Contractors**

- **All Industries Global Data**

**Improved Project Safety Reported by Contractors**

- **All Industries Global Data**

**Safety Performance – TRIR**

- **All Industries Global Data**

- *OSHA Construction Division, SIC 15-17*

- *Note: Reflects OSHA Reporting Change*
## CII Implementation Resources

- **Education Modules**
  - Pending Interest

- **Continuing Education**
  - Pending Interest

- **Online Education**
  - Pending Interest

- **Registered Education Providers**
  - Yes

- **Community of Practice**
  - ISC, Implementation Champions Program & Workshops
Lessons Learned

“Knowledge gained from experience, successful or otherwise, for the purpose of improving future performance.”
Lessons Learned

Implementation of Lessons Learned Programs Proactive Management Process, IR230-2

• Maturity Model Matrix and Self-Assessment Questionnaire
• Jump Start Guide- recommended steps for program development
• Sample Transactional Work Flow Diagram- roadmap for typical lessons learned transactions.
• Together- framework for integrating lessons learned program into work processes.
Lessons Learned Program Benefits

• Study of over >100 surveys involving >70 organizations
  – 62% of companies reported somewhat effective Lessons Learned Programs (LLP)
  – 8% reported very effective
  – 20% neutral
  – 10% not effective

• Quantifiable measures:
  – 15% base cost improvements for State Department Embassy Prototypes due to LLP
  – Varies safety improvements from 50% to 300%
  – Key Performance Indicator trends improving due to enhanced LLP

Source: CII Knowledge Management Committee Lessons Learned as CII Best Practice Validation Study, May 2008.
### Maturity Model Matrix

**Example: Leadership**

#### Level 1 – Limited upper management focus on LL Program. No stress on program importance.

<table>
<thead>
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<th>CHARACTERISTIC</th>
<th>LEVEL 1</th>
<th>LEVEL 2</th>
<th>LEVEL 3</th>
<th>LEVEL 4</th>
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</thead>
<tbody>
<tr>
<td>LEADERSHIP</td>
<td>Upper management has limited focus on the use of LL. Communities of practice do not stress the importance of using LL.</td>
<td>Upper management mentions the use of lessons learned. Some communities of practice advocate the use of LL, but others do not actively participate.</td>
<td>Upper management stresses the importance of LL and recognizes the need for a program. Most communities of practice advocate use of LL, but some do not participate.</td>
<td>Upper management strongly supports, promotes, and expects the use of the LLP. Communities of practice willingly participate and advocate the use of LLs and share management vision of the program.</td>
</tr>
</tbody>
</table>

#### Level 4 – Upper management strongly supports, promotes, expects use of the program. **Communities of practice willingly participate** and advocate use of program.
Self-Assessment Questionnaire
Example: Lesson Collection

II. LESSON COLLECTION

8. A well-defined work process for submitting or collecting LL exists within your organization.
   a) □ Strongly Disagree  b) □ Disagree   c) □ Agree     d) □ Strongly Agree

9. The work process for submitting/collecting LL is consistently followed within your organization.
   a) □ Strongly Disagree  b) □ Disagree   c) □ Agree     d) □ Strongly Agree

10. Your LL submission/collection process is effective.
    a) □ Strongly Disagree  b) □ Disagree   c) □ Agree     d) □ Strongly Agree
<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Action Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review and assess current status.</td>
<td>• Use of Maturity Model Matrix and/or Self-Assessment Questionnaire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assess organization vs. matrix.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Compile results.</td>
</tr>
<tr>
<td>2</td>
<td>Set out improvement initiative needed.</td>
<td>• Review each matrix category for current level of maturity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Determine levels of maturity needed to initiate an effective LLP.</td>
</tr>
<tr>
<td>3</td>
<td>Senior leadership involvement.</td>
<td>• Prepare results from Steps 1 and 2 in presentation format.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Review presentation with senior leadership.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Obtain their commitment to proceed in establishing LLP.</td>
</tr>
</tbody>
</table>
CII Implementation Resources

- Education Modules
- Continuing Education
- Online Education
- Registered Education Providers
- Community of Practice
Quality Management

All activities conducted to improve
- efficiency
- contract compliance
- cost effectiveness

Engineering

<table>
<thead>
<tr>
<th>Conceptual &amp; Pre Proj. Planning</th>
<th>Basic</th>
<th>Detail</th>
</tr>
</thead>
</table>

Procurement

Construction

Startup & Commissioning

Operations

This Practice Should Always Be In Effect
Quality Management

Implementing TQM in Engineering & Construction, SP31-1

• Shows senior management the potential benefits of TQM implementation.

• Assesses current TQM implementation efforts.

• Assists subs-suppliers in own TQM process.

• Addresses success factors:
  – TQM implementation roadmap
  – Critical role of management
  – TQM training
  – Results of implementing TQM

New research under way- new publications due in 2009!
Benefits of Quality Management

• Increase survivability- increasingly competitive world.

• Improve market share and profitability.

• Better serve the client needs.

• Improve facility quality and safety.

• Reduce project duration and costs.

• More fully utilize employee talent.

• Enhance ability to make informed cost/benefit decisions.
Elements of Quality Management

- Total Quality Management (TQM)- process by which quality management is accomplished.
- Requires senior management as the driving force.
- Senior management must be convinced of the benefits.
- Senior management must personally and persistently lead the building of quality values into the organization’s operations.
- A quality program should follow a recognized quality methodology and or a recognized international standard.
## The Quality Management Process:

<table>
<thead>
<tr>
<th>CEO</th>
<th>Senior Mgrs</th>
<th>Middle Mgrs</th>
<th>Work Force</th>
<th>Internal TQM Coord.</th>
<th>External Consultant</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Phase I: Exploration & Commitment

Phase II: Planning & Preparation

Phase III: Implementation

Phase IV: Sustaining
Elements of the Measurement Process Include:

- Identification of project variables.
- Why and when these variables should be measured.
- Examples of how to measure these variables.
- How the results can be utilized in making project decisions.
CII Implementation Resources

• Education Modules
  Pending Interest

• Continuing Education
  Pending Interest

• Online Education
  Pending Interest

• Registered Education Providers
  YES

• Community of Practice
  Pending Interest
CII Best Practices

**Project Planning Phase**
- Partnering
- Alignment of Project Objectives
- Pre-Project Planning
- Disputes Resolution
- Team Building

**Design Phase**
- Change Management & Scope Control
- Constructability
- Materials Management

**Construction/Startup Phase**
- Planning for Start-Up
- Zero Accidents Techniques

**Project Life Cycle**
- Benchmarking
- Implementation of CII Research
- Lessons Learned
- Quality Management
Value of Best Practices

Theoretical Relationship

Performance

Practice Use

4th Quartile 3rd Quartile 2nd Quartile 1st Quartile

Low

High

Better

-0.2 -0.1 0 0.1 0.2 0.3 0.4
CII Best Practices In Industry

• Washington Group included CII Best Practices as operational procedural base while restructuring out of bankruptcy into successful world class operation.

• Adopted by St. Louis Council of Construction Consumers as basis of annual awards.

• Cited in May 2003 GAO report to U.S. Senate verifying UN capital program budget.

• December 2008, CII tapped by President Obama’s transition team to provide multiplier for stimulus investment job growth.
Key CII Education & Participation Resources

• The **Professional Development Continuum**- path for construction project management professional development & resources aid.

• **CII Education Modules**- recast CII original research into adult-learning courses for instructor-led training.

• **Online Education courses**- based on CII Best Practices, use the Internet to deliver CII education.

• **CII Web Seminars**- live events delivered on various topics of interest via the Internet.

• **Continuing Education Courses**- present CII education modules in an interactive classroom environment at The University of Texas at Austin.

• The **CII Executive Leadership Program**- partnership between CII and The University of Texas’ McCombs School of Business to offer a world-class leadership program for senior executive candidates.
Session Objectives Check

• Reviewed
  – CII & ACCE
  – CII Practice/ Best Practice Concept
  – CII Best Practices, including
    • Benefits
    • Key Elements
    • Supporting Resources
• Questions?
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Thank you for your attention!