Disrupting Construction- Needs and Challenges in Emerging Countries

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Construction productivity 1950-2012
Real productivity (GDP value-add per employee) by industry in the US Indexed; 1950 = 1.0

SOURCE: Bureau of Economic Analysis (BEA), Hideyuki (2011)
WHY AUTOMATE?

December 8, 1980

March 29th 2014
Owens Bottle Making Machine - 1905

<table>
<thead>
<tr>
<th>Automated</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,280 bottles/day, 2 Man Crew</td>
<td>2,880 bottles/day by 6 men/boys</td>
</tr>
<tr>
<td>$0.10 /bottle</td>
<td>$1.80 /bottle</td>
</tr>
</tbody>
</table>

https://www.asme.org/about-asme/who-we-are/engineering-history/landmarks/86-owens-ar-bottle-machine

Ended child labor in bottle-making plants.

The automatic machine did more to eliminate child labor than they had been able to do through legislation -National Child Labor Committee of New York City 1913
Why Automate?

Increased Value For All Stakeholders

- Time
- Cost
- OH&S
- Social Responsibility
- Corporate Image & Innovation
- Sustainability
- Quality

AUTOMATION IN EMERGING ECONOMIES
COUNTRIES – LARGEST POPULATION

GLOBAL POPULATION DISTRIBUTION

62% 25% 13%

CHINA  INDIA

United States Indonesia Brazil Pakistan Nigeria Bangladesh Russia Japan

Rest
<table>
<thead>
<tr>
<th>POPULATION TRIANGLE SHAPE</th>
<th>GENERAL REQUIREMENT FOR AUTOMATION</th>
<th>REQUIREMENT FOR JOB CREATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>HIGH</td>
<td>High</td>
</tr>
<tr>
<td>Med</td>
<td>HIGH</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Lack of infrastructure – Serious constraint
Lack of Infrastructure - Development Problem

The most problematic factors for doing business

- Inadequate supply of infrastructure: 18.5%
- Corruption: 17.3%
- Inefficient government bureaucracy: 14.4%
- Restrictive labor regulations: 9.5%
- Access to financing: 6.5%
- Tax regulations: 6.0%
- Policy instability: 5.6%
- Inadequately educated workforce: 4.6%
- Inflation: 4.4%
- Tax rates: 3.5%
- Poor work ethic in national labor force: 2.8%
- Government instability/coups: 2.6%
- Crime and theft: 1.6%
- Poor public health: 1.4%
- Foreign currency regulations: 1.2%

Source: Global Competitiveness Report 2013 World Economic Forum

Roads
Ports

Airports
Real Estate

Power
Urban Population Growth

http://news.bbc.co.uk/2/shared/spl/hi/in_depth/china_modern/html/2.stm

URBAN METRO-RAIL CONSTRUCTION
**ONGOING METRO PROJECTS (11 Projects)**

<table>
<thead>
<tr>
<th>City</th>
<th>Estimated Value x10^7 (INR)</th>
<th>Total Length (km)</th>
<th>Year of Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mumbai</td>
<td>67618</td>
<td>161</td>
<td>2020-21</td>
</tr>
<tr>
<td>Chennai</td>
<td>56000</td>
<td>121</td>
<td>2023-24</td>
</tr>
<tr>
<td>Hyderabad</td>
<td>14132</td>
<td>71</td>
<td>2016-17</td>
</tr>
<tr>
<td>Lucknow</td>
<td>12500</td>
<td>36</td>
<td>2017-18</td>
</tr>
<tr>
<td>Ahmedabad</td>
<td>10000</td>
<td>35</td>
<td>2018-19</td>
</tr>
<tr>
<td>Jaipur</td>
<td>9732</td>
<td>32</td>
<td>2016-17</td>
</tr>
<tr>
<td>Indore</td>
<td>8500</td>
<td>33</td>
<td>2019-20</td>
</tr>
<tr>
<td>Patna</td>
<td>8000</td>
<td>40</td>
<td>2016-17</td>
</tr>
<tr>
<td>Kochi</td>
<td>5181</td>
<td>26</td>
<td>2016-17</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,12,763</td>
<td>653</td>
<td></td>
</tr>
</tbody>
</table>

About 40 Billion US$ PPP Equals US$ 125 Billion

**Spending on Infrastructure - India**

*Mechanization & Automation is essential to meet the national infrastructure development requirements*  
Confederation of Indian Industries

Source: [http://infrastructure.gov.in](http://infrastructure.gov.in)
Labour Intensive Construction

THE NATIONAL RURAL EMPLOYMENT GUARANTEE ACT,
INDIA 2005

Rural Road Construction
Labour Intensive vs. Equipment-Based
44% vs. 6% - Labour Cost
Labour Intensive - 50% Cheaper – Direct Cost
Quality? Schedule? ..........?

Labour Intensive OR Automated ??

THE NATIONAL RURAL EMPLOYMENT GUARANTEE ACT, 2005

Labour Intensive

Increasing Mechanization & Automation

Automated

Labour shortage, wage increase hit Indian industry hard: FICCI
Example – Rail Track Laying

Which Method Should be Chosen?

Emerging Nation - Requirements

Labour Intensive  Mechanized  Automated

ALL MODES ARE ESSENTIAL – FOR HOLISTIC DEVELOPMENT IN EMERGING NATIONS
Emerging Nation Requirements

Rural Infrastructure
- Village roads
- Rural Housing
- Minor Irrigation
- Maintenance works

Urban Infrastructure
- Residn / Commercial
- Roads – Light Rail
- Utilities
- Light Industrial

Critical National Infrastructure
- Power Plants
- Railways / Roads
- Airports
- Dams
- Heavy Industrial Plants

[Image of construction site]
### Construction Industry Transformation Framework

**2.1 Technology, materials and tools**
- Advanced building and finishing materials
- Stand, modularizing and prefabricated components
- New construction technologies, e.g. 3D printing
- Smart and life-cycle-optimising equipment
- Digital technologies and Big data along the value chain
- Zero or autonomous construction equipment
- Frictionless and cost-effective design and planning
- Enhanced management of subcontractors and suppliers
- Lean and safe construction management and operations
- A common framework for project management
- Rigorous project monitoring (scope, time, cost)

**2.2 Processes and operations**

**2.3 Strategy and business model innovation**
- Differentiated business model and expanded business partnerships
- Sustainable products with national lifecycle value
- Internationalization strategy and increase scale

**2.4 People, organization and culture**
- Continuous learning and knowledge management
- High-performance organization, inclusive and incentive schemes

**3.1 Industry collaboration**
- Mutual consent on standards across the industry
- More data exchange and best practice sharing
- Cross-industry collaboration along the value chain

**3.2 Joint industry marketing**
- Industry-wide collaboration on employer marketing
- Coordinated communication with civil society
- Effective interaction with public sector

**4.1 Regulation and policies**
- Harmonized building codes/standards and efficient permit processes
- Market openness to international firms and SMEs
- Promotion and funding of R&D, technology adoption and education
- Activity managed and strategic project pipeline with reliable funding

**4.2 Public procurement**
- Direct implementation of transparency and anti-corruption standards
- Innovation-friendly and whole-life-cycle-oriented procurement

*The World Economic Forum, The Boston Consulting Group*
Innovative Contracts with Balanced Risk Sharing

Common Framework for Project Management
Sustainable Construction & Life Cycle!

Circular Economy Principles in the Construction Value Chain

- Mining/materials manufacturing
- Building materials
- Construction
- Service
- Operations
- Collection
- Energy recovery
- Landfill
- Recycle
- Refurbish/ remanufacture
- Reuse/redistribute
- Maintain
- Repair
- Leakage to be minimized

Lean & Safe Construction Management and Operations

STATISTICS IN PERSPECTIVE:
CONSTRUCTION FATALITIES

1 IN 3 FATAL OCCURS IN CONSTRUCTION WORK
29% OF ALL FATAL WORKERS ARE WORKERS FOR SUPPLIERS AND TRUCKERS
31,000 NEW CASES OF CONSTRUCTION WORK-RELATED ILL HEALTH PER YEAR
CANCER CASES SINCE 2005 AS A RESULT OF PAST EXPOSURES IN CONSTRUCTION
Strict Implementation of Anti-Corruption and Transparency Standards
University Innovation Through Start-ups?
Thank you