How can technology help with the challenges of a tightening labor market?

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The better the question. The better the answer. The better the world works.
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What are some of the critical challenges we face?

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What are some of the critical challenges we face?

Declining workforce
The engineering and construction (E&C) industry is facing a challenge with an aging workforce, and a smaller talent pipeline than other industries.

Reduced productivity
Less experienced workers and a lack of training have reduced the efficiency of many construction roles.
What’s affecting the current workforce?

**Job Stress**
- Stress and anxiety are the top reasons millennials use disability insurance
- Wellness programs and stress reduction workshops are increasingly popular

**Generational shift**
- Retiring boomers (freeing up positions for Gen X and Gen Y)
- Pipeline of leadership may be an issue
- Less emphasis on remaining with the same company or in the same industry

**Erosion of work / life boundaries**
- Increasingly enabled by technology
- Workers can be exhausted by being ‘always on’
- Increased stress levels

**Productivity**
- Automation
- AI
- Data Acquisition
- Robotics
- Factory

**Environment**
- Weather
- Safety

**Collaboration**
- Ability to share ideas
- Worker isolation
- Level / lack of hierarchy
What are the critical challenges we face?
Declining workforce

- A continued shortage of labor in the construction industry in the US and Japan impacts the industry.
- While in the US, the industry is facing rising construction costs, one of the reasons being higher labor wages required to attract talent, in Japan, detailed workforce record keeping is being used as a tool to improve labor force availability.

**United States**

![Construction job - openings and additions ('000s)](chart)

- Jan-Aug 2015: 150k Job additions
- Jan-Aug 2016: 72k

**Japan**

- 28% Decline in skilled construction workers in Japan over the last two decades
- 1997 Skilled construction labor force (million): 4.55
- 2015: 3.31
- 90% of them are above the age of 30

Openings more than additions; contractors face an ongoing struggle

To manage the labor crisis, Japan's industry associations are building a voluntary database of all 3.3 million workers, their names, skill sets, employment history, training, etc.

This in turn will help the workers and Japan's Land, Infrastructure, Transport and Tourism Ministry to employ workers at the job sites where they are most needed.

Source: 2017 U.S. CONSTRUCTION FORECAST REPORT & BLS
What are the critical challenges we face?
Declining productivity

50% reduction in US construction productivity in the last 50 years
Source: The Economist

90% of the world’s infrastructure projects are either late or over-budget
Source: ENR

>$1 trillion potential output lost each year due to lagging productivity compared to other industries
Source: McKinsey & Company

Why does productivity continue to decline?

Why is the engineering and construction industry lagging behind others with technology adoption?

How can the productivity gap be closed?

What does our future look like?
There are various technology solutions in use and being developed that will help owners and contractors execute projects more efficiently.

Sources: McKinsey, ENR, The Economist
How can technology solve these problems?

**3D Printing:** Could complex fabricated items be produced cheaper and quicker?

**Robotics:** Could specialty robots perform tasks in less time?

**Managed services and RPA:** Could routine tasks like invoicing be outsourced to be more efficient?

**VR/AR/MR/BIM:** Could we virtually see potential issues before construction starts?

**Modularization:** Could a building be built in a fraction of the normal time?

EY technology survey link: [https://eysurveytool.ey.com/wix/p1577076.aspx](https://eysurveytool.ey.com/wix/p1577076.aspx)
How can technology solve these problems?
Modularization

Challenges to modularizing the construction industry

► Changing the mindset on quality and monetary value (financing and resale) of modularization
► Depreciation/taxes of modular buildings treated differently from traditional construction
► Additional collaboration between stakeholders: owner, design, contractor and vendors
► Flexibility in design and material selection to match traditional construction options
Integration of robots into construction industry is already underway.

Current application of robotics:
► Drones are being commonly used for site inspection and monitoring.
► Komatsu has developed unmanned haul trucks and driverless dozers with use of drones
► Q-Bot applies floor insulation beneath floorboards to reduce heat loss
► Construction Robotics has developed a Semi-Automated Mason, SAM100, a brick laying robot

Increasing the innovation of robots and integrating collaboration with humans will reduce cost and save time on construction projects.

Areas of focus for robotics innovation:
► Develop robots to perform high volume, difficult and repetitive tasks
► Develop robots perform dangerous tasks the enhance safety
► Develop robots for lifting and placing heavy objects (i.e. steel and rebar) to reduce the need for additional workers
► Develop robots to perform tasks associated with precise surveying, measurements and layouts
How can technology solve these problems?

Robotics

Example of equipment management with the use of integrated technologies:

Remote equipment diagnostics

Equipment cost allocation to the site

Optimization of equipment use

Remote diagnostics and problem solution based on sensor data integration and analysis by qualified staff located in HQ

Booking the cost of equipment use based on actual construction site location using GPS

Optimization of equipment productivity based on availability, location, and demand data
How can technology solve these problems?
Virtual, augmented and mixed reality

**Augmented reality (AR)**
- View live virtual overlays of buildings or systems
- Can view static virtual objects from any angle simply by walking around them and pointing your device
- Will become more prevalent with the adoption of Apple’s ARKit

**Virtual reality (VR)**
- Fully immersive BIM model
- Project teams can review the space and context better than just looking at drawings
- Usability and clashes can be improved earlier than the traditional process
- Stakeholders and end users can get a better understanding of what is to be built
How can technology solve these problems?  
Virtual, augmented and mixed reality

**Virtual Reality**
- Complete virtual world
- Limited physical movement
- Isolation of user & prototyping

**Augmented Reality**
- Augment holograms in real world
- Works well with mobile devices
- Easier integration

**Mixed Reality**
- Interaction between real & virtual worlds
- Normal gestures
- Spatial mapping

**Visualization**
- Enables the user to visualize surrounding which is not directly visible
- Get visual insight of an object or model

**Increased collaboration**
- Working together on projects whereby visualization is an important part
- Support through linked view, voice and gestures

**Business transformation**
- Show information as part of the real-world on a wall or table
- Unlock new possibilities for business and productivity

**Improved education**
- Working together on projects whereby visualization is an important part
- Support through linked view, voice and gestures

**Emerging opportunities include:**
- Walk through models using virtual immersion tools (3D blueprints)
- Increased accuracy in projections during the project
- Younger workforce eager to use innovative products to streamline functions
- Safety training and education
BIM is an acronym for Building Information Modeling or Model. At the highest level, “BIM is a digital representation of the building process to facilitate exchange and interoperability of information in digital format.” – Charles Eastman, 1999

Emerging opportunities include:

► Integrated Project Delivery (IPD)
► Enabling of digital asset management
► Virtual collaboration of project stakeholders

During design and construction, BIM offers savings in cost and time, gains in accuracy, and reduction in errors and rework during design and construction.

Integration and optimization maturity

Time


2D CAD 3D CAD 3D BIM 6D, cloud, AIM, FM 3D/4D/5D BIM

The tipping point of BIM maturity

Advanced participants

Laggards

Note:
1. CAD: computer aided design
2. BIM: building information modeling
3. 2D: two dimensional building/infrastructure drawings
4. 3D: three dimensional building models
5. 4D: 3D models interconnected with schedule data
6. 5D: 3D models with material quantity and unit cost data
7. 6D: 3D models with operations and maintenance property data
How can technology solve these problems?

3D printing

3D printing is the process of creating a three dimensional object from a digital model.

**Current usage** - 36% of companies are already applying or intend to apply 3D printing, according to a recent EY global survey of 900 companies, with Aerospace, Defense and Automotive being the most mature industries in applying 3D printing.

**Emerging opportunities include:**

- Simple house builds
  - Embed MEP systems within printed walls
  - Extrude quick-setting concrete into sections that would normally require complicated formwork
- Piping and plastic fittings

**Worldwide 3D-printing products and services ($B)**

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CAGR: 20.3%

Source: Wohlers Associates
How can technology solve these problems?

3D printing examples

Caterpillar is currently using limited amounts of 3D printed parts in production.

A house in China was printed on site in 45 days.

Concept of 3D printed bridge.

NASA is looking for ways to 3D print habitats on Mars.
How can technology solve these problems?

3D printing benefits

By 2019, 10% of all discrete manufacturers will be using 3D printers to produce parts for the products they sell or service.

Source: Gartner Predicts 2016

With traditional methods, an engineer would create a computer model of an intake manifold – the most complicated engine part – and wait about four months for one prototype. With 3D printing, Ford can print the same part in four days, including multiple iterations and with no tooling limits.

Ford, 2014

We commonly see cost savings of 50-80% compared with traditional manufacturing methods. Time savings can be even greater for parts or tools.

Stratasys 3D, July 2013

By 2019, 10% of out-of-production spare parts for cars, trucks, bicycles and motorcycles, in addition to military vehicles and drones, will be 3D-printed.

Gartner Predicts 2016

In areas which are remote/offshore or subject to rigorous parts screening, 3D printing would enable on site development of parts, potentially mitigating long lead times and quarantine checks.

Strategy& July 2015

3D printing has substantial implications for both domestic and international freight businesses, particularly in reducing the importance of some transportation lanes.

Strategie& July 2015
How can technology solve these problems?
Managed services and RPA

E&C firms will be looking for different ways to optimize standard project processes by outsourcing.

Managed Services

Managed services are the combination of outsourced expertise and a software technology to provide E&C companies with an efficient data-centric process, saving time and resources.

Sample services
- Invoice / payment application compilation and processing
- Data analytics and trend analysis
- Claims analysis

Benefits
- Reduced overhead
- Enhance communication and transparency between all stakeholders
- Identification and reduction of risk
- Predictive views of your business

People management
- Timesheet administration
- Job role change
- Amendment of address details
- On- and off-boarding procedures

IT
- Password resetting
- System maintenance
- Data cleansing
- Data analytics

Finance
- Account closure and opening
- Account audit requests
- Foreign exchange payments
- Claims processing

Supply chain
- Order management
- Material requirements planning system
- Energy consumption and procurement
- Payment protection measures

Robotics

RPA is the application of a cost-effective software that mimics human action and connects multiple fragmented systems together through automation without changing the current enterprise IT landscape, allowing employees to focus on other critical tasks.
Despite the growing acceptance, the sector still faces some significant challenges in adopting new technology. These challenges can be seen across five broad pressure areas:

1. **Sector dynamics**
   - Competitive environment
   - Silo operations and project focus

2. **Corporate environment**
   - Challenging established ways of working
   - Sector status

3. **Solution limitations**
   - Limited perceived need
   - Integration issues

4. **Financial constraints**
   - Legacy investment
   - Limited R&D funding
   - Uncertainty of success

5. **Change fatigue**
   - Resource intensive
In conclusion ...

1. The E&C industry is facing a challenge to meet current construction demands. There is an ever growing demand for housing, infrastructure, and energy projects, yet there are challenges with the current workforce that all companies must learn to adapt to.

2. Advances in construction technology will change how projects are executed. Technological advances in construction will allow projects to be better designed, and constructed faster, leading to customer satisfaction and financial gains.

3. Embarking on a digital journey requires nurturing from the top. New technology is exciting and challenging; to navigate this medium, innovative and rapid ways to learn, assess, and develop new capabilities are required. Innovation requires governance and nurturing from the top.
Questions and answers
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