IISE Body of Knowledge

Progress & Applications

Diana Berry
Krishnan Krishnaiyer Ph.D.
Joel Brock
Jose Monreal

Sponsored by ISE BoK
Governing Board
Webinar Speakers

Diana Berry, 
IIE VP Technical Operations 
Global Supply Chain Specialist, 
Harsco Rail

Joel Brock, 
Director Operations Excellence, 
West Monroe Partners

Krishnan Krishnaiyer, Ph.D. 
Partner, Center for Improvement, 
Marathon Petroleum Corporation

Jose Monreal, 
Senior Technical Staff 
Systems & Industrial 
Engineering, Raytheon Technologies
Agenda

✓ ISE BoK Overview
✓ ISE BoK Boards
✓ ISE BoK Governing Board Members
✓ ISE BoK Maintenance and Dissemination Updates
✓ ISE BoK Applications:
  ISE BoK in Design & Manufacturing Engineering,
  Operations Engineering Management, Information
  Engineering, Product Design and Development
  ISE BoK in Work Design and Measurement
  ISE BoK Industry Study Case
✓ ISE BoK Future and How to get involved
ISE Body of Knowledge Overview

- **2010**: Activities started as an outcome of IISE strategic plan
- **2013**: Draft version was sent to societies and divisions to collect input
- **2015**: Task force was created
- **2017**: First version was published online
  - Open access document
  - Anyone can submit proposals for changes
How to submit changes?

cs@iise.org
ISE Body of Knowledge Boards

Content Review
Chair: Natarajan Gautam
➢ Reviews and approves all new content and revisions
➢ Three members appointed per knowledge area

Governing Board
Chair: Diana Berry
➢ Maintains, updates, and disseminates
ISE BoK Governing Board

Diana Berry, 2016-2022
IIE VP Technical Operations
Global Supply Chain Specialist, Harsco Rail

Alison Knight, 2019-2021
Senior Process Improvement Consultant
Carilion Clinic

Joel Brock, 2019-2021
Director Operations Excellence,
West Monroe Partners

Bryan Norman, 2019-2021
Professor Department Chair,
Department of Industrial, Manufacturing & Systems
Engineering, Texas Tech University

Krishnan Krishnaiyer, 2019-2021
Partner, Center for Improvement,
Marathon Petroleum Corporation

Russell Wooten, 2019-2021
IIE Fellow

Soundar Kumara, 2020-2021
Allen E., & M., Pearce Professor of Industrial and Manufacturing Engineering, Penn State, University Park

Jose Monreal, 2019-2021
Senior Technical Staff
Systems & Industrial Engineering, Raytheon Technologies
ISE BoK Governing Board Maintenance

- Chapters format review
- Logistics and Supply Chain chapter
- Work Systems chapter
- Logos included in new format
IISE Magazine Forum & Dissemination – Moving Forward

➢ Bimonthly articles highlighting 14 areas of knowledge
➢ First article released April 2019
➢ 7 articles published
➢ Current article in September Edition
IISE YouTube Channel & Dissemination – Moving Forward

➢ Spanish speaking YouTube video targeting international IISE members: Diogenes Alvarez Solorzano

➢ IISE BoK information will be included on the Lean and Six Sigma in person trainings
YouTube videos in IISE channel: Joel Brock, Diana Berry

ISE BoK Inclusion at annual conference

New infographic
Design & Manufacturing Engineering  
Operations Engineering & Management  
Information Engineering  
Product Design and Development
100 Years of America's Top 10 Companies

1917
- U.S. Steel: $46.4B
- American Telephone & Telegraph: $14.1B
- Standard Oil of N.J.: $10.7B
- Bethlehem Steel: $7.1B
- Armour & Co.: $5.8B
- Swift & Co.: $5.7B
- International Harvester: $4.9B
- E.I. du Pont de Nemours: $4.9B
- Midvale Steel & Ordnance: $4.8B
- U.S. Rubber: $4.6B

1967
- IBM: International Business Machines: $258.6B
- American Telephone & Telegraph: $200.5B
- Eastman Kodak: $177B
- General Motors: $171.2B
- Standard Oil Company: $106.5B
- Texaco: $82.3B
- Sears, Roebuck: $64.6B
- General Electric: $63.9B
- Polaroid: $58B
- Gulf Oil: $58B

2017
- Apple: $898B
- Alphabet: $719B
- Microsoft: $644B
- Amazon: $543B
- Facebook: $518B
- Berkshire Hathaway: $452B
- Johnson & Johnson: $374B
- Exxon Mobil: $350B
- Wells Fargo & Co.: $266B
- JPMorgan Chase: $340B

Assets ($bn) Inflation adjusted September 2017
Market Value ($bn) Inflation adjusted September 2017

Industry
- Tech
- Conglomerate
- Medical
- Oil & Gas
- Financial Services
- Film
- Rubber
- Retail
- Autos
- Telecom
- Steel
- Foods
- Chemicals
- Heavy Equipment

Mkt. Val. ($bn) as of November 10th, 2017

Understand
<table>
<thead>
<tr>
<th>The least safe jobs</th>
<th>Chance of automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telemarketer</td>
<td>99%</td>
</tr>
<tr>
<td>Loan officer</td>
<td>98%</td>
</tr>
<tr>
<td>Cashier</td>
<td>97%</td>
</tr>
<tr>
<td>Paralegal and legal assistant</td>
<td>94%</td>
</tr>
<tr>
<td>Taxi driver</td>
<td>89%</td>
</tr>
<tr>
<td>Fast food cook</td>
<td>81%</td>
</tr>
</tbody>
</table>

Source: The Future of Employment

<table>
<thead>
<tr>
<th>The safest jobs</th>
<th>Chance of automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental health and substance abuse social worker</td>
<td>0.3%</td>
</tr>
<tr>
<td>Occupational therapist</td>
<td>0.35%</td>
</tr>
<tr>
<td>Dietitian and nutritionist</td>
<td>0.39%</td>
</tr>
<tr>
<td>Physician and surgeon</td>
<td>0.42%</td>
</tr>
<tr>
<td>Clergy</td>
<td>0.81%</td>
</tr>
</tbody>
</table>

Source: The Future of Employment
# Top 10 Skills

**in 2015**
1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity

**in 2020**
1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

Source: Future of Jobs Report, World Economic Forum
1. Work Design & Measurement
Work measurement approaches utilized by West Monroe

<table>
<thead>
<tr>
<th>Approach</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predetermined Time Studies</td>
<td>Build work standards through observing processes and assigning time to each task using MOST, MTM, or other predetermined time systems.</td>
</tr>
<tr>
<td>Stopwatch Time Studies</td>
<td>Traditional time and motion studies involving low interaction and stopwatch studies.</td>
</tr>
<tr>
<td>Job Shadowing</td>
<td>Side by side observations of individuals across the process with more interaction.</td>
</tr>
<tr>
<td>Work Sampling</td>
<td>Observer simultaneously collects data on employees' activities in the same work area by taking ‘samples’ of work at regular intervals.</td>
</tr>
<tr>
<td>ActivityTrak</td>
<td>Data gathering tool and approach designed for employees to self track all work-related activities.</td>
</tr>
</tbody>
</table>

VARYING DEGREES OF INVASIVENESS AND SUBJECTIVITY
We have been leveraging multiple work measurement and labor quantification approaches in retail

### Pre-Determined Time Studies

**MOST LABOR STANDARDS**

- Store operations
- Distribution centers
- Pharmacies

### Time Studies & Manual Observation

**TIME STUDY**

- Store operations, distribution centers
- Pharmacy and clinical services
- Corporate job roles

**WORK SAMPLING**

- PHD (% of time)

**JOB SHADOWING**

- Store operations, distribution centers
- Pharmacy and clinical services
- Corporate job roles

### Self Reporting & Total Population Sampling

**ACTIVITY TRAK**

- Human resources
- Corporate job roles
West Monroe partnered with the client’s engineering, operations, and technology stakeholders to design, test, and implement, enabling significant savings in cross dock labor costs as well as setting the client up for sustained success and a culture of continuous improvement.

**Methods Design:** Teamed up with operators and applied industrial engineering principles to optimize processes by eliminating waste.

**Workplace Organization:** Used a 5-S based approach to stand-up a cross-functional team who redesigned the cross dock physical layout.

**Work Measurement:** Built detailed engineered standards based on newly optimized layout and processes.

**Data Analytics & Reporting:** Led the client through building and deploying a robust Labor Management System and BI reporting tool, integrating the transactional data with engineered standards.

**Continuous Improvement:** Stood up cross-functional teams at each facility with a unified governance structure to drive engagement, address issues, and improve processes.
ISE BoK Study Case – RTX – Jose Monreal
The Challenge

Readily available information/writings describing:

Workforce challenges in the Aerospace and Defense industry

• Multi-generational workforce
• Skills gap; lack of succession planning
• High attrition rate
• 60% A&D > age 45 (44% overall)
• 42% A&D < age 44 (56% overall)

Current State

• Changing demographic
• Individual satisfaction
• Reduce development cycle time
• IE Methods/Benefits highlighted
The Approach

Industrial Engineering Authority

• Credentialing program
• Partnership

Comparisons

• Needs of the business
• Needs of the stakeholders
• To accepted competencies

Comparison to Industrial Engineering BoK

• View into the profession recognized by the professional society
• View into what the IE role could be and should be
• Recognition of existing specializations
  ➢ To collaborate with
  ➢ To not duplicate
The Result

Industrial Engineering Authority Certification

- 5 Main categories
- 23 Sub-categories
- 69 Individual Skill Elements
- Level of proficiency required
- Requirement to achieve

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Requirement</th>
<th>Level Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Support</td>
<td>System Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process Optimization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Management and Strategic Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leadership / Soft Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Support</td>
<td>Labor Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process Observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Throughput</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk Mitigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Changes</td>
<td>Problem Solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constraint Elimination</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process Mapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Factory Layouts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>New Product Introduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous Improvement</td>
<td>Future Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capital Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business Accumen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project Execution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Product Introduction</td>
<td>Coaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emotional Intelligence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer Focus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturing Ethics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Result
Questions?
Speakers Contact Information

Diana Berry, dianapz@hotmail.com

Krishnan Krishnaiyer, Ph.D. Kkrishnaiyer@Marathonpetroleum.com

Joel Brock, jbrock@wmp.com

Jose Monreal, Jose.monreal@raytheon.com
ISE BoK Future

➢ Review 2017 policies and procedures
➢ IISE connect
➢ Encourage Divisions and Societies involvement
➢ Integration with the Maynard’s ISE handbook
➢ Integration with Lean and Six Sigma Training
➢ Integration of ISE BoK logos at annual conference