Safety Maturity Index™
for Machinery

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PUBLIC INFORMATION
The Importance of Safety

Every 15 seconds, somewhere in the world:

160 workers have a work-related accident.

Someone dies from a work-related accident or disease.

240 Deaths in the next hour
Interrelated Safety Issues

- Aging Global Workforce
- Supply Chain Risks
- Reputational Risks
- Productivity
- Worker Safety
- Social Responsibility
Every year...

2.3 million people die,

317 million accidents

4% Global Gross Domestic Product

Source: International Labour Organization
What if?

- Reduce Injury Rate by Half
- Increase Overall Equipment Effectiveness (OEE) 5%-7%
- Reduce Unscheduled Downtime 2%-4%

Best-In-Class Performance
Global Leadership & Recognition

Innovation
- Forbes: The World's Most Innovative Companies (Top 100 Innovative Companies)
- Thomson Reuters: Global Innovators (Top 100)
- World's Most Ethical Companies (World's Most Ethical Companies)

Ethics & Integrity
- Better Business Bureau International Torch Award
- American Business Ethics Award

Corporate Responsibility & Sustainability
- Justmeans: Insights - Global 1000 Sustainable Performance Leaders (Top 100 Company Sustainable Performance Leader)
- FTSE4Good
- Dow Jones Sustainability Indexes
- Most Sustainable Companies
Rockwell Automation

- Manufacturing safety performance
  - Recordable case rate: 0.51 per 100 employees
    - Best in class when compared to private industry 1.2
    and electronic manufacturing peers 0.6.
  - Lost work day case rate: 0.2 per 100 employees.

- Global EHS performance
  - Singapore Ministry of Manpower’s Workplace Safety and Health Council’s Excellence Award (6 consecutive years).
  - Greater Cleveland Safety Council and the Ohio Bureau of Workers’ Compensation’s Occupational Safety and Hygiene Awards.
Rockwell Automation has a well-established reputation for helping manufacturers improve productivity and quality.

We’re also the world’s largest safety system provider*

• Proven expertise: >200 Certified Functional Safety Experts/Engineers
• Focus on meeting your safety and productivity goals
• Most complete safety offering
  • Machinery – services, inputs, logic, outputs
  • Process – SIL 1, SIL 2, SIL 3 applications
  • Electrical/Arc Flash Safety mitigation

Searching for “The Epiphany”
What causes the Epiphany?
Issues: Aging Global Workforce

- Average age of a skilled U.S. mfg. worker is 56
- More than half of U.S. skilled trades workers over 45
- 600,000 unfilled jobs in U.S. manufacturing

- China's workforce to contract beginning in 2015.
- New Chinese entrants into the workforce already falling and will decline by 30 percent by 2020 vs 2010
- By 2050 more than ¼ of Chinese population will be over 65

- The EU27 employment rate for people 55–64 rose 10% from 2000-2009.
- The EU27 average exit age from the labour market increased steadily from 59.9 (2001) to 61.2 (2007).
- The Europe 2020 Strategy aims to increase the employment rate of the population aged 20-64 to 75%. For this to happen, European citizens will have to work longer.
Issues: Aging Global Workforce

- Older workers:
  - Staying on the job longer
  - Changing functional capacities, health, disabilities.
  - May require adapting work to individual abilities, skills and state of health.
  - EU pension reforms to prevent increased disability claims

- Younger workers:
  - Injury rate of workers under 25 18% higher than those over.
  - 20% of all work-related injuries experienced by Australian workers were incurred by workers aged 25 years and under.
  - Younger workers are at higher risk of workplace injury:
    - Inexperience
    - Physical, cognitive, and developmental characteristics.
    - Hesitance to ask questions.
    - Failure to recognize workplace dangers.

- Large individual differences in functional capacities, health and disabilities.
Issues: Supply Chain Risks
Accidents, Production, Labor, Regulatory, Legal

Analysis of over 2,500 disruptions

- Accidents
- Production Problems
- Labor Unavailability and Shortage of...
- Natural Disasters
- Sabotage, Terrorism, Crime and War
- Financial Losses and Premiums
- Demand Variability/Volatility
- Physical and Regulatory
- Industry-wide (i.e., Market) Challenges
- Lawsuits

Source: Zurich’s supply chain loss event database
Issues:
Reputational Risk = Financial Risk

- Financial Risk
- Reputational Risk
- Sustainability
- Supply Chain Risk
- Legal Risk
The Safety Life Cycle

1. Hazard or Risk Assessment
2. Functional Requirements
3. Design & Verification
4. Installation & Validation
5. Maintain & Improve

System design based on integrating safety & machine functionality
Risk Reduction Methods

Hierarchy of Protective Measures

- **Design it out**
- **Fixed enclosing guard**
- **Monitoring Access / Interlocked Gates**
- **Awareness Means, Training and Procedures**
- **Personal protective equipment (PPE)**

Most Effective → Least Effective
## Business Value of Safety

### Defining Best-In-Class Performance

<table>
<thead>
<tr>
<th>Definition of Maturity Class</th>
<th>Mean Class Performance</th>
</tr>
</thead>
</table>
| **Best-in-Class:** Top 20% of aggregate performance scorers | 90% OEE  
0.2% Repeat Accident Rate  
0.05 Injury Frequency Rate  
2% Unscheduled Asset Downtime |
| **Industry Average:** Middle 50% of aggregate performance scorers | 85% OEE  
2.4% Repeat Accident Rate  
0.9 Injury Frequency Rate  
6% Unscheduled Asset Downtime |
| **Laggard:** Bottom 30% of aggregate performance scorers | 76% OEE  
10% Repeat Accident Rate  
3.0 Injury Frequency Rate  
14% Unscheduled Asset Downtime |

- 5%-7% Higher OEE
- 2%-4% Less Downtime
- <50% injury rate

### Top Pressures:
- Compliance
- Reduce safety risks
Safety Maturity

What differentiated Best-in-class Manufacturers from their Peers?

- **Culture (behavioral):** The company DNA from upper management support, cross-functional safety teams, observable.

- **Compliance (procedural):** Established risk management processes, procedures, and standards to identify, prioritize and mitigate risks.

- **Capital (technical):** Investments in technologies that improve *both* safety and productivity. Contemporary safety solutions and technologies are seen as a viable investment with an ROI.
Culture eats strategy for lunch.

- Peter Drucker
Organizational Capabilities

Safety Performance Gap

The difference between what is expected vs. what is accepted by the company’s leadership, supervisors & employees

what is expected  what is accepted

C-level commitment and investment to safety initiative (by allocating budget for personnel and technology)
Executive champion focused on reduction of safety incidents / improvement of safety
Safety is regularly promoted by executive champion and is part of the organization
Established cross-functional team responsible for aligning maintenance, production, plant safety and corporate goals
Established cross-functional team responsible for performing risk assessment of operations
Roles and responsibilities established within departments to maintain safety technology
Assessments: Forethought or Afterthought?

Equipment Maintenance and Decomm
Knowledge and Performance Management

- Integration of Standard and Safety Controls
- Integrated Safety
- Manufacturing Intelligence
- Reduced Downtime
- Increased OEE
- Increased Productivity
Good Companies: Safety = Cost Savings/Avoidance
Great Companies: Safety = Performance

Pressure Driving Companies to Invest in Safety Technology

- Reduce the risk of an adverse event (injury/incident, regulatory issues, etc.):
  - S4: 85%
  - S3: 80%
  - S1&S2: 81%
  - All Respondents: 81%

- Need to be in compliance with regulatory and safety requirements/standards:
  - S4: 77%
  - S3: 73%
  - S1&S2: 77%
  - All Respondents: 75%

- Globalization of standards:
  - S4: 31%
  - S3: 26%
  - S1&S2: 21%
  - All Respondents: 23%

- Improve manufacturing efficiency (i.e. Overall Equipment Effectiveness (OEE)):
  - S4: 27%
  - S3: 15%
  - S1&S2: 21%
  - All Respondents: 21%

- Minimize the cost of avoidance (fines, medical cost, litigation, insurance, etc.):
  - S4: 36%
  - S3: 31%
  - S1&S2: 19%
  - All Respondents: 32%

- Need to improve Return on Assets (RoA):
  - S4: 15%
  - S3: 8%
  - S1&S2: 9%
  - All Respondents: 9%

- We made no investment in safety technology:
  - S4: 3%
  - S3: 5%
  - S1&S2: 5%
  - All Respondents: 3%
When will a serious accident or fatality happen in your plant?

“One of the oldest human needs is having someone to wonder where you are, when you don't come home at night.” – Margaret Mead
Why did NASA continue to operate the space shuttle Challenger in 1986 when O-ring erosion problems were well known and documented over 2 years prior to launch?
Geologist Daniel J. Miller, who twice surveyed the area for local Native American tribes and for the Army Corps of Engineers wrote in his 1997 report that the Hazel Landslide, as the mountain is known, was constantly shifting, experiencing landslides and would one day suffer “a catastrophic failure.”
Beware the Normalization of Deviance

- A **gradual erosion of normal procedures** that would never be tolerated if proposed in one single, abrupt leap.

- Incremental deviations are observed, tolerated (if no accident) **become normalized** to meet higher priorities (production, schedule, funding).

- Safety violations are seen as technical violations that can be tolerated and managed, **undermining the culture of safety**.
Challenge Perceptions

“A historical lack of accidents does not imply a current presence of safety. It simply means you’ve been faster than the machine.”

Bill Hilton, Director of Health and Safety
The Keys to Success

PUBLIC INFORMATION
Safety Performance

Operational Excellence

Cost Avoidance

Minimizing Investment

Compliance (Procedural)

Culture (Behavioral)

Capital (Technical)
## Safety Maturity Index™ for Machinery

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>FOCUS</th>
<th>CULTURE</th>
<th>COMPLIANCE</th>
<th>CAPITAL</th>
</tr>
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<tbody>
<tr>
<td>SMI 4</td>
<td>Operational Excellence</td>
<td>BEHAVIORAL</td>
<td>Standard processes established to design safety and productivity into machinery throughout the supply chain.</td>
<td>Use of <strong>contemporary</strong> safety technologies &amp; techniques to optimize safety and productivity.</td>
</tr>
<tr>
<td>SMI 3</td>
<td>Cost Avoidance</td>
<td></td>
<td>Standard processes established to design <strong>safe machinery throughout the company.</strong></td>
<td>Use of safety technologies &amp; techniques to <strong>optimize safety.</strong></td>
</tr>
<tr>
<td>SMI 2</td>
<td>Attaining Compliance</td>
<td></td>
<td>Standard processes established to meet <strong>minimum requirements.</strong></td>
<td>Use of <strong>basic safety technologies &amp; techniques.</strong></td>
</tr>
<tr>
<td>SMI 1</td>
<td>Minimizing Investment</td>
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<td>Minimal processes established to avoid fines and complaints.</td>
<td>Incomplete or improper use of safety technologies.</td>
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</table>

- Safety is a **value** – essential to the health of the business.
- Safety is a **priority** – important to the health of the business.
- Safety is a **necessity** – to meet compliance requirements.
- Safety is **minimized** – it could interfere with other prerogatives.
**Culture**

- **Attitude:**
  - Safety is considered vital to the health of the business and its employees – a key indicator of business optimization.
  - Safety is a value. No exceptions to safety are acceptable in pursuit of other goals: Employees would rank priorities as: Safety, Quality, Production, Cost Reduction
  - Safety is a prominent part of the business and strategic plans, including being considered a key element of brand image.

- **Accountability:**
  - Upper management is held accountable, including compensation, for safety metrics.
  - All safety incidents are reported appropriately with total transparency.
  - Leaders/managers are constantly on the floor asking about, coaching about or observing opportunities for improving safety.
  - Employees view leader/manager adherence to safety as 100% on board, caring about worker safety.

- **Commitment:**
  - Anticipatory, pre/during/post-incident accountability exhibited by employees for their safety and the safety of others, aligned with systemic process or procedure.
  - >90% of employees are committed to actively managing their own safety behavior, and coaching others regarding workplace safety, to specified behavior standards and expectations.
  - >90% of employees are involved and participating in safety improvement initiatives.
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<td><strong>Operational Excellence</strong></td>
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<td>SMI 4</td>
<td><strong>Compliance</strong></td>
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<tr>
<td></td>
<td>• EH&amp;S:</td>
</tr>
<tr>
<td></td>
<td>• Entire supply chain required to meet safety standards.</td>
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<td></td>
<td>• Clearly defined appropriate roles and activities for all levels of employees.</td>
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<td></td>
<td>• Rigorous Management of Change process in place, and functioning.</td>
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<tr>
<td></td>
<td>• Accountability though performance management process established.</td>
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<tr>
<td></td>
<td>• Formalized risk assessment process for EHS impacts in place, based on established standards.</td>
</tr>
<tr>
<td></td>
<td>• Engineering:</td>
</tr>
<tr>
<td></td>
<td>• Documented safety assessments performed throughout the machinery life cycle steps including concept/design, fabrication, installation, validation, operation/maintenance, decommissioning.</td>
</tr>
<tr>
<td></td>
<td>• Functional safety specifications developed to improve safety and productivity.</td>
</tr>
<tr>
<td></td>
<td>• Design considerations for safety and productivity.</td>
</tr>
<tr>
<td></td>
<td>• Safety system design using safety rated products.</td>
</tr>
<tr>
<td></td>
<td>• Design and verification of safety system to ensure risks are mitigated.</td>
</tr>
<tr>
<td></td>
<td>• Safety system validation and documentation to ensure functional safety by a qualified safety engineer.</td>
</tr>
<tr>
<td></td>
<td>• Perform regular maintenance and modification assessments of safety systems.</td>
</tr>
<tr>
<td></td>
<td>• Requires machinery suppliers to provide proof/documentation of risk assessment, design verification, and system validation to ensure that all machines meet requirements.</td>
</tr>
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<td></td>
<td>• Provides standardized global specification of safety performance or integrity level.</td>
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## Rockwell Automation Safety Maturity Index™ for Machinery

### Operational Excellence

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<td><strong>Capital</strong></td>
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<tr>
<td></td>
<td>- Use of contemporary safety techniques and technologies to optimize safety and productivity, reduce unscheduled downtime, such as:</td>
</tr>
<tr>
<td></td>
<td>- Integration of safety, discrete and motion control systems diagnostics to reduce unscheduled downtime (MTBF, MTTR).</td>
</tr>
<tr>
<td></td>
<td>- Use of advanced safety technologies and techniques (safe speed, safe direction, safe torque off, safe position, zone control, presence sensing, etc.) to optimize productivity.</td>
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<tr>
<td></td>
<td>- Use of alternative measures to lock-out/tag-out to protect tasks deemed to be routine, repetitive, and integral to the process (e.g. - limited shutdown) to optimize productivity.</td>
</tr>
<tr>
<td></td>
<td>- Use of manufacturing intelligence to monitor safety system performance (MTTFd), diagnostics, and ensure proper safety system maintenance and validation.</td>
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Return
# Safety Maturity Index™

for Machinery

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<td>TECHNICAL</td>
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<td>SMI 1</td>
<td>Minimizing Investment</td>
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<td>Minimal processes established to avoid fines and complaints.</td>
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**PUBLIC INFORMATION**
Zone Control Simulation
Safety Resource Center

Zone Control for Maintenance

Conventional Solution

Contemporary Solution

Safe Speed Simulation
Safety Resource Center

Conventional Solution

Reduced MTTR Simulation
Safety Resource Center

http://discover.rockwellautomation.com/SFTY_EN_fault_identification_2.aspx
How Mature is Manufacturing today?

- **SMI 4**: 15% of all respondents
  - Implemented 90% or above of all capabilities
  - *Optimizing Safety and Productivity*

- **SMI 3**: 23% of all respondents
  - Between 75% and 90% of all capabilities
  - *Safety – sacrificing productivity*

- **SMI 2**: 37% of all respondents
  - Between 50% and 75% of all capabilities
  - *Marginal safety and productivity*

- **SMI 1**: 25% of all respondents
  - Less than 50% of all capabilities
  - *Unsafe*

Source – Rockwell Automation, 2013 Manufacturing Safety Effectiveness Study by The Aberdeen Group
Rockwell Automation

Safety Maturity Index™ for Machinery

- **Collaboration**
  - Management, EHS, Engineering
  - Supply Chain Partners

- **Key Elements of Safety Maturity**
  - Culture (Behavioral)
  - Compliance (Procedural)
  - Capital (Technical)

- **Return on Investments in Safety**
  - $$$ Improved Profitability
  - Reduced Risk
    - Reputation
    - Supply Chain
    - Personnel
    - Assets
  - Corporate Social Responsibility
  - Sustainable Business Practice
SMI assessment database
- Completely anonymous
- Will compile industry and market data
- Generate a report (.xls or pdf)
- Allows users to compare results by:
  - Product/Industry
  - Geo. Region
  - Size (emp. & revenue)
  - Years in operation

Comparison Report

<table>
<thead>
<tr>
<th>SMI MEASUREMENTS</th>
<th>Your Facility</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMI Overall</td>
<td>2.4</td>
<td>2.8</td>
</tr>
<tr>
<td>Culture</td>
<td>2.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Compliance</td>
<td>2.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Capital</td>
<td>2.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>
Next Steps

- **Goal Setting**
  - Management, EHS, Engineering
  - Level of Performance Expected

- **Safety Maturity Index**
  - Gather key data
  - Grading - [http://www.rockwellautomation.com/go/smi](http://www.rockwellautomation.com/go/smi)
  - Determine Strengths/Weaknesses

- **Develop Action Plan**
  - Cultural (Behavioral) Development
  - Compliance (Procedural) Development
  - Capital (Technical) Development