

**ROCKWELL AUTOMATION**  
& AUTOMATION WORLD



**SAFETY**  
AUTOMATIONFORUM™

# Functional Safety an Overview

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# What is functional safety?

- The concept of functional safety is changing the behaviour of users and designers of automation systems.
- The way to keep a machine safe is to control it properly.
- The better that safety is integrated into the control system the more in-control the machine is.
- The more in-control a machine is, the safer it is.
- We need to know - How safe is safe enough? - is the control system good enough? - That's what the new standards for functional safety are all about.

*Functional safety* is part of the overall safety that depends on a system or equipment operating correctly in response to its inputs.

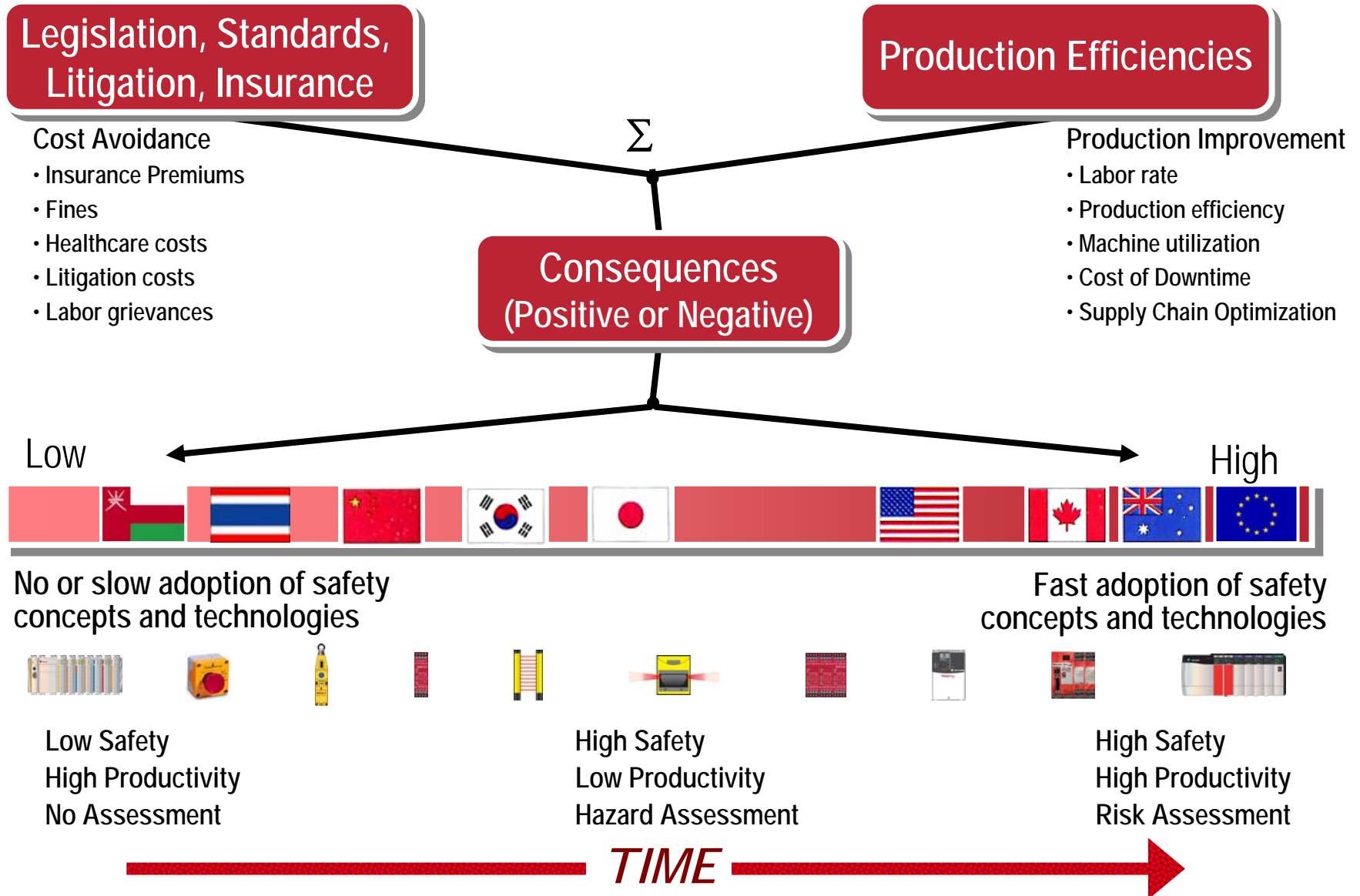
# Example of Functional Safety

## Drill functional safety example

- 30 years ago a drill looked like what?
  - Metal case, no grounding, 115VAC operation
  - Potential problem – electrical shock
  - Solution – include third prong to ground drill chassis
- 20 years ago a drill looked like what?
  - Lexan case, no grounding, 115VAC
  - Potential problem – still electrical shock but vary low probability
  - Solution – electrically isolate chassis from voltage source (voltage source still exist)
- 10 years ago (today) a drill looks like what?
  - Lexan case, DC voltage
  - Potential problem – no possibility of electrical shock (functionally saf



# Machine Safety Market Adoption Model



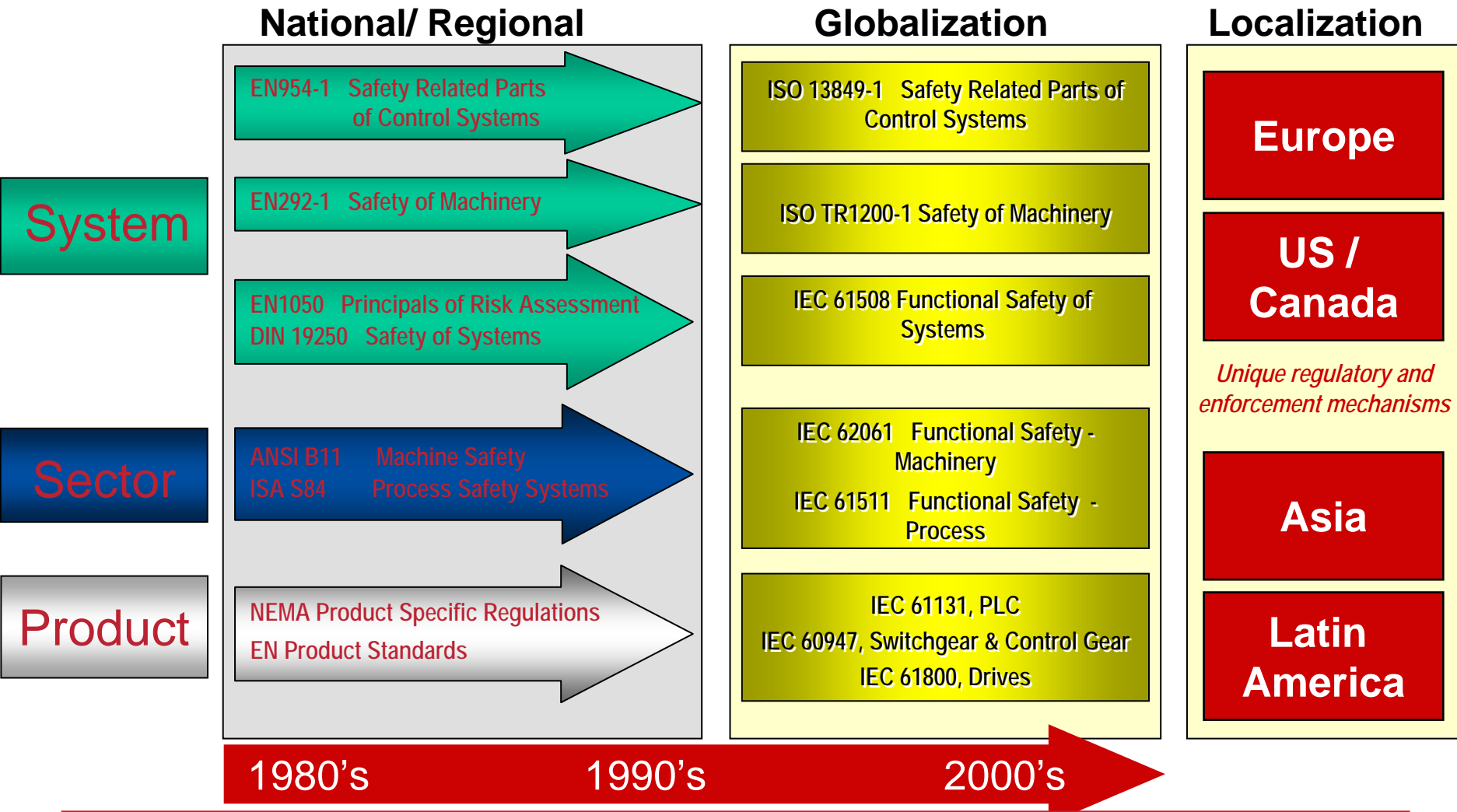
# Safety Motivators for OEMs

- Limit liability
- Improvements in productivity
- Improved machine sustainability
- Reduced developmental cost

# Safety Motivators for Users

- Regulatory/Legal
- Motivated to produce its end product efficiently and safely, so it can turn a profit for its owners or shareholders.
- Social/moral responsibility

# Safety Control Standards are in Transition



***IEC 61508, IEC 62061 & ISO 13849 are Key Emerging Global Standards; Global Standards-based Designs Enables Global Product Marketing***

# Functional Safety Standards

**“Generic”**  
Electrical  
Control  
Systems



IEC 61508

**“Process”**  
Electrical  
Control  
Systems



IEC 61511

**“Machinery”**  
Electrical  
Control  
Systems

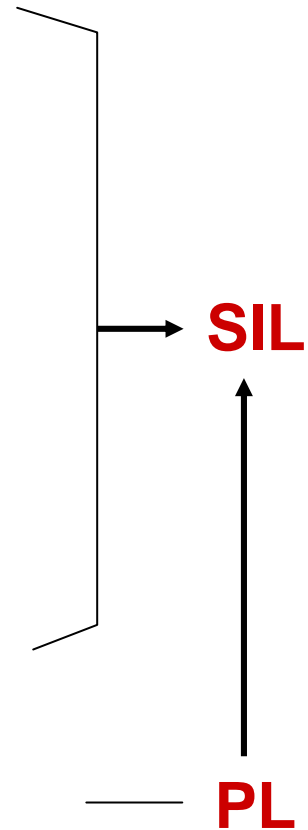


IEC 62061

**“Machinery”**  
Control  
Systems  
(All technologies)



ISO 13849-1: 2006  
replaces EN 954-1 in  
December 2009



# Example of regional requirements: Machinery Directive - European Union

- **EN ISO 13849-1:2006** Machinery safety – safety related parts of control system non electrical and simple electrical
  - This standard is a development of EN 954-1 and provides safety requirements and guiding principles for design and integration of safety-related parts of control system; e.g. electrical, mechanical, pneumatic and hydraulics technologies.
- **EN IEC 62061:2003** Machine safety – functional safety of electrical, electronic and programmable electronic control systems.
  - This is a machinery sector standard based on IEC 61508 primarily for electrical, electronic and programmable electronic systems.

**European Machine Directive  
2006/42/EC**

**Machine Safety - Basic concepts  
EN/ISO 12100**

**Machine Safety - Principles for Risk  
Assessment  
EN/ISO 14121**

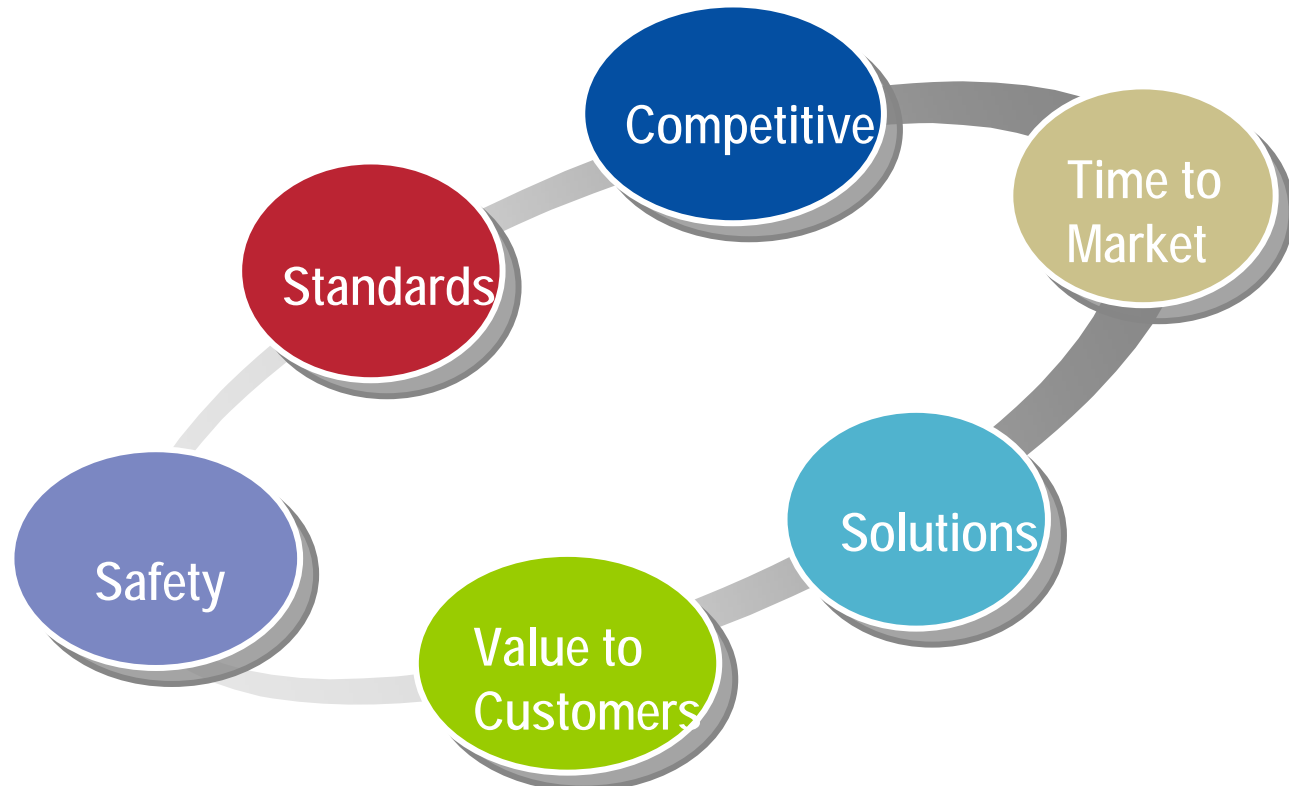
<b>Machine Safety - safety-related parts of control systems EN/ISO 13849-1 Non-electrical and simple electrical</b>	<b>Machine Safety - Functional safety of EEPES control systems IEC 62061</b>
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**Machine Safety - Electrical equipment  
of machines  
IEC 60204-1  
ANSI/NFPA 79**

# How can you win?

- How do OEMs maximize responsiveness and flexibility while delivering better, lower cost machines in record time?
- How do End Users optimize the latest technology and leverage best practices to reduce operating cost and improve profit margins?

By implementing a solution that addresses each of these challenges as an integrated system.



# Developing a Safety Strategy

- From a purely functional point of view the more efficiently a machine performs its task of processing material then the better it is. But, in order for a machine to be viable it must also be safe.
- Safety must be regarded as an integral part of the overall machine.
- In order to devise a proper safety strategy there must be two key steps, which work together.
  - RISK ASSESSMENT based on a clear understanding of the machine limits and functions and the tasks that may be required to be performed at the machine throughout its life.
  - RISK REDUCTION is then performed if necessary and safety measures are selected based on the information derived from the risk assessment stage.
- Safety Strategy is a Life Cycle approach to safety system development

# Functional Safety Life Cycle

## STEP 5

### MAINTAIN & IMPROVE The SAFETY SYSTEM

- Maintain the safety system at optimal levels
- Improve the safety system as new knowledge is gained



## STEP 1

### RISK OR HAZARD ASSESSMENT

- Identify the Hazards and Sources of Failure on a machine or process



## MACHINE SAFETY LIFE CYCLE

## STEP 4

### SAFETY SYSTEM VALIDATION

- Verify that the Safety System meets the requirements
- Train personnel to safely operate and maintain machine



## STEP 2

### SAFETY SYSTEM REQUIREMENTS

- Determine how much risk is tolerable
- Define methods to reduce risk to tolerable levels



## STEP 3

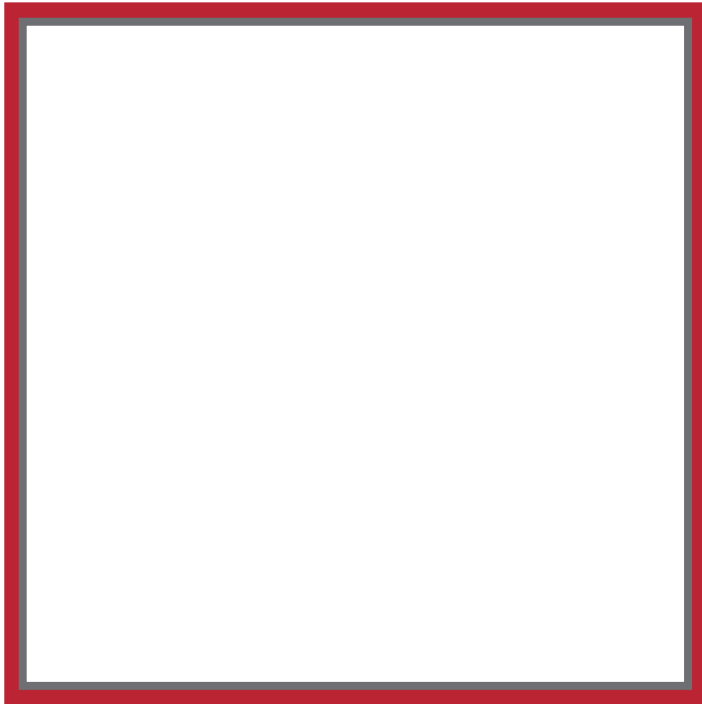
### SAFETY SYSTEM IMPLEMENTATION

- Design hazards out of the system
- *Choose / Purchase Safety Products for Guarding*
- Implement the Safety System



# In Summary: What does Functional Safety mean to me?

- It's a Culture; It's a Process; It's a design Philosophy
  - It is a combination of people systems (procedures) and technologies (components, circuits)
- It is a systematic approach –
  - Machine Safety is like an anchor chain – only as strong as the weakest link.
- It is a lifecycle –
  - From system concept, through Risk Assessment, Design, Build, Start-Up, Validation, Operations and Decommissioning



## Practical Example John Christiansen, Automation Manager, Gram Equipment