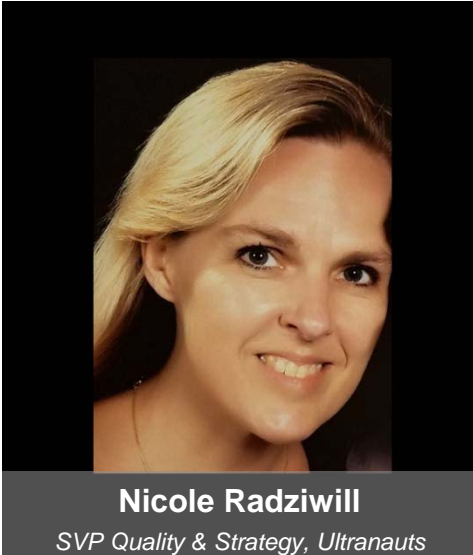


# Avoiding Automation Anxiety: Managing Risk in the Age of Industry 4.0

**Nicole M. Radziwill, PhD**  
SVP Quality & Strategy, Ultronauts Inc.

**INTELEX**

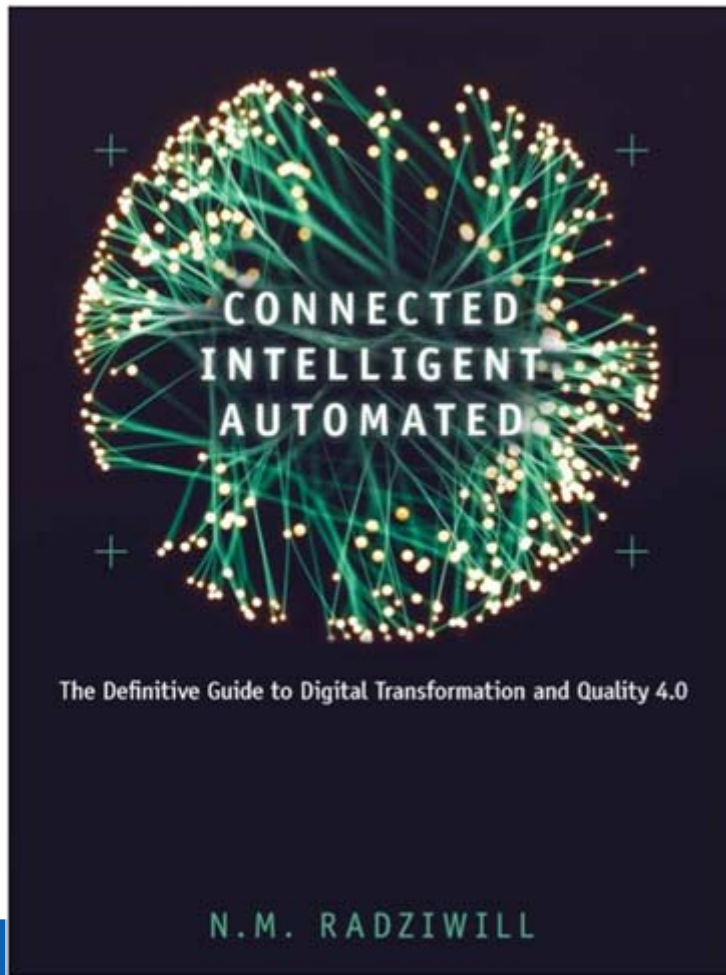
## About the Presenter



**Nicole Radziwill** is SVP Quality & Strategy at Ultronauts. She was formerly VP of the Quality and Supply Chain Practice at Intellex (EHSQ) in Toronto, Ontario, and is a former tenured Associate Professor of Production Systems and Data Science at James Madison University.

Nicole is a Fellow of the American Society for Quality (ASQ), a Certified Six Sigma Black Belt (CSSBB), a National Examiner for the Malcolm Baldrige National Quality Award (MBNQA), and Editor-in-Chief of Software Quality Professional journal with a PhD in Quality Systems from Indiana State. She is one of ASQ's Influential Voices and blogs at <http://qualityandinnovation.com>.

[nradziwill@ultronauts.co](mailto:nradziwill@ultronauts.co)

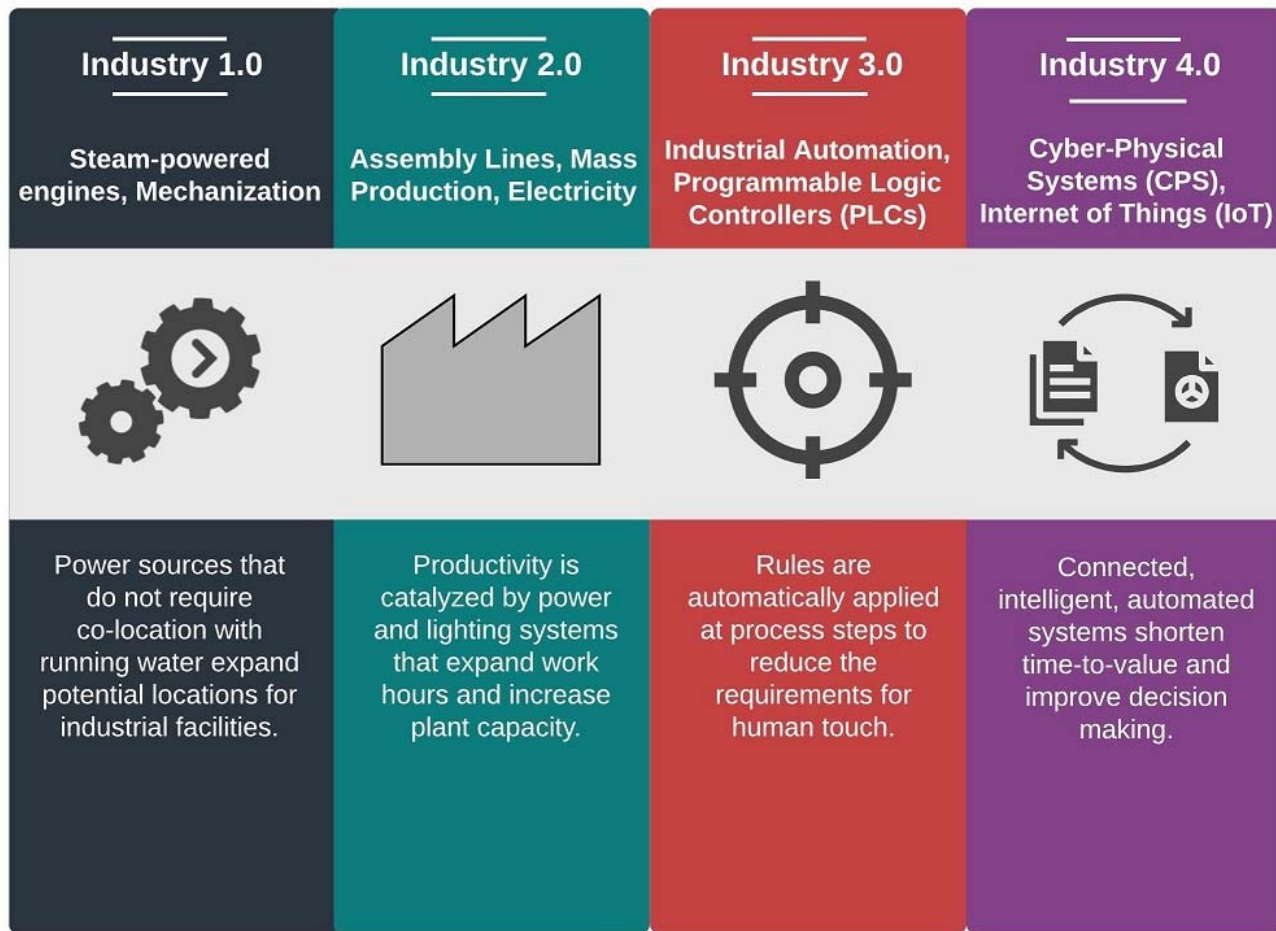


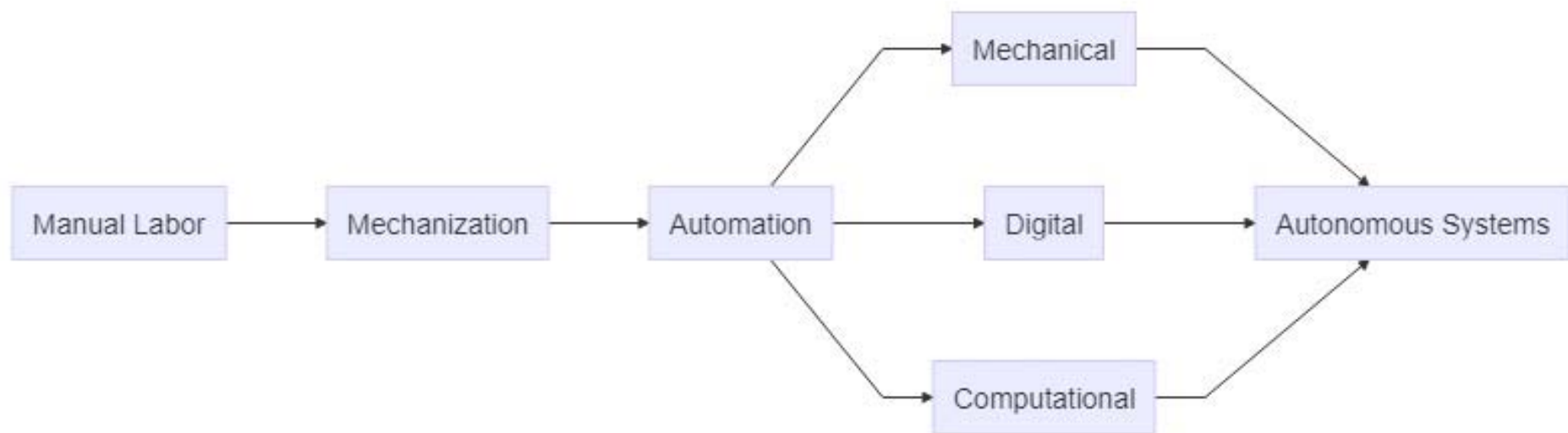
**June 15, 2020**

<https://amzn.to/2WvXmXr>

<https://asq.org/quality-press>



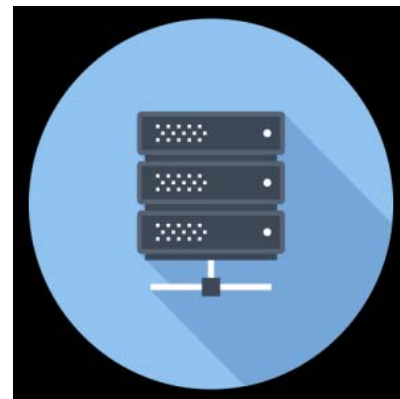






# Benefits of Automation

1. Accomplish processes that cannot be done manually
2. Improve complex, slow, labor intensive, error prone processes
3. Improve safety - shift hazardous tasks from humans to machines
4. Improve labor productivity, throughput, reduce lead time
5. Improve product quality, reduce variation in production
6. Increase flexibility, ability to add new products quickly
7. Free your team for more high value tasks
8. Reduce outages and improve time-to-recovery
9. Enhance error detection and increase resilience
10. Avoid losing competitive advantage



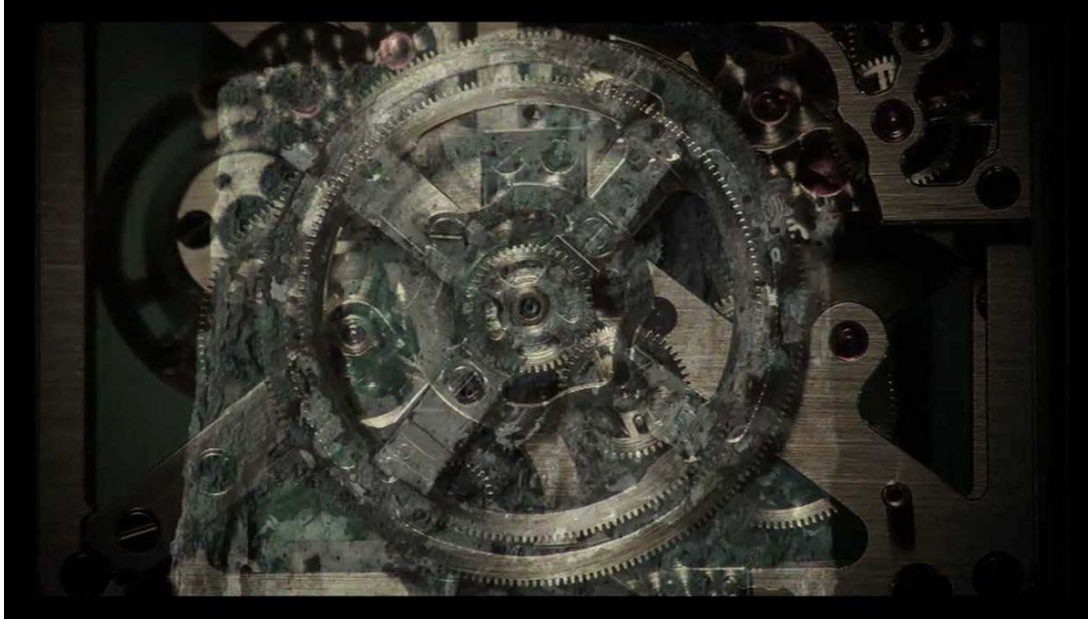
Greenberg, A. (2018). The untold story of NotPetya, the most devastating cyberattack in history. *Wired*, August, 22.



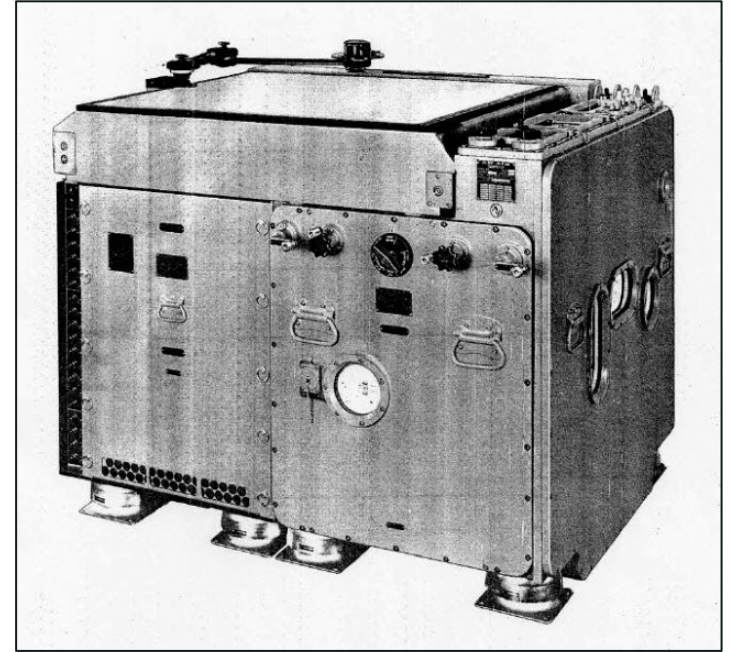
# Lesson #1

Automation is Much More than Robots and Hardware

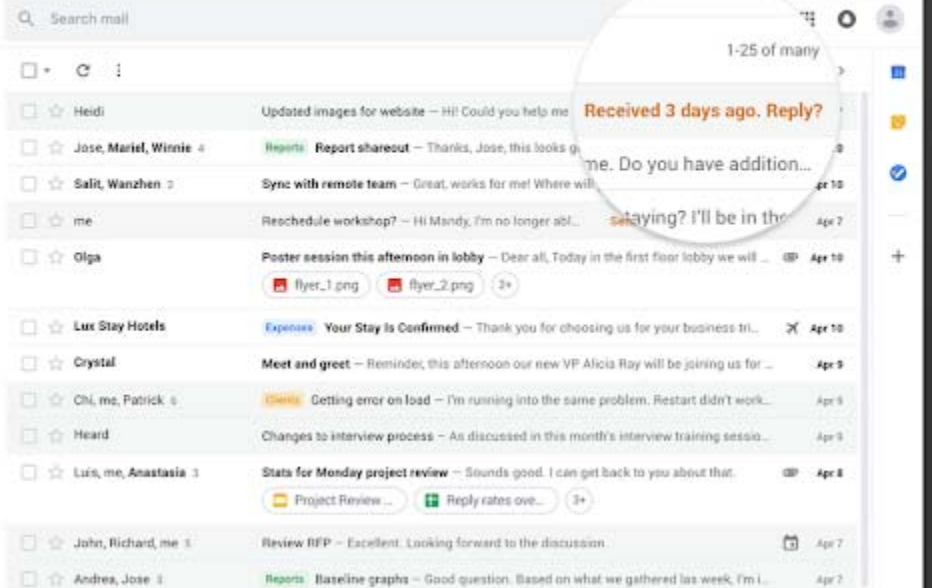
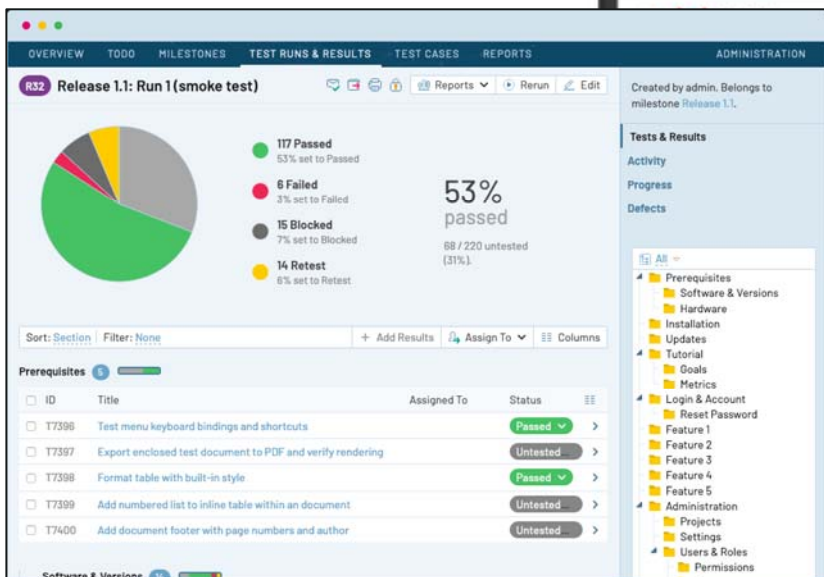
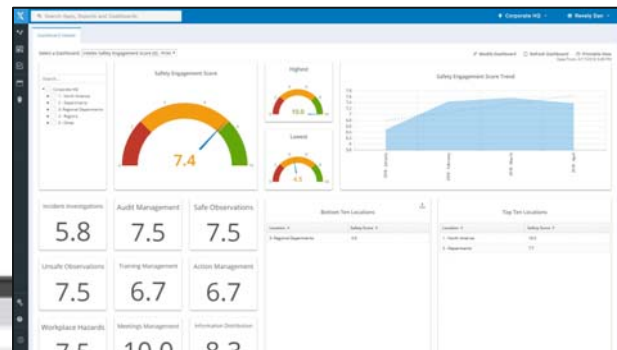
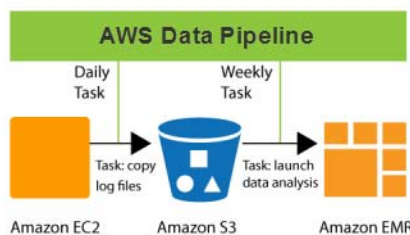




<https://www.washingtonpost.com/news/speaking-of-science/wp/2016/06/14/the-worlds-oldest-computer-is-still-revealing-its-secrets/>



<https://arstechnica.com/information-technology/2014/03/gears-of-war-when-mechanical-analog-computers-ruled-the-waves/3/>



ISA-95	Timescale	Description	Software & Hardware
"Level 5" (from Jacob)	months/ years	Strategy and Governance	Executive level activities including APM, CPM, GRC, knowledge management, ORM, SPI
Level 4	days	Business Planning and Logistics ( <b>Why</b> work is done; ensure work meets specifications)	Management oriented activities including APQP, CRM, Document control, ERP, GXP/PRP, HACCP, PLM (CAD/CAM, ETO, MTO), PPAP, Project management, QMS (Audits, CAPA/CAR, Continuous Improvement, Management review), Risk management (DFMEA, PFMEA, Control plans), SCM (SQM/SRM), Training and certification management
Level 3	hours	Operations Management ( <b>How</b> work is done)	Workflows including Deviations, EAM, EHS, Inspections, LIMS, MES/ MOM, MSA, SIEM, SPC. <b>A function is in Level 3 if it is critical to product quality, workplace safety, plant reliability, plant efficiency, or is critical to maintaining product or production regulatory compliance.</b>
Level 2	minutes	Monitoring and Supervising	Monitor and control oriented activities including DCS, Historian, HMI, Intelligent devices (e.g. cameras, scanners), SCADA, SIS
Level 1	seconds	Sensors, Field Devices, Field Controllers	Execution oriented activities including PLC, Sensors, switches, actuators, beacons, tags
Level 0	milliseconds/ microseconds	Physical Production Process	Hardware, physical devices, industrial robots

**Tasks &  
Processes**

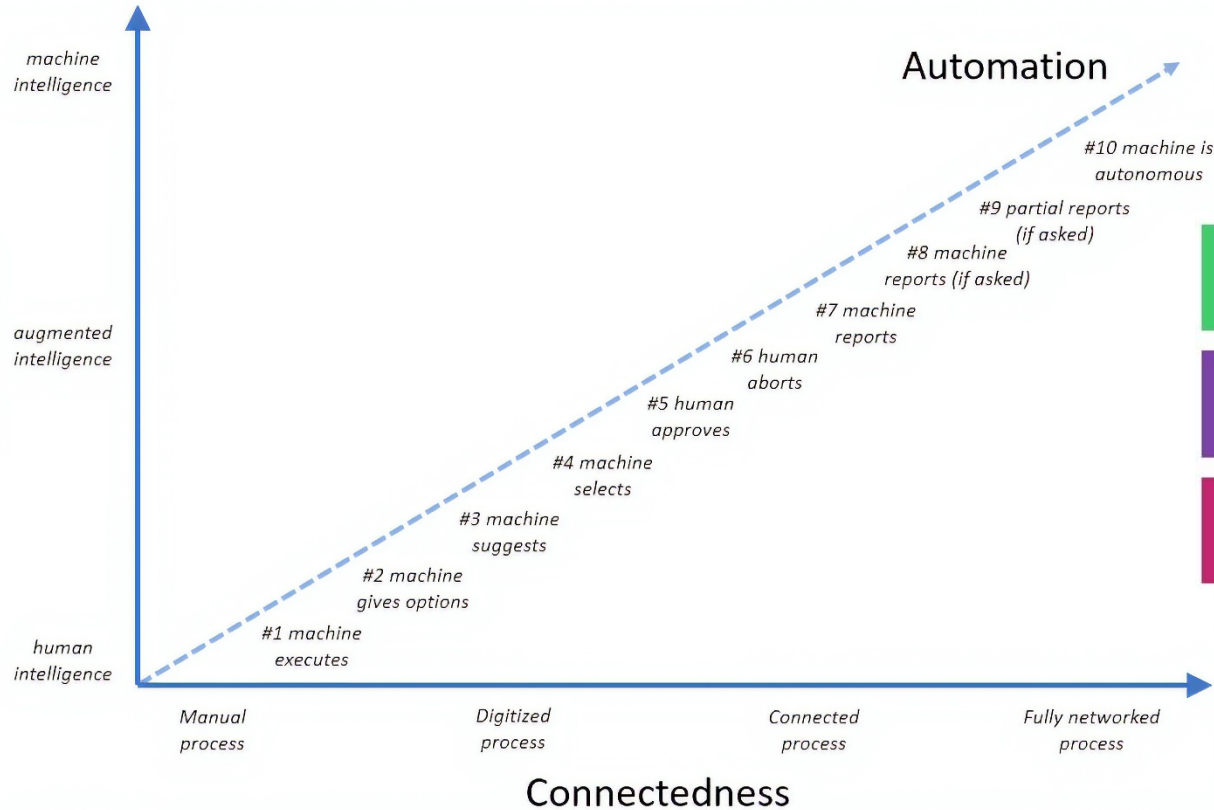
**Oversight &  
Governance**

# Lesson #2

Automation is a Spectrum







**Connectedness**

**Intelligence**

**Automation**

# Technology Follows Behavior

You buy a software system that automates sales communications. It provides you with intelligence about how well each pitch works (so you can customize pitches to future prospects).

If your sales force does not currently think or work in terms of “pitching,” it’s unlikely they will start thinking this way just because the software becomes available to do it. The automation investment will be in jeopardy.

# Lesson #3

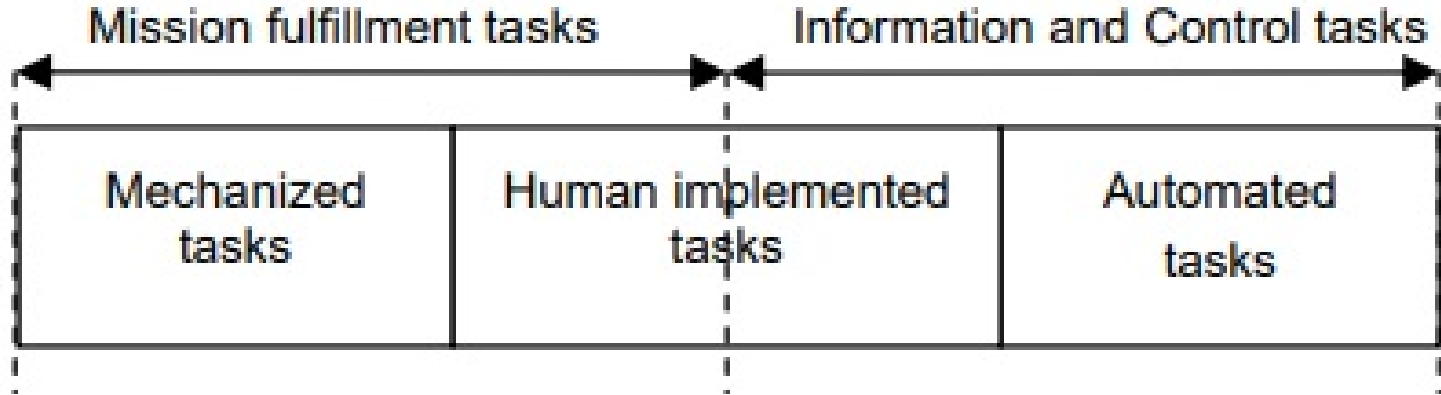
Automation Still Needs People



“Developing automation without consideration of the human operator leads to new and more catastrophic failures. For automation to fulfill its promise, designers must avoid a technology-centered approach and adopt an approach that considers the joint operator–automation system.

Automation-related problems arise because **introducing automation changes the type and extent of feedback that operators receive**, as well as the nature and structure of tasks. In addition, operators’ behavioral, cognitive, and emotional responses to these changes can leave the system vulnerable to failure.

Humans are good at:	Machines are good at:
<ul style="list-style-type: none"> <li>● Pattern recognition</li> <li>● Learning and generalizing old information and experiences to new situations</li> <li>● Identifying new solutions</li> <li>● Building trust with other humans</li> <li>● Creative or abstract thinking</li> </ul>	<ul style="list-style-type: none"> <li>● Repetitive tasks</li> <li>● Long duration tasks</li> <li>● Making quick, accurate calculations</li> <li>● Multitasking</li> <li>● Recalling information</li> <li>● Consistency</li> <li>● Precision</li> </ul>





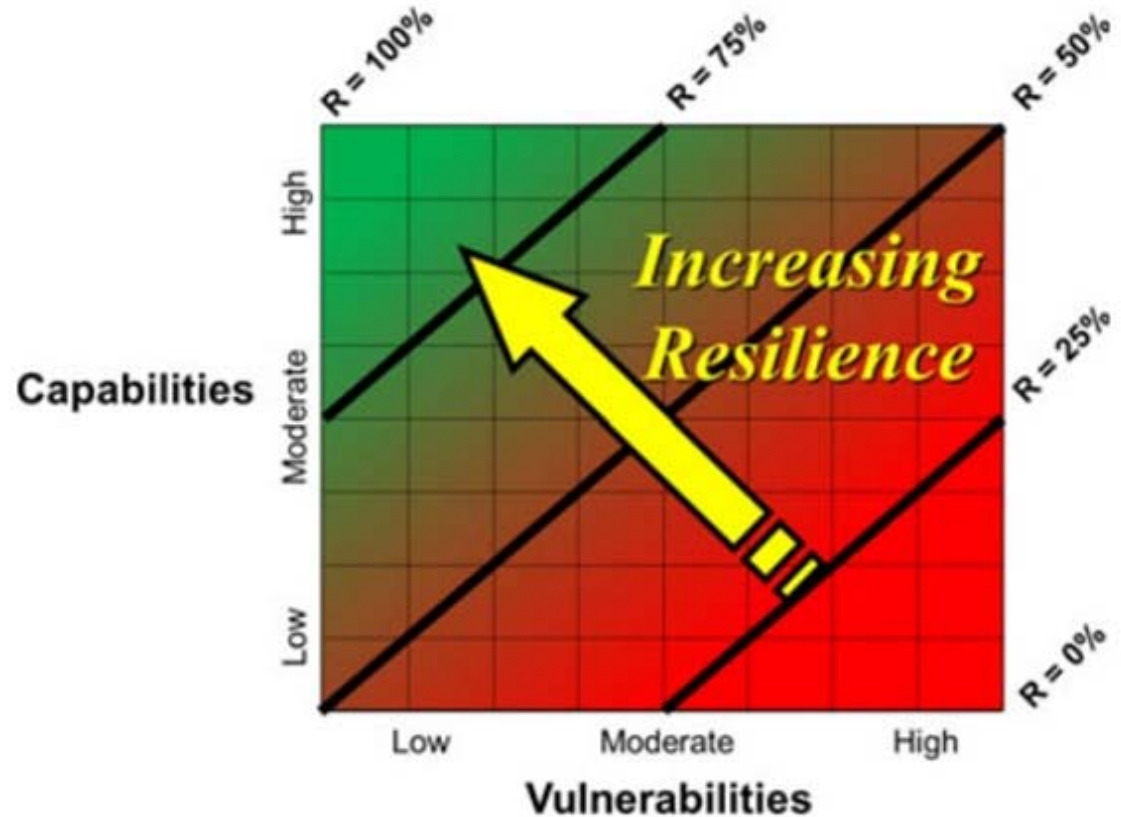
# Intelligent Automation

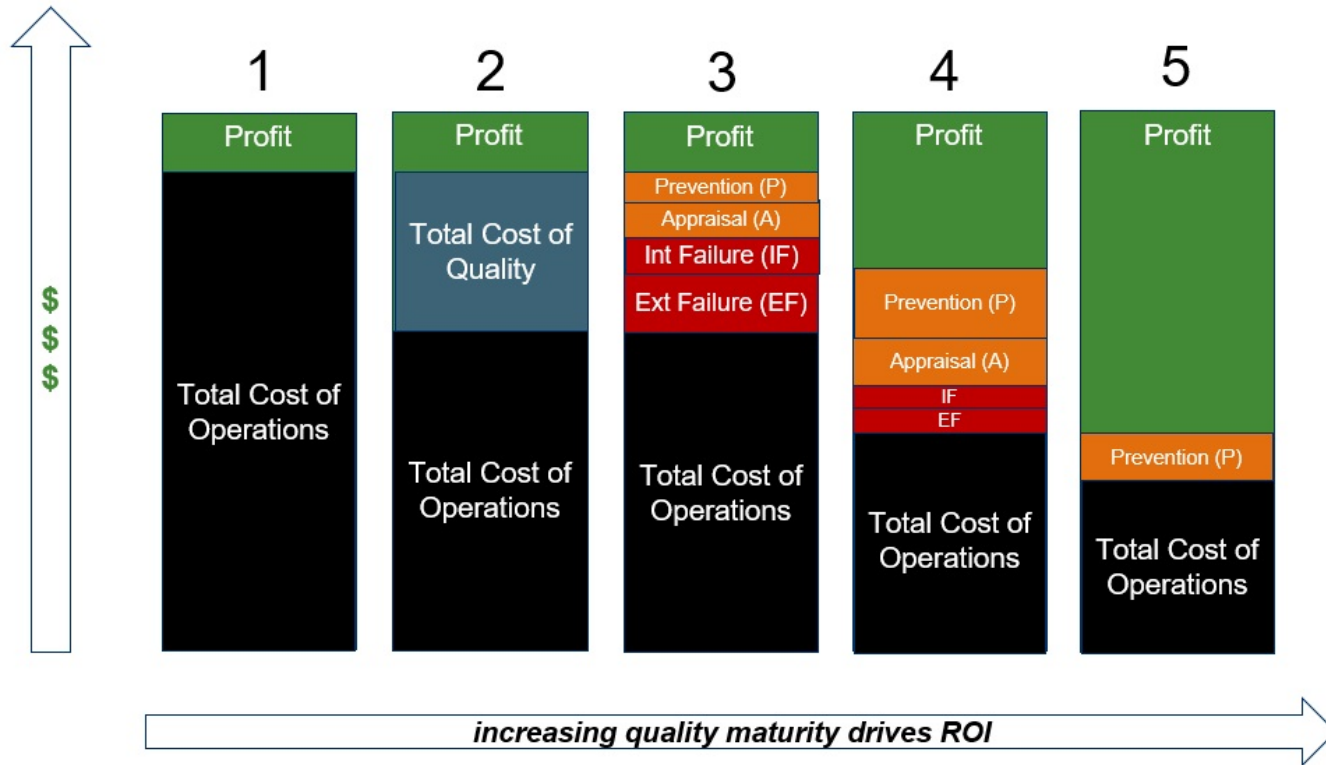
How to Deliver Optimal Value from Incremental Investment



# Build Resilience

- Reduce vulnerabilities
- Increase capabilities
- Build social capital





Adapted from DeFeo, J. A. (2018, March 28). The Smart Factory, Industry 4.0, and Quality. Juran Institute. Available from [https://www.youtube.com/watch?time\\_continue=4&v=z4-R4YZ\\_Ao8](https://www.youtube.com/watch?time_continue=4&v=z4-R4YZ_Ao8)

**WHY automation & WHY NOW**

**Choose WHAT to automate**

**Identify HOW to automate**

**Decide WHEN to automate**

## **Tasks & Processes**

1. High risk or mission critical
2. Unsafe or dangerous
3. Prone to human error
4. Manually intensive
5. Tedious
6. Frequent
7. Mathematically reducible

## **Oversight & Governance**

# Examples

from EHSQ, Pipeline Processing, and Software Test Automation



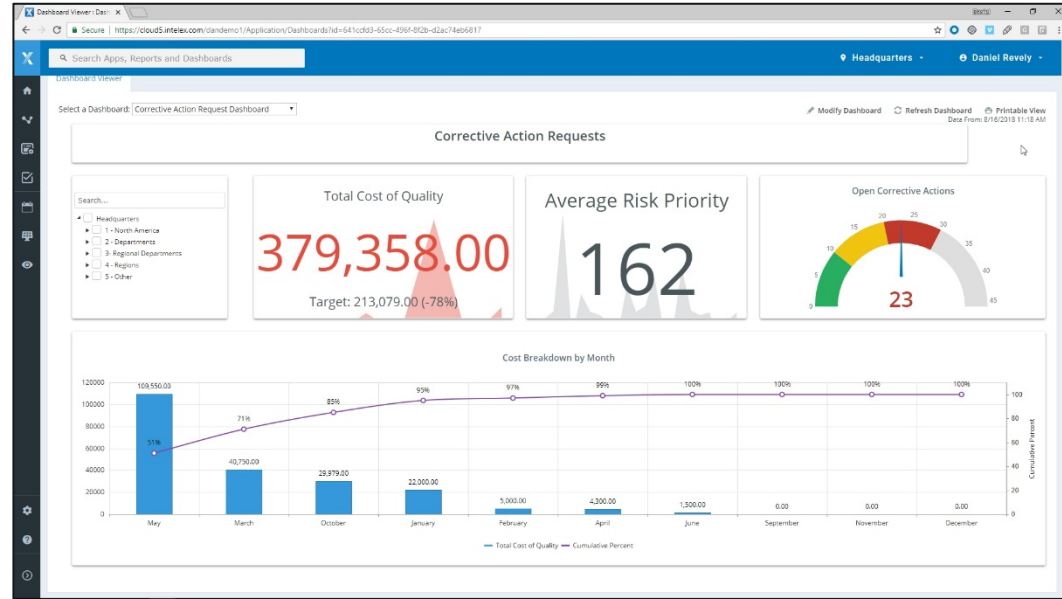


# Example 1: EHSQ Automation

You manufacture 12 different product lines. One of those lines generates 88% of your income.

You automate task management and action plans for working corrective actions (CARs) **only on that line**, reducing vulnerabilities associated with dropped tasks.

You build social capital by adding mobile capabilities to ensure your front line workers don't miss vital information.



## Example 2: Quality/ML Automation

You run a popular web site for cat pictures and cat memes that is supported by ad revenue. You receive pictures from subscribers, and also scour popular web sites and cat groups to keep your site fresh.

A Failure Mode and Effects Analysis (FMEA) of 16 key data ingest channels indicates a significant reduction in Risk Priority Number by automating image inspection on just two channels using deep learning.

By automating image processing **on only these two channels**, you increase staff capabilities by freeing them up for more value-adding tasks.



## Be the Algorithm

Once you've looked at aggregate metrics and cluster information, I'd encourage you to follow the advice in "Monica Rogati: How to Choose and Prioritize ML Projects" on page 20 and try to do your model's job by labeling a few data points in each cluster with the results you would like a model to produce.

If you have never tried doing your algorithm's job, it will be hard to judge the quality of its results. On the other side, if you spend some time labeling data yourself, you will often notice trends that will make your modeling task much easier.

You might recognize this advice from our previous section about heuristics, and it should not surprise you. Choosing a modeling approach involves making almost as many assumptions about our data as building heuristics, so it makes sense for these assumptions to be data driven.

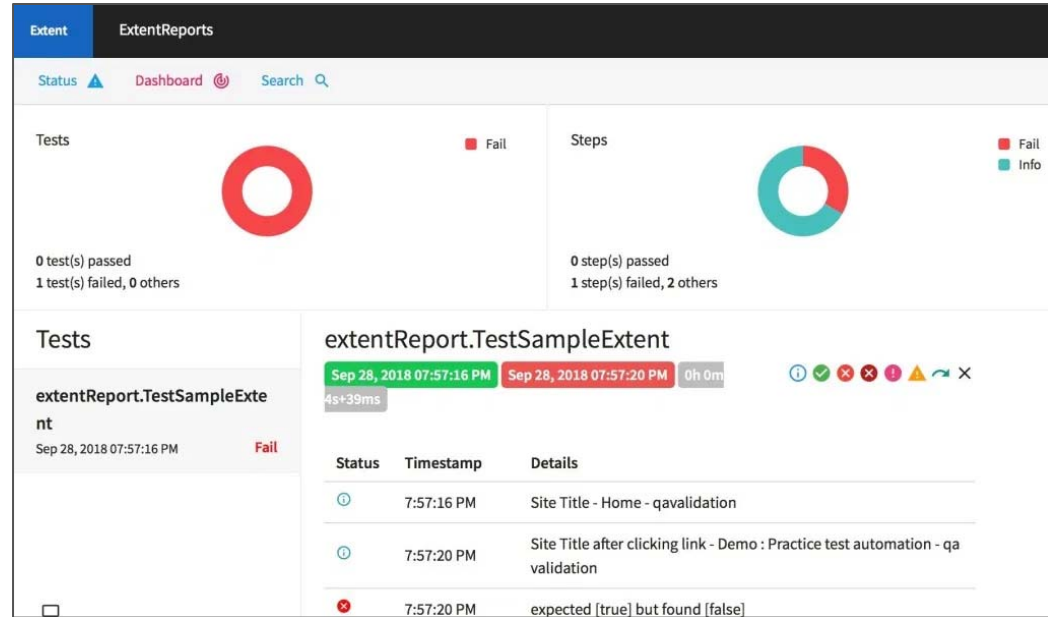
You should label data even if your dataset contains labels. This allows you to validate that your labels do capture the correct information and that they are correct. In our

# Example 3: Software Test Automation

Your organization relies on a full EHSQ software suite for incident management, observations, and tracking frequent compliance training to ensure that only properly prepared workers conduct inspections.

Two of these applications service 78% of all transactions.

You simplify 7,200 test cases on these apps to 650 using combinatorial methods, and implement automated UI tests to catch issues before your users experience them.



# Build Resilience

- Reduce vulnerabilities
- Increase capabilities
- Build social capital

***Nicole Radziwill***

SVP Quality & Strategy

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## Tasks & Processes

1. High risk or mission critical
2. Unsafe or dangerous
3. Prone to human error
4. Manually intensive
5. Tedious
6. Frequent
7. Mathematically reducible

## Oversight & Governance

# Thank You!