Digital Transformation is Revolutionizing Manufacturing

David A. Vasko | Oct 19, 2017

PURDUE UNIVERSITY.

Manufacturing Forum-2017

Catching the Digital Wave

Rockwell Automation

DIGITAL
Transformation

THE “HIDDEN” FACTORY

64% Rely more on experience when addressing key business issues

25% Using data for proactive purposes

57% Using spreadsheets to analyze sensor data

THE PROBLEM ISN’T A LACK OF DATA

IT’S A LACK OF CONNECTIVITY

Sources: IndustryWeek, MESA, ARC

DIGITAL TRANSFORMATION BENEFITS

Reimagining Business Models

Operational Benefits

TIME TO MARKET

Faster prototype for new product introductions
Shorter cycle times
Mass customization make to order vs make to stock

PRODUCTIVITY

Shorter setup and change over times
Improved quality
Reduction in downtime
Reduction in energy consumption

SUPPLY

Reduced inventory & waste
Improved planning & forecasting

COMPLIANCE

Reduction in human errors and risk of product recall
Automated digital monitoring ensures accurate records

Beyond Operational Benefits…

NEW BUSINESS & REVENUE STREAMS

NEW FINANCIAL MODELS

PAY FOR USE & PERFORMANCE

TECHNOLOGY **UPGRADES**

The Rockwell Automation *Journey*

Rockwell Automation

Rockwell Automation at A GLANCE

$5.9B
FISCAL 2016 SALES

22,000
EMPLOYEES

80+
COUNTRIES

WORLD'S LARGEST COMPANY DEDICATED
TO INDUSTRIAL AUTOMATION AND INFORMATION

AUTOMATION for a *broad range*
SOLUTIONS *of industries*

SERVING
CUSTOMERS FOR
114 YRS

- Innovation
- Domain expertise
- Culture of integrity & corporate responsibility

2017 WORLD'S MOST ETHICAL COMPANIES® ™
WWW.ETHISPHERE.COM

ABOVE-MARKET GROWTH | PRODUCTIVITY | INTELLECTUAL CAPITAL **VALUE CREATION**

ROCKWELL AUTOMATION

Manufacturing Overview

Rockwell Automation

387,000
SKUs

20
PLANTS

UP TO
200 SKUs
AVG ORDER

20 YEARS
AVG PRODUCT LIFE

PRODUCT TYPES
- *Stock + Configure to Order*
- *Engineered to Order*

BROAD PORTFOLIO
Integrated Architecture®

DESIGN SOFTWARE

Studio 5000 | CCW | Arena

DISTRIBUTED CONTROL SYSTEM

PlantPAx System

VISUALIZATION & INFORMATION SOFTWARE

FactoryTalk | ThinManager

PROGRAMMABLE AUTOMATION CONTROLLERS

CompactLogix | ControlLogix | GuardLogix | Armor GuardLogix

INDUSTRIAL NETWORK INFRASTRUCTURE

Stratix

OPERATOR INTERFACES & INDUSTRIAL COMPUTERS

PanelView | MobileView

SMART SENSING DEVICES

RightSight | VisiSight | RFID | Pressure

INPUT / OUTPUT DEVICES

Compact I/O | Flex I/O | Point I/O | ArmorBlock | ArmorPoint

MOTOR CONTROL DEVICES

PowerFlex | IntelliCENTER

MOTION CONTROL

Kinetix | iTRAK | MagneMotion

THE LACK OF CONNECTION
Between ERP & The Floor

ISSUES CAUSED BY LACK OF CONNECTIVITY

DATA

- No Data
- Inconsistent/Bad Data
- Irrelevant Data

RESULTS

- Slow Decisions
- Inconsistent Analysis
- Wrong Conclusions
- Not Tied to Key Business KPIs

THE LACK OF CONNECTIONS
IT/OT Convergence

Business Systems – Transactional

ERP - MRP FINANCIALS HR LOGISTICS QUALITY CRM . . .

IT

CONVERGENCE

Operations - Real-time

OT

SENSORS, ACTUATORS

CONTROLLERS

MATERIALS & TRANSPORT

MACHINES & EQUIPMENT . . .

OPERATIONS EXECUTIVE SPONSORSHIP

PROCESS MAP

ASK THE RIGHT QUESTIONS

Determine Business Drivers & Strategy

Justify Various Phases

Assess ROI

DETERMINING READINESS

GAIN BUY IN

- ✓ DETERMINE FUNDING
- ✓ ESTABLISH APPROACH

ORGANIZATION

✓ STRUCTURE ✓ TALENT ✓ CULTURE

MACHINE & NETWORK

- ✓ SMART SENSORS
- ✓ NETWORK ROBUSTNESS, SPEED & SECURITY

THE CONNECTED ENTERPRISE

Execution

TWB_SM3

Current Shift Output	278/556	Optel Setup Number	7944
Shift Output Goal	1700/3400	Current Order Number	4005457017
Current Shift Eff	93%	Current Part Number	PN-235754
Shift Eff Goal	70%	Current Order Qty	1250/2500
Current Shift Yield		Current Order Balance	290/580
Yield Goal	95%	Average Unit Time	00:49
Last CO Time	01:16	Expected Finish	10/08/14 05:32:05
		Last Updated	10/07/14 12:30:11

Current Constraint Time (mm:ss)

GC5(U): 01:14 FPZ1(U): 01:08 FP9(U): 01:06 FP4(U): 00:22 OV11(S): 00:36

Quality Data - Current Order

	Fail_Code	Cause_Operation	Ref_Desig	Quantity
1	0030-Test equipment error	TWB_PCBA_ICT		24
2	E55-Fixture or seating problem	TWB_PCBA_ICT	SW1	15
3	M20-Missing component	TWB_PCBA_SM6_SM_BOT_GSM	C498	7
4	E55.06-Test jet failure	TWB_PCBA_ICT	U75	6
5	M75-Bad Component	TWB_PCBA_SM3_TOP_FP	SW1	6

Quality Data - Last 90 Days - Current Part

	Fail Code	Cause Operation	Ref Des	Quantity
1	0030-Test equipment error	TWB_PCBA_ICT		1370
2	P16-Part misaligned	TWB_PCBA_SM6_BOT_FP	RV1	118
3	M75-Bad Component	TWB_PCBA_SM6_BOT_FP	Y3	116
4	E55.01-Wrong assy of encoder	TWB_PCBA_ICT	U75	92
5	E55.06-	TWB_PCBA_ICT	U75	80

Hourly Performance

Help

Hour	Output Hr	Output Shift	CO Time (mm:ss)	Line Eff Hr (%)	Line Eff Shift (%)	Yield (%)	Line Working (min)
12:00 - 13:00	20/40	278/556	0:0	82	93	N/A	30
11:00 - 12:00	37/74	259/518	0:0	76	94	N/A	60
10:00 - 11:00	36/72	222/444	3:10	223	96	N/A	60
09:00 - 10:00	35/70	187/374	0:0	72	73	N/A	60
08:00 - 9:00	32/64	151/302	0:0	60	72	N/A	60
07:00 - 8:00	34/68	118/236	0:0	70	74	N/A	60
06:00 - 7:00	37/74	84/168	0:0	76	76	N/A	60
05:00 - 6:00	38/76	47/94	0:0	78	76	N/A	60
04:00 - 5:00	39/78	476/952	0:0	80	82	N/A	60
03:00 - 4:00	40/80	447/894	0:0	82	81	N/A	60
02:00 - 3:00	40/80	408/816	0:0	82	82	N/A	60
01:00 - 2:00	49/98	368/736	0:0	101	81	N/A	60

Downtime Events

Type	Time Open	Time Closed	Status
MACHINE - COMP PICK ISSUE - 4005457017	10/07/14 11:32		Running Impaired
MACHINE - SOLDER PASTE ISSUE - 4005457017	10/07/14 07:52		Running Impaired
MACHINE - NOZZLE ISSUE - 4005457017	10/07/14 05:51		Running Impaired
SCRAP - HIGH SCRAP RATE - 4005457017	10/07/14 07:56	10/07/14 08:19	Up
BARCODE - INOP/NO READ - 4005457017	10/07/14 07:24	10/07/14 07:25	Up

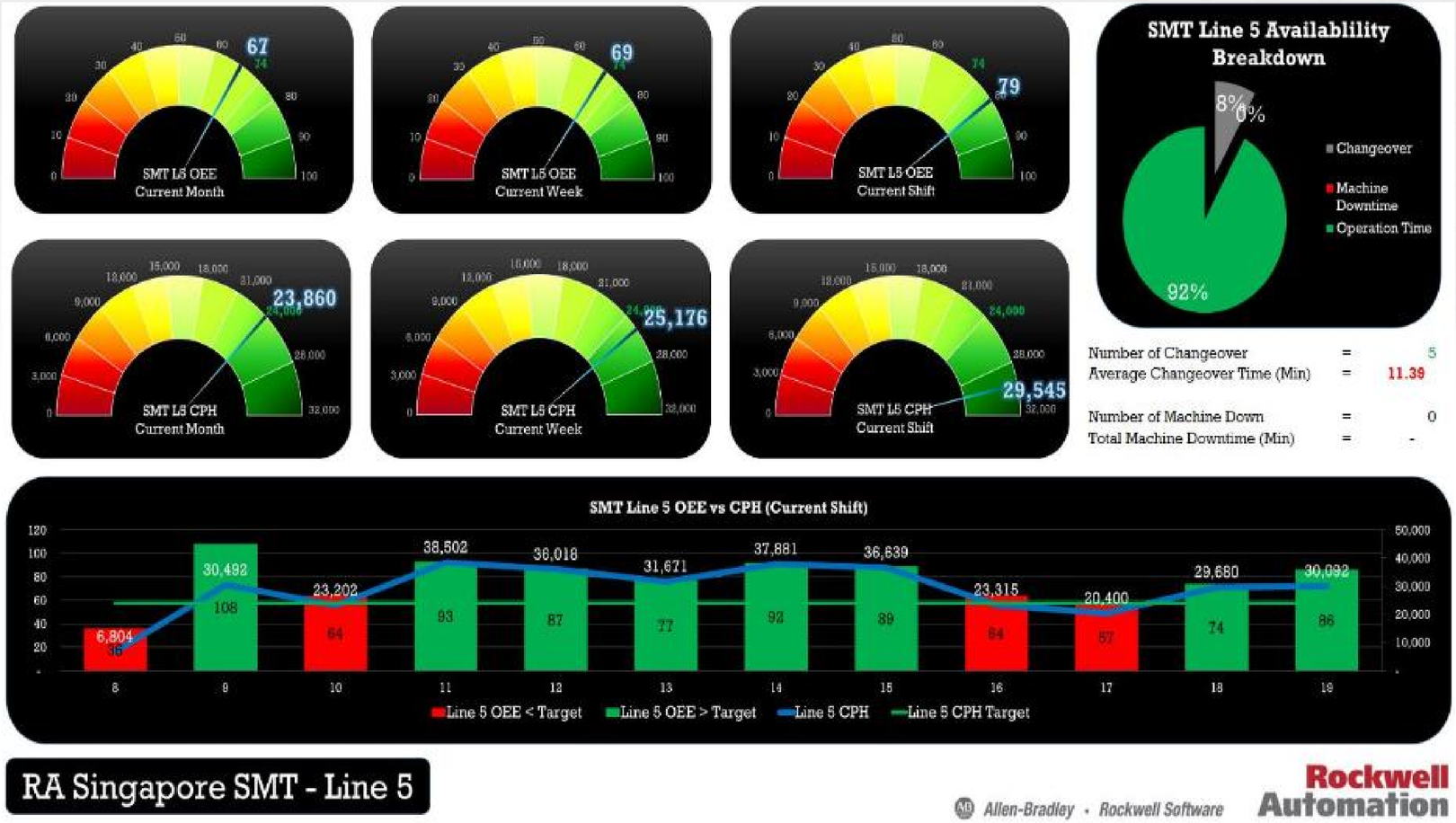
Queue

Priority	Status	Expected Start Time	Expected Duration (Hrs)	Work Order Number	Part Number	Quantity
7944 - 2	Delv	10/08/14 06:56	0.6	4005484845-Top	PN-195482	25/50
7945 - 1	Sched	10/08/14 08:16	4.1	4005467376-Top	PN-135497	239/478
7946 - 1	Sched	10/08/14 13:09	2.1	4005471453-Top	PN-177875	115/690
7946 - 2	Sched	10/08/14 16:01	2.1	4005494816-Top	PN-177875	115/690
7946 - 3	Sched	10/08/14 18:54	2.8	4005494825-Top	PN-177873	145/870
7947 - 1	Sched	10/08/14 22:28	0.4	4005498675-Top	PN-210326	25/50

Production Cell Performance Displays – Actionable Information

THE CONNECTED ENTERPRISE

Remote Dashboarding



THE CONNECTED ENTERPRISE

Rockwell Automation Transformation

Inventory
120 days to 82 days

Delivery
Mid-80s to 96%

Time to Want
82% to 98%

CapEx
30% per year in capital avoidance

Lead Times
Reduced 50%

Quality
50% reduction in PPM

Productivity ► 4% to 5% per year

Rockwell Automation Journey Video

THE CONNECTED ENTERPRISE
Rockwell Automation Transformation

KEY TAKEWAYS

Senior Management Sponsorship Required

Strong IT and OT Collaboration is Essential

Don’t Underestimate the Culture Change Required

Create a “Win” … Others Will Follow

Must be Tied to Business Strategy … Not a Stand Alone Initiative

Focus on Critical KPIs … Versus Data

Never Ending Journey … Close Monitoring Required

Faster Time to Market

Lower Total Cost of Ownership

Improved Asset Utilization

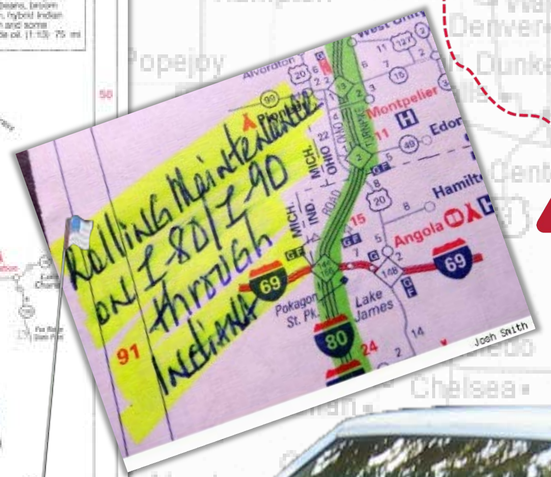
Enterprise Risk Management

Our Customer's *Journey*

Rockwell Automation

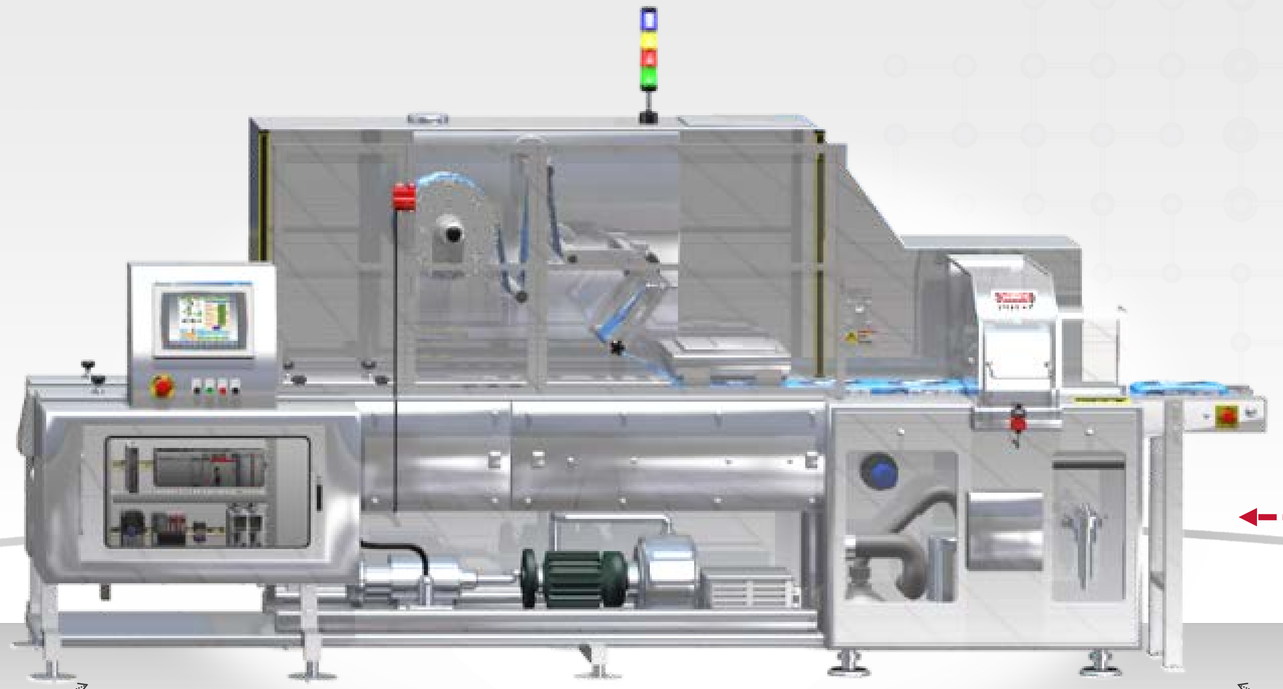
DATA
Competitive Advantage

DATA
Into Insight



SMARTER

Machines & Equipment



Real-time Data

Voltage, Current, Running Time, Temperature

Information

CONTEXTUALIZATION

Energy/Product, Kwh, OEE

Knowledge

ANALYTICS

Predict bearing will fail in 10 hours

Wisdom

OPTIMIZE

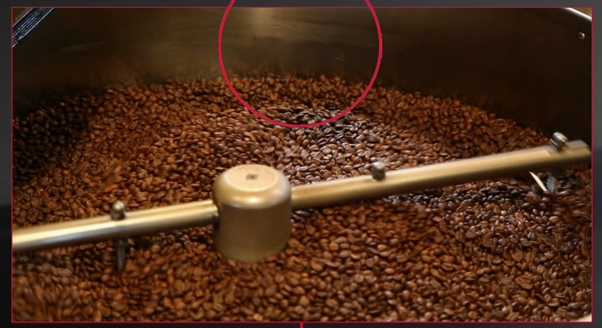
More efficient process workflows

PREDICTIVE ANALYTICS ARCHITECTURE

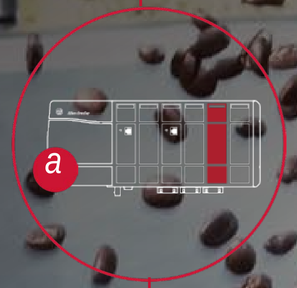
Pilot at Customer Site

CHALLENGE

Vapor caused downtime of dryer



Coffee beans release varying amounts of vapor contaminating heat transfer surfaces



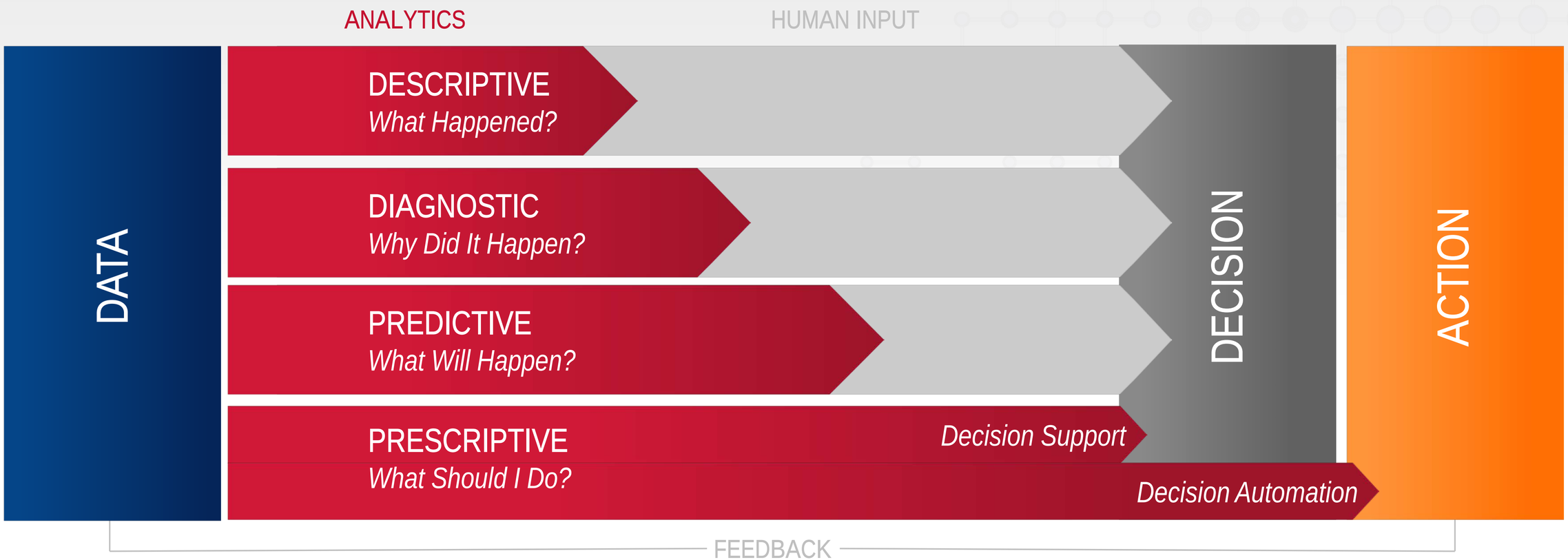
Analytics *in the cloud* optimizes multiple dryers

Analytics *at the controller* determines when to clean the surface per type of bean

Eliminated contamination and higher productivity / uptime achieved!

ANALYTICS

The discovery and communication of meaningful patterns in data



*Source: Gartner

Finding The

Path to Value

THINK SMALL AND WORK YOUR WAY UP

CONNECTED OPERATIONS

58%
Improved product quality

PREVENTATIVE MAINTENANCE

47%
Improved maintenance uptime

REMOTE MONITORING

40%
Improved coordination with customers

PREDICTIVE ANALYTICS

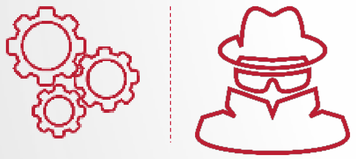
57%
Increased speed of operations

*Sources: MPI Internet of Things Study, The MPI Group, December 2015

WHAT'S GETTING IN THE WAY

ORGANIZATIONAL DISCONNECT

OT & IT are silo'd organizations with different cultures, objectives and priorities



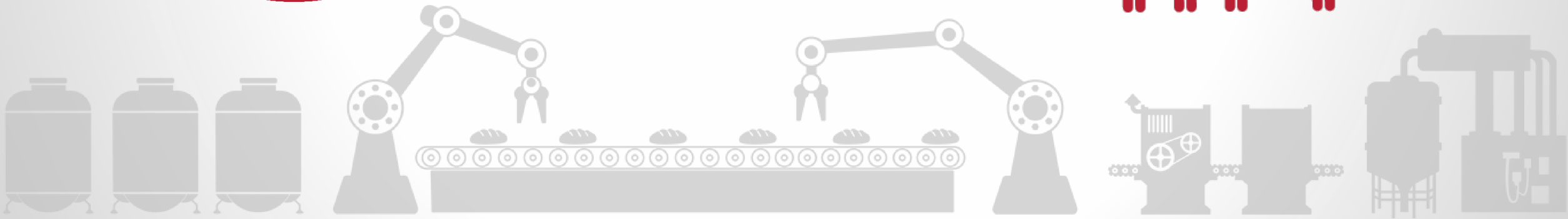
SECURITY & DATA PROTECTION

Security breaches can be a huge contributor to unscheduled downtime

$4M AVG COST OF DATA BREACH*

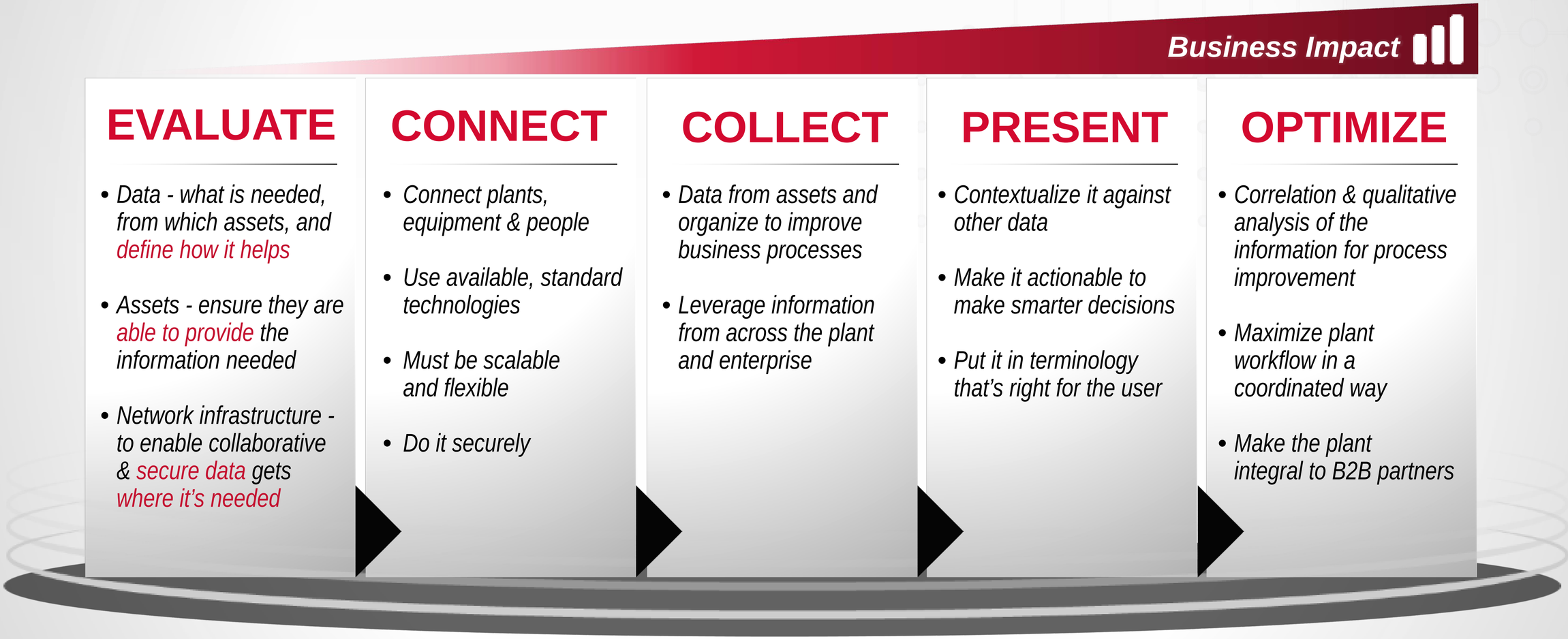
NEW WORKFORCE SKILL GAPS

Tribal knowledge is getting ready to walk out the door



*Source: Ponemon Institute

WHERE TO START
Pragmatic Steps



Enabling the Workforce
of the Future
Rockwell Automation

418,000 Boomers

left the Workforce in 2013

Source: USA TODAY

30M+ GEN Zs

will be employed by 2019

Source: Industry Week

SKILLS
AT ALL LEVELS

85%

of jobs will change by 2030

NEW
INNOVATORS

IT TAKES A VILLAGE

TIPS for SUCCESS

Implementing a Connected Enterprise will bring positive impact to your business

- **Don’t** Wait
- **Identify** Opportunities
- **Start** Small
- **Work** with Partners
- **Continuously** Improve
- **Develop** Talent

FOR MORE INFORMATION

The Connected Enterprise visit:

www.rockwellautomation.com/connectedenterprise

Rockwell Automation

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