

Albemarle's Digital Transformation

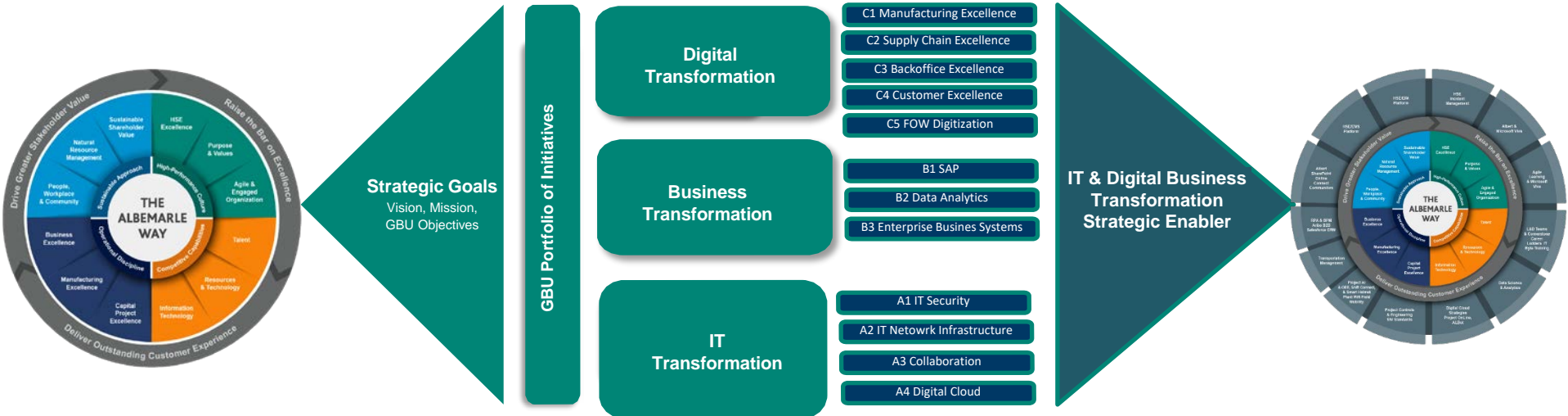
Patrick Thompson
Chief Information & Digital Transformation Officer

Global Business IT Digitization Strategy



Right Information. Right Time. Anywhere.

Albemarle IT Mission Right Information. Right Time. Anywhere! *Empowering our Employee's Potential*



IT Digital Strategy built and aligned with Albemarle Excellence Programs

IT Transformation



Right Information. Right Time. Anywhere.

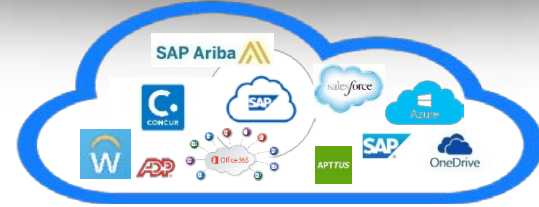
Engineering & HSE Apps



Collaborative
Albert, Sync, Share
ConvergePoint



Private & Public Cloud Computing



BYOD
Albert, Workflow, Communications,
Fiori, Cloud Apps, Office 365



3-1 Mobility Computing
Desktop/Laptop/Tablet

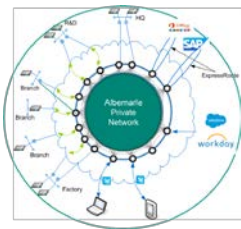


Always On - VPN Anywhere
SSO &
Self Service Password Reset

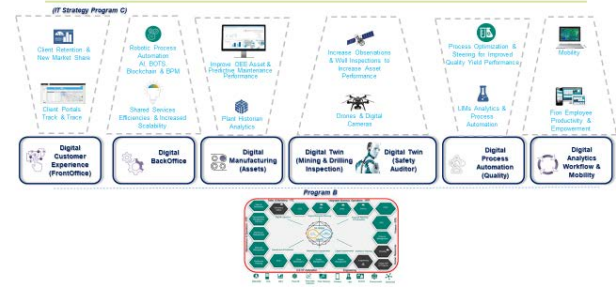
Plant
SharePoint Management of Change
(Lotus Notes Sunset)



Network & ICS
Zoning Improvements



Program C - Digital Business Transformation



OEE & Yield Improvements
Performance Analytics



Elemica

Transportation Management
Track & Trace



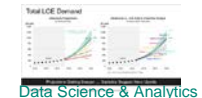
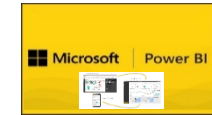
NIST, GDPR, DRM
Document & Records
Management



SAP S4 Fiori Support



Compliance, Financial, & Spend Analytic Dashboards



Data Science & Analytics



Business Transformation

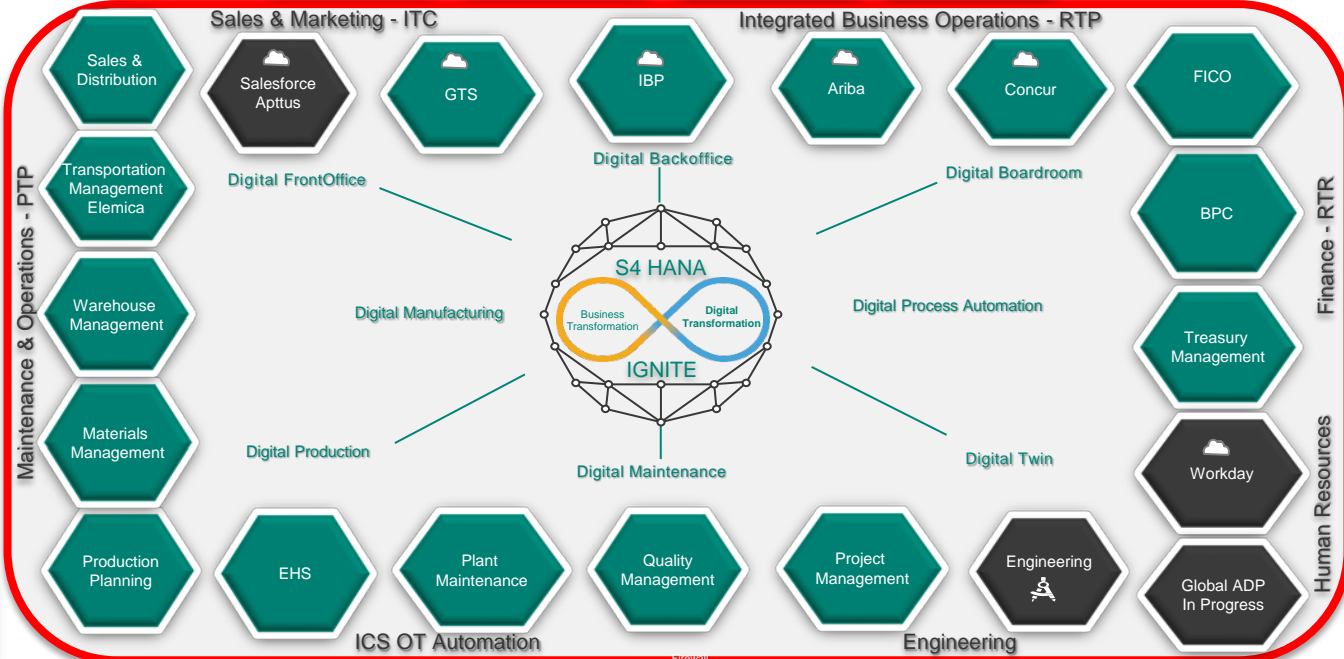


Digital Operations Centers

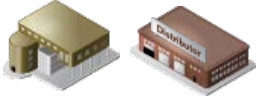


Unified Messaging & Collaboration

Digital Boardroom & SAP Cloud Analytics



Extranet Client Portals



Supplier Track & Trace

Client Track & Trace



Digital OT Dashboards



Maintenance & Operations - PTP

Finance - RTR



Security



DCS



MES



Plant DB



Plant Data Collection



Plant Historian



Wireless



LIMs



SCADA



Environmental

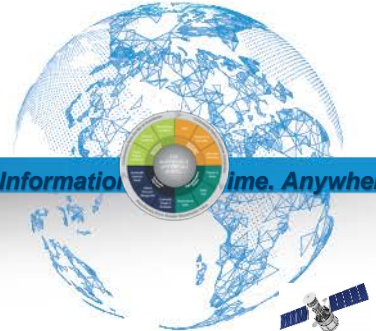


SENSORS



Research & Technology

Digital Transformation



Right Information. Right Time. Anywhere.



Shared Services
Efficiencies & Increased Scalability

Improve OEE Asset &
Quality Product Delivery

Ariba Supply Chain
Sourcing, Warehouse,
Delivery, Global Trade



Business Process Mining &
Robotics Process Automation



Digital Operations Centers



Plant Historian
Osi PI Analytics



LIMS
NWA Analytics



Increase Observations &
Well Inspections to
Increase Asset
Performance



Client
Retention & New Market Share



Salesforce Customer
Portals and Track &
Trace



Digital
BackOffice
Excellence

Digital
Manufacturing
Excellence

Digital
Supply Chain
Excellence

Digital
Customer
Excellence



Drones & Digital
Cameras

Digital Drones
& Smart Helmet



Smart Helmet

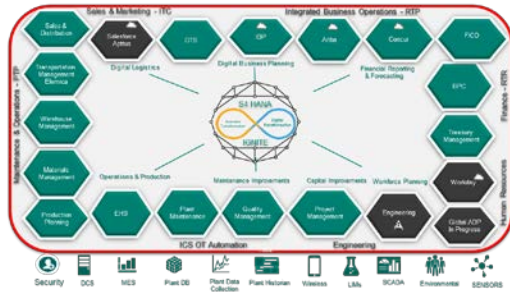
Eliminate & Reduce
Incidents & Recordables



Drones & Digital
Cameras



Digital Twin
(Safety Auditor
Smart Helmet)



Digital
Workflow &
Mobility



Mobility

Fiori Employee
Productivity & Empowerment





Albemarle Excellence Digitization Portfolio



ALBEMARLE *Right Information. Right Time. Anywhere.*

NPS
Customer Satisfaction Analytics
Net Promoter Score

Ariba Supply Chain
Sourcing, B2B, Warehouse, Global
Trade, Risk Management, Life Cycle
Management

Digital Drones
Satellite Imagery &
Smart Helmet

FP&A KPI Analytics

Hoteling & Hybrid Innovation Hubs

Customer
Customer Self Service Order

Transportation Management
Customer Track & Trace

Field Mobility – OEE, Shift Connect, HSE, EIMS

Microsoft Project On-Line
Non-Manufacturing Project Portfolio
Management

Digitization 1.0 to 4.0 Road Maps
HSE, MX, Engineering, R&D



Manufacturing Cloud & DocuSign
& Customer Service Portal

STP
BPM & RPA

Project AI

Plant Historian
Osi Pi Analytics

Digital
Manufacturing
Excellence
(MX)

LIMs
NWA Analytics

Business Process Mining &
Robotics Process Automation

INTRODUCING ALBOT
Albemarle's
Support
chat bot

Microsoft Viva
Insights, Topics, Connections, Learning



Digital
Customer
Excellence
(CX)

Digital
Supply Chain
Excellence
(SX)

Digital
BackOffice
Excellence
(BX)

Digital
Future of Work
Excellence
(FX)

Albemarle Cybersecurity Framework

Henry Capello
Chief Information Security Officer

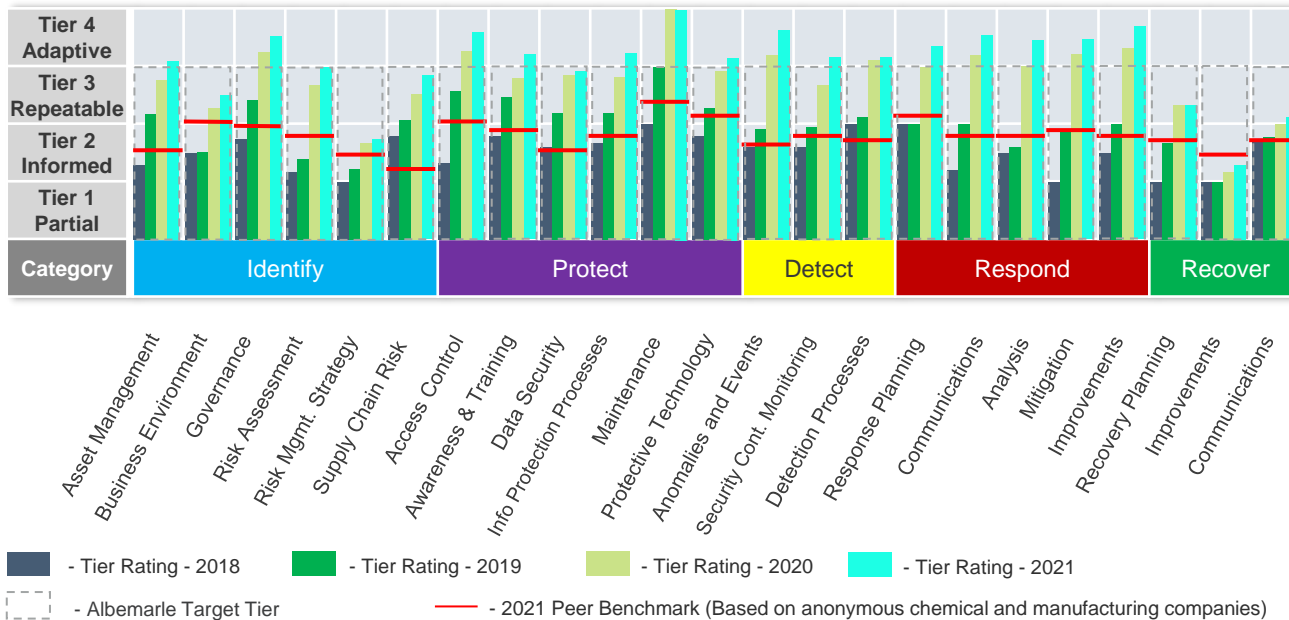
NIST CSF 4-year progress



All 23 NIST CSF categories have improved since the initial 2018 review






Albemarle exceeded a Tier 1 rating in all categories

16 NIST CSF categories have met or exceeded management's target



Results prepared by Third Party Technology Consulting Firm

NIST Cybersecurity Health Check

Core Function	Q3 2021 (Protiviti)	Category	Q1 2020 Profile (Protiviti)	Q3 2021 Focus Areas			Q3 2021 Profile (Protiviti)
				People	Process	Technology	
ID	 2.8	Asset Management	2.78 ▲	2.83 ▲	3.33 ▲	3.00 ▲	3.05 ▲
		Business Environment	2.27 ▲	2.60 ▲	2.40 ▲	2.60 ▲	2.53 ▲
		Governance	3.25 ▲	3.25 ▬	4.00 ▲	3.24 ▲	3.50 ▲
		Risk Assessment	2.67 ▲	3.00 ▲	3.17 ▲	2.83 ▲	3.00 ▲
		Risk Management Strategy	1.67 ▲	2.00 ▬	2.00 ▬	1.33 ▲	1.78 ▲
		Supply Chain Risk	2.53 ▲	2.80 ▲	3.20 ▲	2.60 ▬	2.87 ▲
			2.53 ▲	2.75 ▲	3.02 ▲	2.60 ▲	2.79 ▲
PR	 3.3	Access Control	3.29 ▲	3.43 ▲	3.71 ▲	3.57 ▲	3.57 ▲
		Awareness and Training	2.80 ▲	3.00 ▲	3.40 ▲	3.20 ▬	3.20 ▲
		Data Security	2.79 ▲	2.88 ▬	2.75 ▲	3.13 ▲	2.92 ▲
		Information Protection	2.83 ▲	3.00 ▲	3.50 ▲	3.08 ▲	3.19 ▲
		Maintenance	4.00 ▲	4.00 ▬	4.00 ▬	4.00 ▬	4.00 ▬
		Protective Technology	2.93 ▲	3.00 ▬	3.00 ▲	3.40 ▲	3.13 ▲
	3.11 ▲	3.22 ▲	3.39 ▲	3.40 ▲	3.34 ▲		
DE	 3.4	Anomalies and Events	3.20 ▲	3.40 ▲	3.60 ▲	3.80 ▲	3.60 ▲
		Security Continuous Monitoring	2.67 ▲	3.13 ▲	3.00 ▲	3.25 ▲	3.13 ▲
		Detection Processes	3.13 ▲	3.00 ▬	3.20 ▬	3.20 ▬	3.13 ▬
			3.00 ▲	3.29 ▲	3.37 ▲	3.51 ▲	3.39 ▲
RS	 3.4	Response Planning	3.00 ▲	3.00 ▬	4.00 ▲	3.00 ▬	3.33 ▲
		Communications	3.20 ▲	3.60 ▲	3.60 ▲	3.00 ▬	3.40 ▲
		Analysis	3.00 ▲	3.00 ▬	3.75 ▲	3.50 ▲	3.42 ▲
		Mitigation	3.22 ▲	3.33 ▲	3.33 ▲	3.67 ▲	3.45 ▲
		Improvements	3.33 ▲	3.00 ▬	4.00 ▬	4.00 ▬	3.67 ▲
			3.15 ▲	3.20 ▲	3.67 ▲	3.45 ▲	3.44 ▲
RC	 1.9	Recovery Planning	2.33 ▲	2.00 ▬	2.00 ▬	3.00 ▬	2.33 ▬
		Improvements	1.17 ▲	1.00 ▬	1.50 ▲	1.50 ▬	1.33 ▲
		Communications	1.89 ▲	1.67 ▬	2.67 ▲	2.00 ▬	2.11 ▲
	1.80 ▲	1.56 ▬	2.06 ▲	2.17 ▬	1.93 ▲		

Map Standards to Framework



Subcategory = Specific Outcome

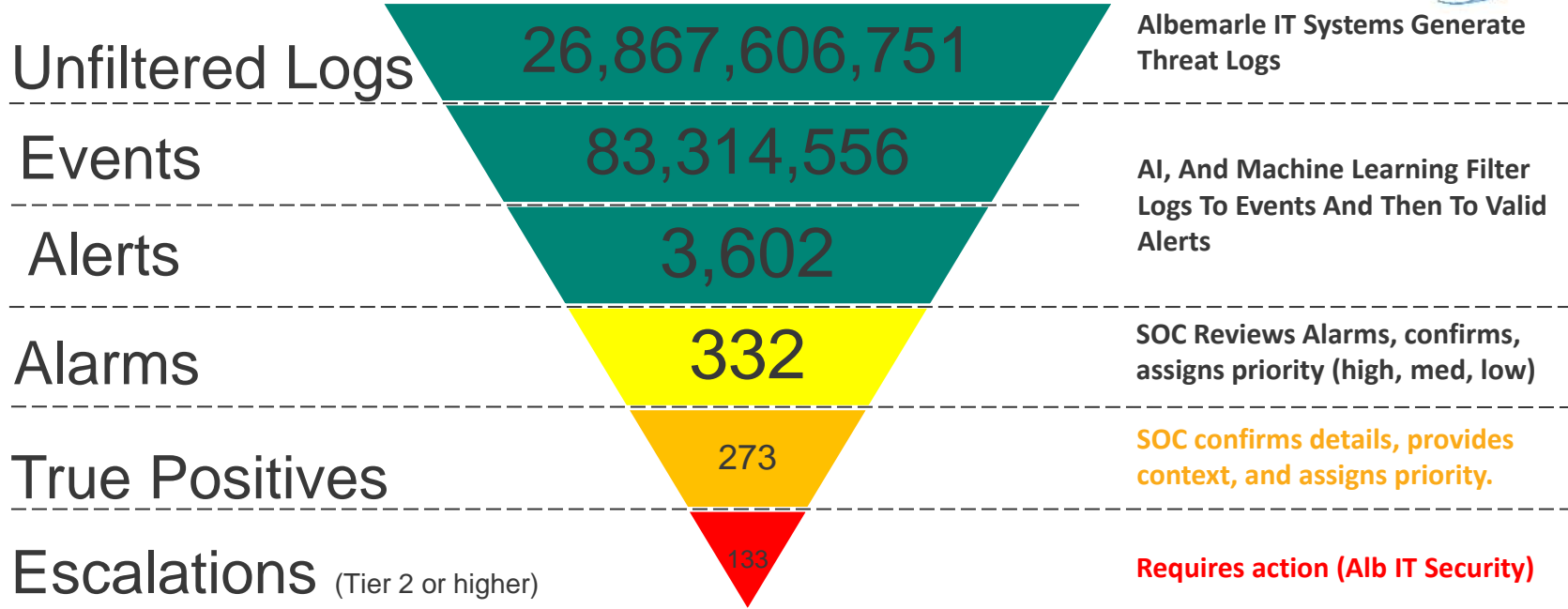
- ISA/IEC 62443
- SOX
- Others
- GDPR
- NIST 800-xx
- CFAT
- CIS Controls

Function	Category	Subcategory	NIST SP800-53 Rev. 4 (National Security Standards)	NIST SP800-82 (Government ICS Standards)	ISA 62443-2/3 (ICS Standards)	RBPS-8: Cyber (CFAT Standards)	CIS Top 20	Albemarle SOX IT Controls	
Protect		PR.DS-6: Integrity checking mechanisms are used to verify software, firmware, and information integrity	SI-7 Software, Firmware, and Information Integrity - The organization employs integrity verification tools to detect unauthorized changes to organization-defined software, firmware, and information.	Refer to NIST standards listed in column E 6.2.17 System and Information Integrity	3-3:2013 SR 3.1, SR 3.3, SR 3.4, SR 3.8	Network of ICS Cyber Security Controls - The facility has implemented cyber security controls to prevent malicious code from exploiting critical cyber systems, such as control systems.	CIS CSC 2 - Inventory and Control of Software Assets CIS CSC 3 - Continuous Vulnerability Management	N/A	
		PR.DS-7: The development and testing environment(s) are separate from the production environment	CM-2 Baseline Configuration - The organization develops, documents, and maintains under configuration control, a current baseline configuration of the information system.	Refer to NIST standards listed in column E	N/A	N/A	CIS CSC 10 - Application Software Security	N/A	
	Information Protection Processes and Procedures (PR.IP): Security policies (that address purpose, scope, roles, responsibilities, management commitment, and coordination among organizational entities), processes, and procedures are maintained and used to manage protection of information systems and assets.	PR.IP-1: A baseline configuration of information technology/industrial control systems is created and maintained	AC-17 Remote Access - The organization establishes and documents usage restrictions, configuration/connection requirements, and implementation guidance for each type of remote access allowed. The organization authorizes remote access to the information system prior to allowing such connections.			[2-1:2009 4.3.4.3.2] Develop and implement a change management system - A change management system for the IACS environment shall be developed and implemented. The change management process shall follow separation of duty principles to avoid conflicts of interest.		CIS CSC 3 - Continuous Vulnerability Management	
			AC-19 Access Control For Mobile Devices - The organization establishes usage restrictions, configuration requirements, connection requirements, and implementation guidance for organization-controlled mobile devices. The organization authorizes the connection of mobile devices to organizational information systems.	Refer to NIST standards listed in column E 6.2.5 Configuration Management	[2-1:2009 4.3.4.3.3] Assess all the risks of changing the IACS - Using clearly defined criteria, proposed changes to the IACS shall be reviewed for their potential impact to HSE	N/A	CIS CSC 20 - Penetration Tests and Red Team Exercises CIS CSC 3 - Limitation and Control of Network of Ports, Protocols, and Services CIS CSC 11 - Secure Configuration for Network	N/A	

Cyber Incident Prioritization



May 2022





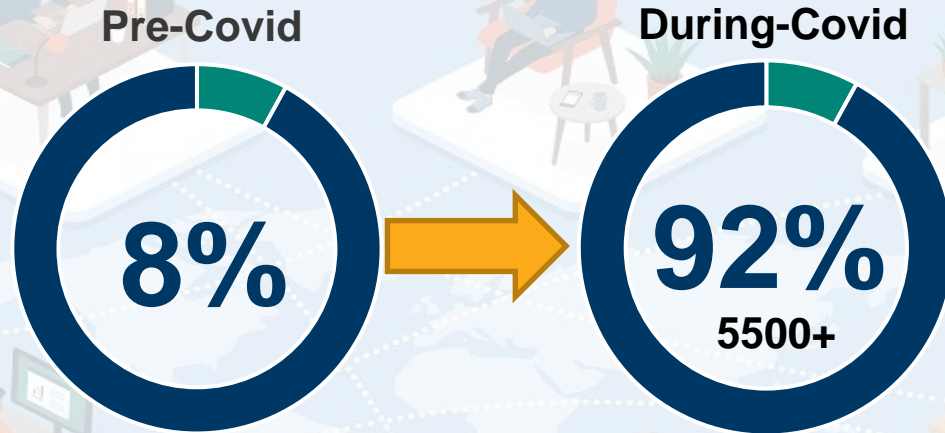
Albemarle Digital Cloud

Richard Caronna
VP, Global Network and Infrastructure





Remote Workforce Transformation



of employees
working remotely
pre-Covid

of employees
working remotely
during-Covid



- Framework
- Baseline Policies
- Governance
- Monitoring



- **Cloud Data Migration**

On-Premises



Cloud



**SharePoint
Online**

**DATA
MIGRATION**



**~100TB
Data Migrated
during Covid**

- Framework
- Baseline Policies
- Governance
- Monitoring

Albemarle Advanced Analytics

Yomesh Deliwala
IT Director – Enterprise Architecture & Analytics

Advanced Analytics through Microsoft Azure



Foundation for Cloud/Data Lake based Solutions



Data Integration

- ✓ Standardize integration methods, tools and technologies
- ✓ Improve accessibility through ease-of-use and self-service



Data Governance

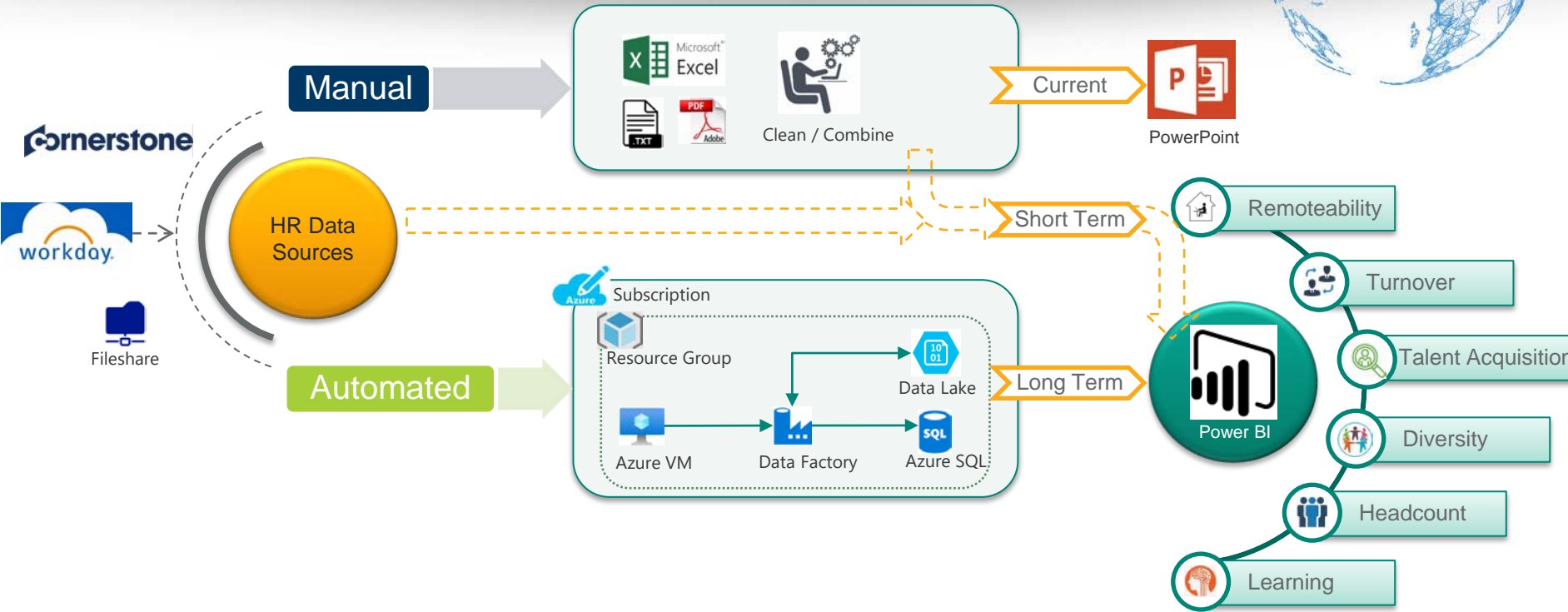
- ✓ Discover and manage data across systems
- ✓ Reduce Unmonitored and Ungoverned data silos (MS Access DBs, Complex Excel Spreadsheets, etc.)



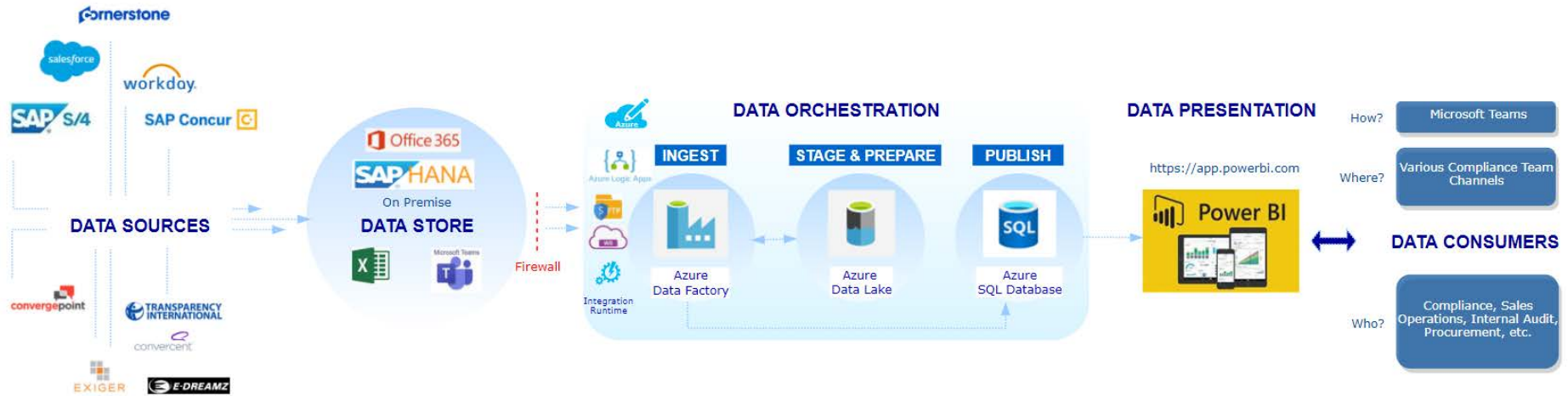
Data Privacy, Compliance & Security

- ✓ Protect data through entire lifecycle
- ✓ DPA and GDPR compliance
- ✓ Data Access and Sharing

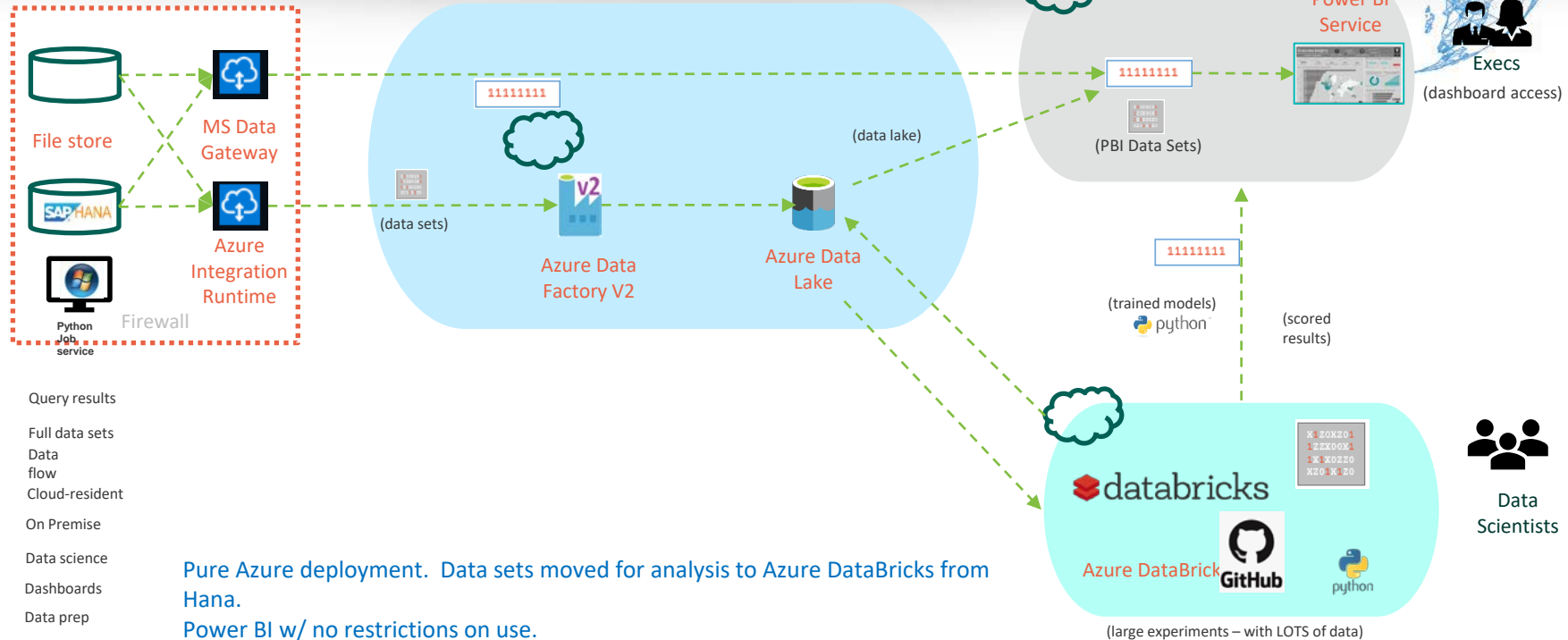
HR Analytics Architecture



Global Ethics & Compliance Analytics - Data Architecture



Lithium Data Science - Data Architecture



Thank You!