### From Quality to Impact: It's All About the Data

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Medvedev, G. (1991). The truth about Chernobyl. IB Tauris.





#### 1. What is being measured & how

- 2. Context of the measurement
- 3. Knowledge of the instrument





#### 1. <u>What</u>: Exposure to ionizing radiation - 3.6 R/hour

- <u>Context</u>: 800-1500 R/hour near exposed reactor;
   300 R accumulated for radiation sickness
- 3. Instrument: 3.6 R/hour is the maximum measurement on the standard device used at those facilities at the time



https://www.sciencephoto.com/media/153269/view/ chernobyl-radiation-burns-victim



### **Every Data Point is Important**







From Andres, R. (2015). Leveraging Computational Power at the Edge: IoT/M2M Solutions with Informix in the Internet Gateway. Available from <a href="https://www.slideshare.net/Eurotechchannel/iot-m2m-solutions-with-informix-in-the-iot-gateway">https://www.slideshare.net/Eurotechchannel/iot-m2m-solutions-with-informix-in-the-iot-gateway</a>





Radziwill, N. M. (2018, October). Let's Get Digital: The many ways the fourth industrial revolution is reshaping the way we think about quality. *Quality Progress*, p. 24-29. <u>http://qualityprogress.com</u>

#### Quality 4.0 = C I A

#### Connectedness

#### Intelligence

Automation

#### for improving performance



# Information is only useful when it's valid, and you are **Connected** to it

# Automation helps bring it to you when you need it, and frees up time and effort

Intelligence helps you understand and respond





**ΕΗSQ** ΛLLIΛΝCΕ

### **Objectives**

- 1. What counts as **data** (it's more than you think)
- 2. What **master data** is, and why it's more important now than ever before
- 3. Why defining systems of record can help
- 4. How data governance supports information and knowledge management
- 5. Why **dashboards** can be destructive (and what to do about it)
- 6. How effective information and knowledge management can greatly improve cross-functional communication and overall performance





#### 1: IoT and Emerging Technologies Produce Big Data

- 1. Lots of it (volume)
- 2. It's coming at you fast (velocity)
- 3. Different formats and sampling frequencies (variety)
- 4. Huge variations in data quality (veracity)
- 5. Different people/organizations produce it or own it (governance)
- 6. It could easily change or disappear (control)
- 7. There may be restrictions on how you use it (policy)

#### "... Big Data is anything bigger or more complex than what your organization is currently prepared to handle."

-- one of the world's experts on cyberinfrastructure for Big Data at a National Science Foundation panel (2013)



#### 1: The Future of Manufacturing OPERATIONS & SUPPLY CHAIN OMNISCIENCE



From Wang, J., Ma, Y., Zhang, L., Gao, R. X., & Wu, D. (2018). Deep learning for smart manufacturing: Methods and applications. *Journal of Manufacturing Systems*.

#### 2015 ASQ Future of Quality Report envisions:

- New technologies automate, redefine, possibly eliminate seams and transitions
- Tighter integration of information, materials, and workforce across previously perceived boundaries
- Innovation will require attention to data quality and data management over the lifetime of the data (curation)
- Ecosystem viability key



#### 1: A Multitude of Data Sources

- Information about products, services, customers, suppliers
- Things you say to customers, and things customers say to you
- Things your customers say about you on social media

#### Additionally:

- Your documents
- The intentions of the original data producers
- Calculation used to create values
- Dates and times that information or reports were created
- Approval statuses and audit trails for workflows
- Forecasts and comparisons to actual values
- Hyperparameters for prediction and classification models
- Configuration management











From http://www.mkomo.com/cost-per-gigabyte



\$~0/GB



#### 1: Fast Data (Pipelines)

"As the stream of data from sensors, actuators and machine-to-machine communication in the Internet of Things and modern networks is very large, it has become vital for enterprises to **identify what data is time-sensitive and should be acted upon right away and, vice versa, what data can sit** in a database or data lake until there is a reason to mine it."



# Accessible Available Accurate



### 2: Master Data Management

"Master Data Management (MDM) is the framework of processes and technologies aimed at creating and maintaining an authoritative, reliable, sustainable, accurate and secure data environment that represents a **single version of truth**, an accepted system of record used... across a diverse set of application systems, lines of business, and user communities"

#### technology + organizational culture + management processes



### **2: Master Data Domains**



"Master data represents **one of the key assets and most valuable resources** an organization owns. Consequently, the lack of an adequate master data management may lead to a multitude of severe problems like operational malfunctions, inadequate decision making, and unnecessarily spent (human) resources and time."



## 3: System of Record (SoR)





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SOR should have the following characteristics:

- 1. Data origination point
- 2. Feeds other systems
- 3. Cleansed for quality
- 4. Sometimes auditable and traceable
- 5. In many cases, SOR is also the single source of truth for a business process

"In all cases it provides business value in different formats and assists the business in DOING business on a daily basis."



# 3: System of Record (SoR)

"A solution can be considered a system of record, Agarwal says, if:

- it runs a mission-critical business process
- it stores proprietary business data
- large portions of the employee population interact with it daily or weekly
- its outputs form the foundation for important business decisions
- it codifies solutions that are 'inside the heads of human beings'
- it learns and improves over time"

Customers, Finances, Employees, IT Operations, Events



## 3: Value of the System of Record (SoR)

"I met this week with the director of a large health department and her information technology (IT) manager. The team described the following challenges in how the department currently functions:

- Multiple overlapping computer systems: Through circumstances too frustrating to unravel, her staff
  were compelled to use multiple systems, each with some margin of value.
- No system of record: Lacking a single trustworthy system, any query required cross-checking and reconciliation with the next best source.
- Abandoned environments: At least one system[was not being maintained] and data were not being backed up at all! Yet, the system remained online because none of the auxiliary systems could perform.
- Manual report reconciliation: [Inspection reports] were so unbelievable that leadership asked the staff to return to their paper records and hand tally the true numbers.

Staff struggled to do their jobs. Managers scrambled to show progress. Leadership was... frustrated. Taking control of one's system implementation can make all the difference."



### 4: Data Governance

The Data Management Association (DAMA) defines data management as the "development, execution, and supervision of **plans**, **policies**, **programs**, **and practices** that control, protect, deliver, and enhance the value of data and information assets."

DAMA defines governance as "the exercise of authority, control, and shared decision making (planning, monitoring, and enforcement) over the management of data assets."





### 4: Why Protecting Data is More Important Now











96.6% chapce of r

96.6% chance of *not blueberry* muffin

- 1. Prediction
- 2. Classification
- 3. Pattern Identification
- 4. Data Reduction
- 5. Anomaly Detection
- 6. Pathfinding



### 4: Visibility & Transparency → Dashboards

"Our dashboards should not be confused with a central command and control environment. That would make us too slow. Reporting insights or issues up the command chain, waiting for an order, and then acting based on remote wisdom would drive suboptimal decisions and slow us down. **Making information available to all helps us to be a faster, more agile company and see new connections that enable innovation**... Enabling the same, seamless information flow within the company drives efficiency and engagement... [and increases] employee retention and engagement."

Baldassari, P., & Roux, J. D. (2017). Industry 4.0: preparing for the future of work. People & Strategy, 40(3), 20-23.



### **5: A Dream for Dashboards**

#### I want my QMS/IMS to...

- Help me make better decisions about my business processes
- Audit itself and alert me when I need to do something
- Tell me where to focus my resources for maximum added value
- Based on risk assessments and theory of constraints, tell me how should I prioritize work
- Alert me when an important change occurs at the systems level





### **5: The Reality of Dashboards**

#### But usually dashboards...

- Display and/or tally data we collected
- Maybe show trends, but not compare them to expected levels, targets or forecasts
- Aren't tuned to a particular company's data and tacit knowledge

You don't have to display all the data you collect. Think about how to use the data to make *meaningful* decisions.











### 6: Measurement, Analysis, & KM (4.1)

#### **1. Performance Assessment**

- Tracking data about daily operations and overall performance
- Comparing performance to other organizations or benchmarks
- Responding to changes
- 2. Performance Review
- 3. Performance Improvement
  - Preparing forecasts and projections
  - Identifying priorities for continuous improvement and innovation



https://www.nist.gov/baldrige

### 6: Measurement, Analysis, & KM (4.2)

- **1. Managing Data and Information** 
  - Ensuring data quality, including accuracy, validity, integrity, reliability, and currency
  - Ensuring data availability to all stakeholder groups

#### 2. Managing Organizational Knowledge

- Capturing and storing organizational knowledge
- Sharing best practices
- Supporting learning and making sure that lessons learned are shared and captured effectively







### 6: Describing Results (LeTCI)

- <u>Levels</u>: How to measure, how often to measure, what constitutes "good"
- <u>Trends</u>: Evolution of levels over time, detection of shifts or anomalies
- <u>Comparisons</u>: Keep track of data that will help you evaluate how good your data is, particularly for financial, market and operations results
- <u>Integration/Impact</u>: Know why you are collecting the data, and how you will use it





### **DM Supports Quality 4.0 Value Propositions**

- 1. Augment (or improve upon) human intelligence
- 2. Increase the speed and enhance the quality of decision-making
- 3. Improve transparency, traceability, and auditability
- 4. Anticipate changes, reveal biases, adapt to new circumstances/ data sources
- 5. Reveal opportunities for continuous improvement
- 6. Learn how to learn: cultivate self-awareness and other-awareness



### Is Data Management a Good Investment?

- One large industrial company we studied had more than a dozen data sources containing similar supplier information, such as name and address. But the content was slightly different in each source... In the first year, having a SSOT yielded \$75 million in benefits.
- One large financial services company doing business in more than 200 countries consolidated nearly 130 authoritative data sources, with trillions of records, into an SSOT... [that] yielded a 190% return on investment with a two-year payback time.





### Conclusions

- 1. Make your data accessible (catalog, data lake, etc.)
- 2. Determine the most critical data objects (master data)
- 3. Decide where master data will live (systems of record)
- 4. Establish how you will manage it (data governance)
- 5. Decide how you will **use it to make decisions** (meaningful dashboards)
- 6. Build processes to **strategically manage and continuously improve** the data and the decisions you make based on it (Baldrige Excellence Framework)





#### **Questions?**





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