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Data governance and visualization

Chapter 1

Introduction to data governance

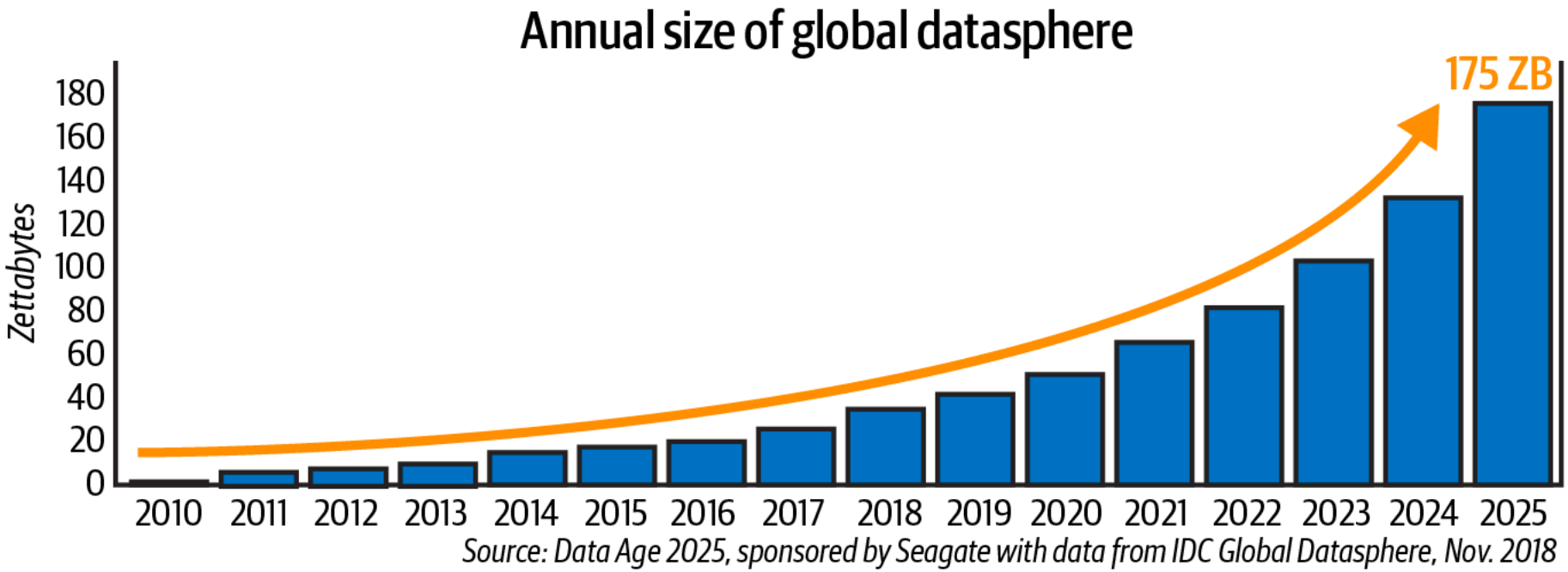
Viet-Trung Tran

Outline

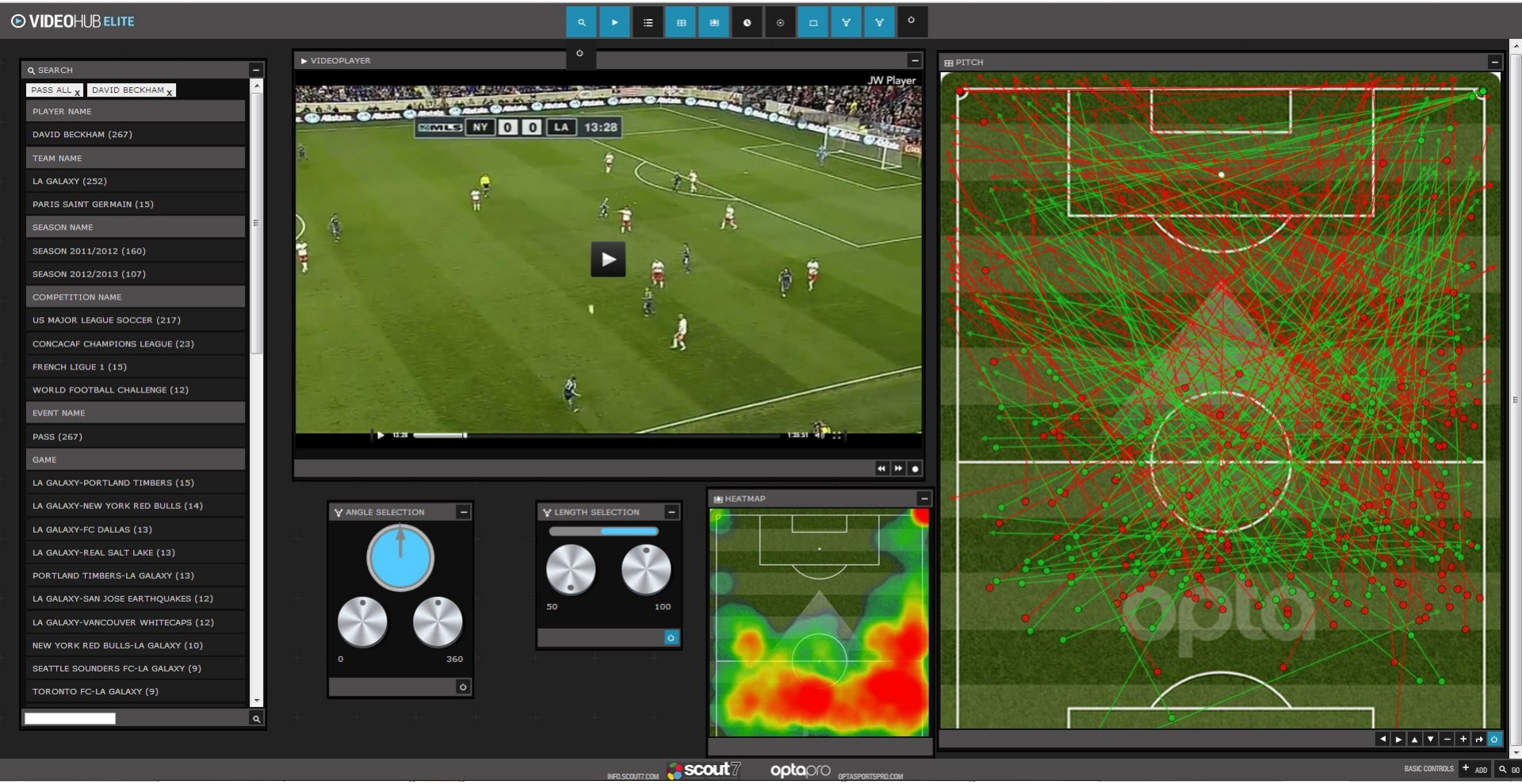
- Motivation
- Introduction to data governance
- Why data governance
- Data governance ingredients
- Maturity models
- Data life cycle management

Data governance is becoming more important

How big is big data?

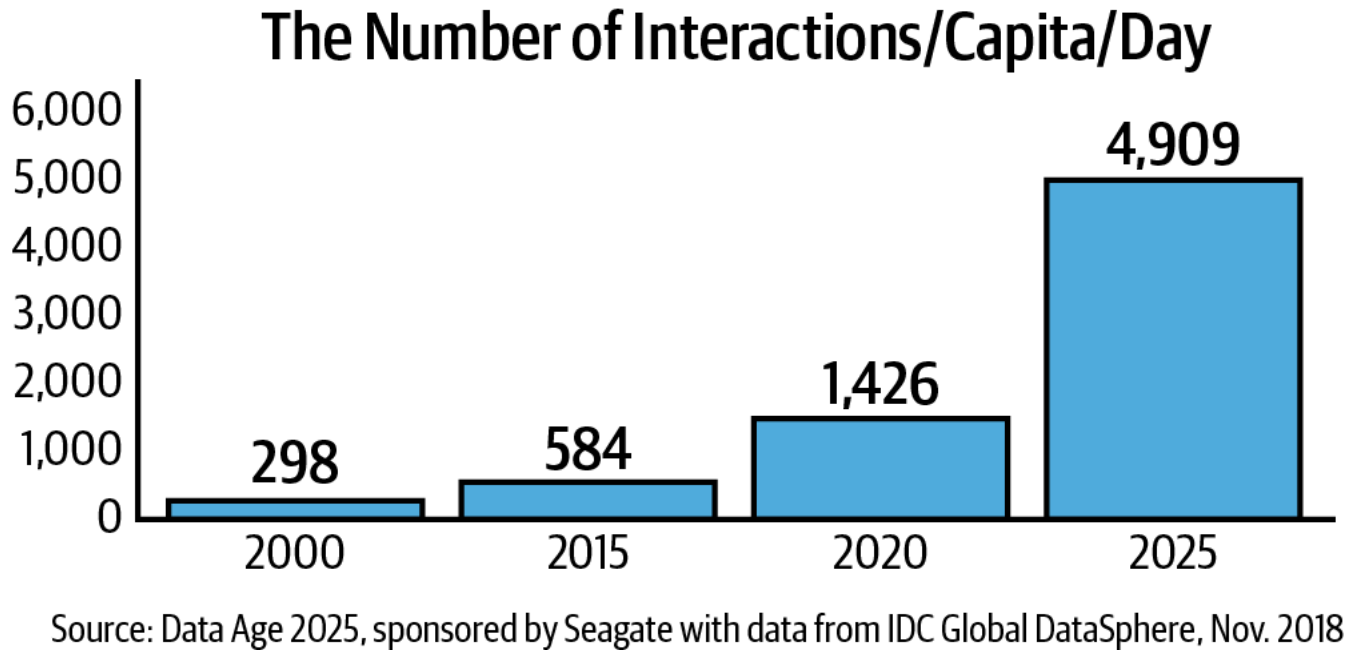


Advanced data collection in sports



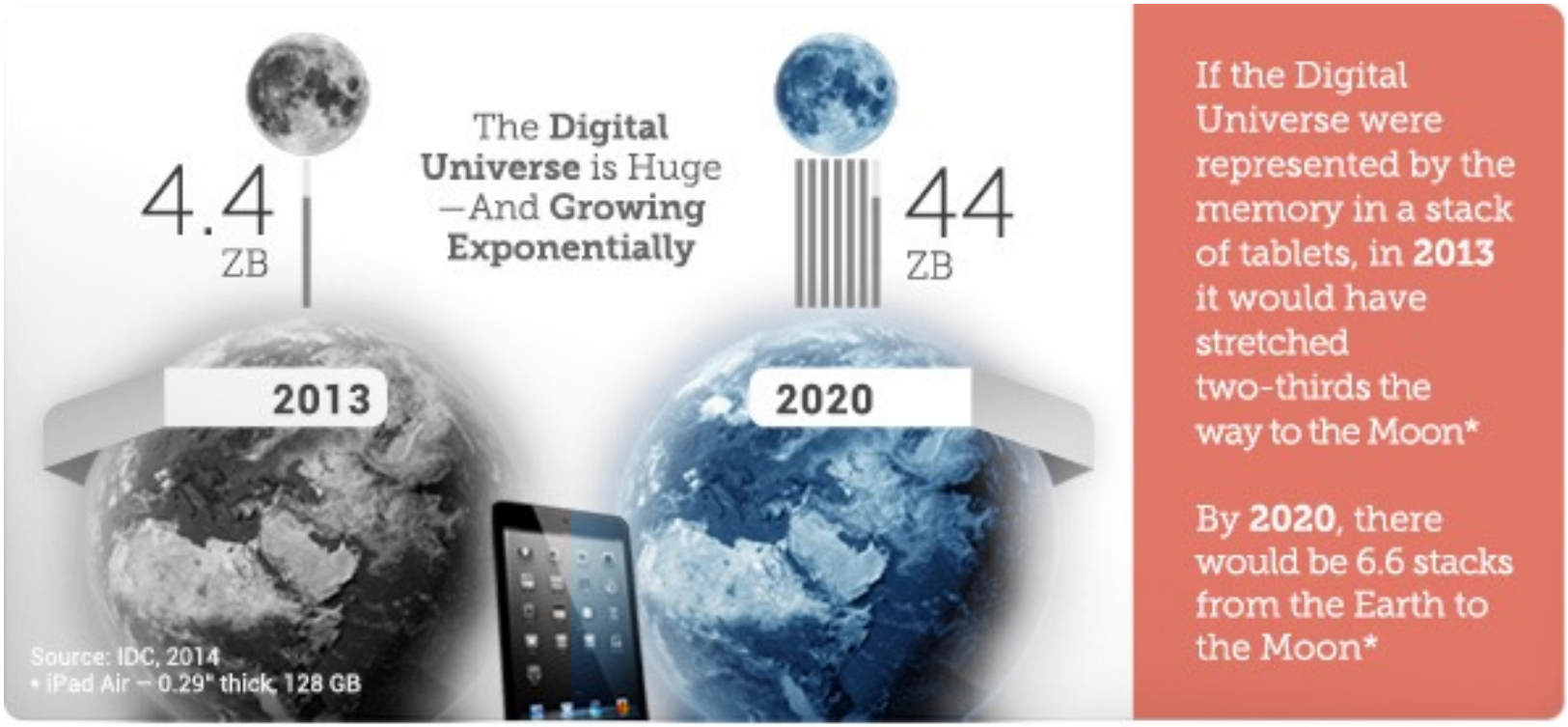
More kinds of data are collected

- One digital interaction every eighteen seconds



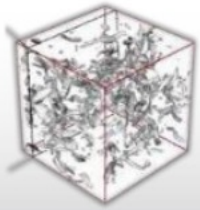
Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov. 2018

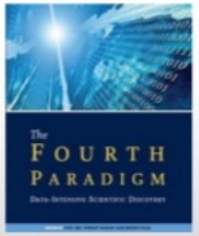
How big is big data?



Data science: The 4th paradigm for scientific discovery

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G\rho}{3} - \mathrm{K}\frac{c^2}{a^2}$$





Experimental	Theoretical	Computational	The Fourth Paradigm
Thousand years ago	Last few hundred years	Last few decades	Today and the Future
Description of natural phenomena	*Newton's laws, Maxwell's equations...*	*Simulation of complex phenomena*	*Unify theory, experiment and simulation with large multidisciplinary Data* *Using data exploration and data mining (from instruments, sensors, humans...)* *Distributed Communities*

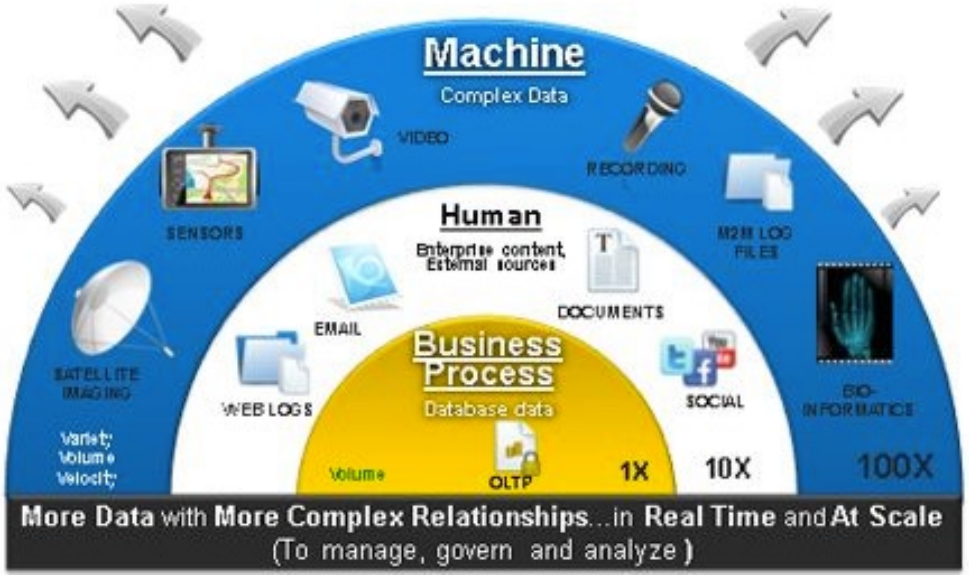
Big data in 2008

http://www.wired.com/wired/issue/16-07

September 2008

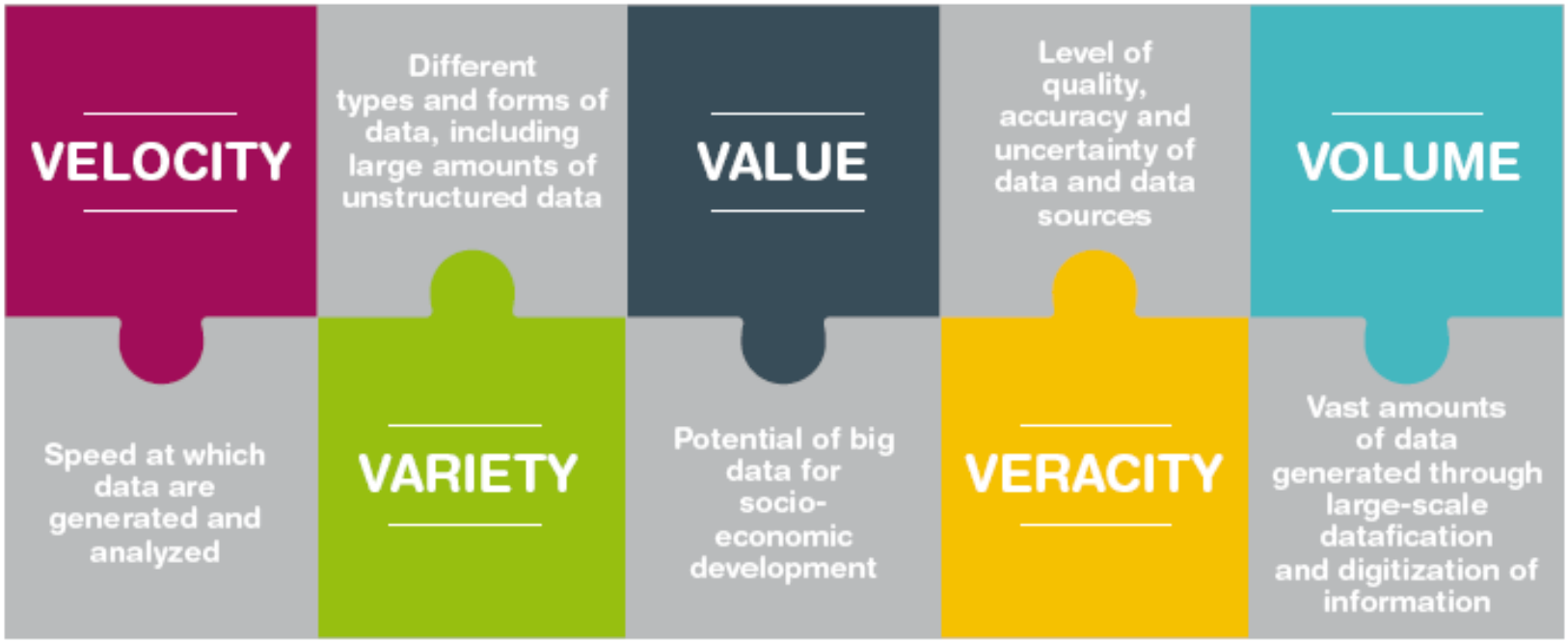
Big data sources

- E-commerce
- Social networks
- Internet of things
- Data-intensive experiments (bioinformatics, quantum physics, etc)



Data is the new oil

Big data 5'V



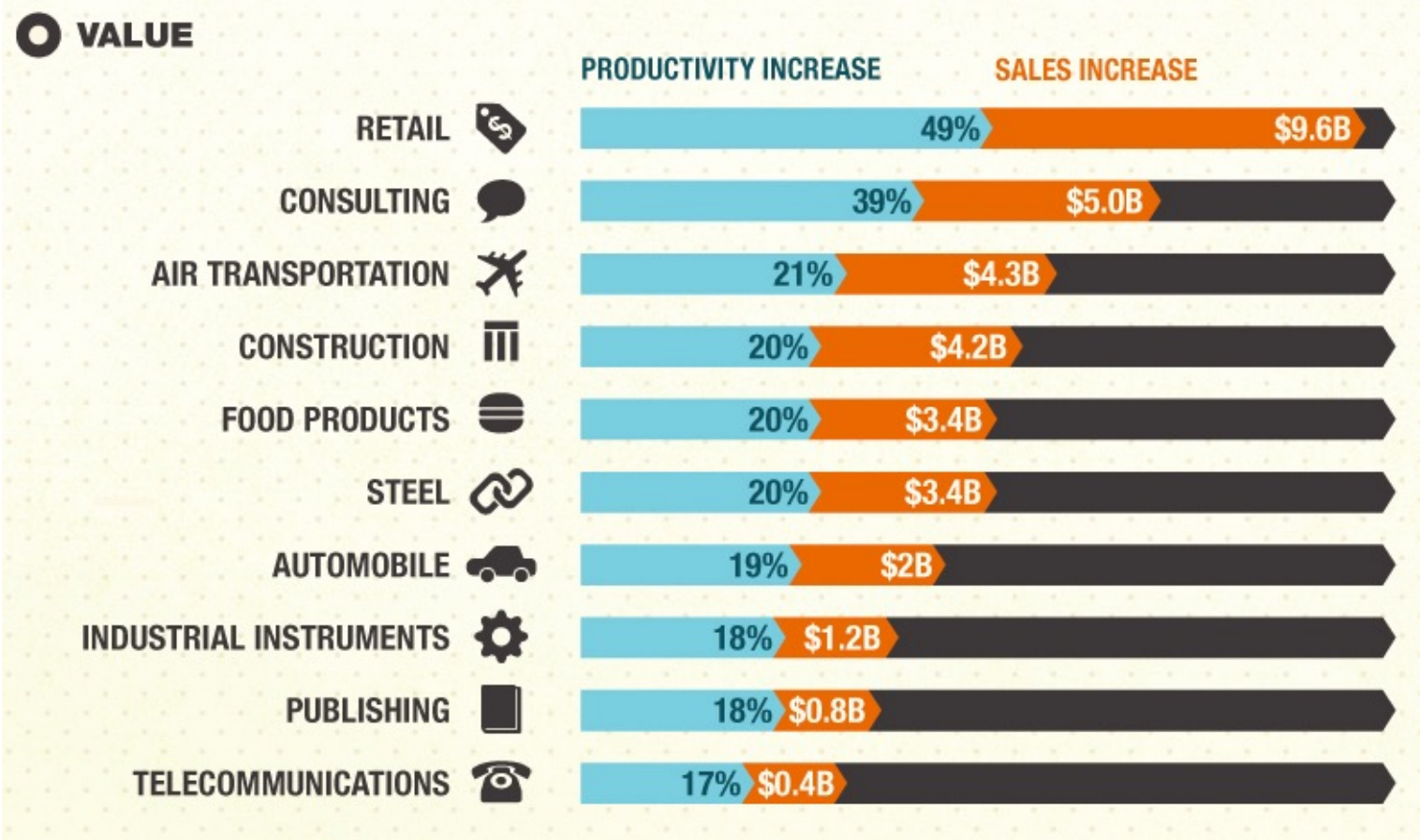
Big data is a term for data sets that are so large or complex that traditional data processing application software is inadequate to deal with them (wikipedia)

Data value

- ***Data is the most valuable asset in an organisation after its people***
  - ***Data is critical to the running of business functions and processes***
- ***Data need constant vigilance and effort to maintain data quality***

Source: sciphilos.info

Big data – big value



source: wipro.com

Introduction to data governance

Data governance

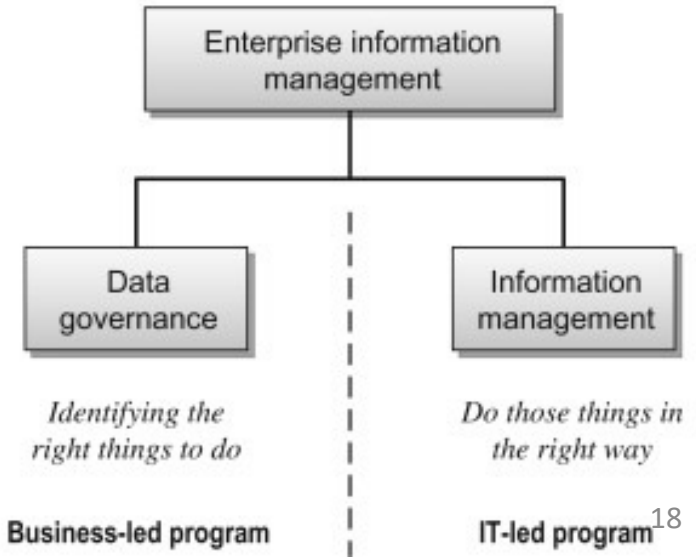
- **Data governance is a collection of processes, roles, policies, standards, and metrics that ensure the effective and efficient use of information**
  - for the end-to-end lifecycle of data (collection, storage, use, protection, archiving, and deletion).

Data governance is …

- a set of guidelines for how people behave and make decisions about data

Data governance vs. data management

- Data management is the technical implementation of data governance.
  - Data governance without implementation is just documentation.
  - Enterprise data management enables the execution and enforcement of policies and processes.
- Data management refers to the management of the full data lifecycle needs of an organization.
  - **Cleansing and standardization**
  - **Masking and encryption**
  - **Archiving and deletion**



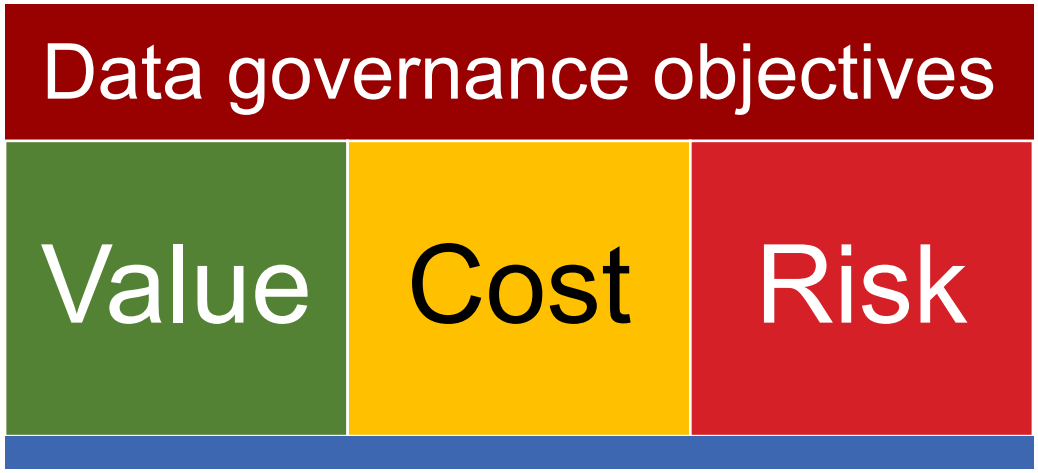
Data governance vs. data management

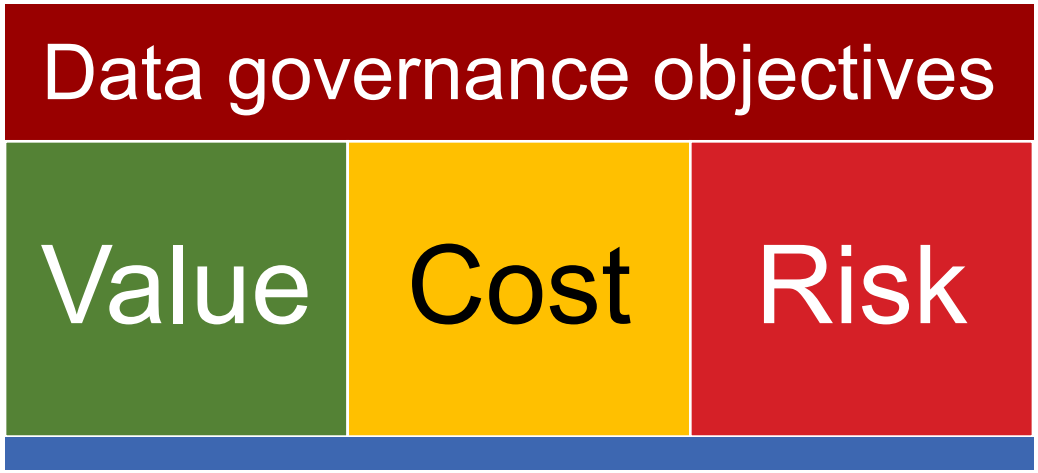
"while data governance and data management are different entities, their goals are the same: create a solid, trustworthy data foundation to empower the smartest people in your enterprise to do their best work."

Why data governance?

Data governance objectives

- Everything an organization does should tie to one of three universal value drivers
  - Increase revenue and value
  - Manage cost and complexity
  - Support Risk Management and Compliance efforts and increase confidence





- Value – what could you do that you can't do now?
- Costs – what costs are you incurring because data are not well governed?
- Risks – what risks are you taking because data are not well governed?

Value: Accelerated decision making

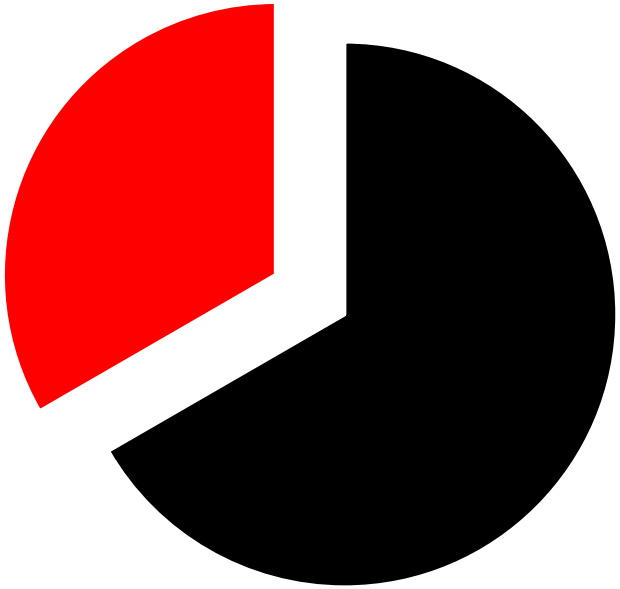
- Improved evidence-based, strategic, and investment decisions by:
  - Quickly acquiring and analyzing large sets of data
  - Decreased reporting errors
  - Easily accessing uniform, reliable data
  - Improved standardization, increasing confidence and transparent communication

Value: Increased revenue

- Heightened business intelligence and advanced customer analytics drive revenue growth by:
  - Introducing new products
  - Enhancing customer service
  - Optimizing marketing techniques

Cost control [1]

- A third of Fortune 100 organizations will experience “an information crisis, due to their inability to effectively value, govern and trust their enterprise information.”



Gartner. (2014). “Why data governance matters to your online business,” retrieved August 1, 2016 from http://www.gartner.com/newsroom/id/1898914s-why-data-governance-matters-to-your-online-business/

Cost control [2]

- Poor data quality costs the US economy $3.1 trillion every year

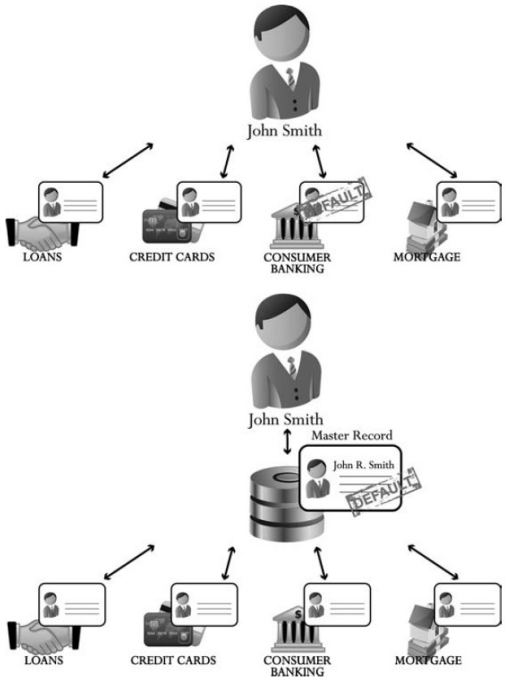
IBM. (n.d.). “Extracting business value from the 4 V's of big data,” retrieved October 1, 2018 from https://www.ibmbigdatahub.com/infographic/extracting-business-value-4-vs-big-data

Manage risk (theft, misuse, data corruption)

- CIO key concerns
  - What are my risk factors, what is my mitigation plan, and what is the potential damage?
- Data governance comes to provide a set of tools, processes, and positions for personnel to manage the risk to data
  - Theft
    - Data is either the product or a key factor in generating value
  - Misuse
    - 2015, AT&T's payout to the FCC after its call center employees disclosed consumers' personal information to third parties for financial gain.
  - Data corruption
    - The risk materializes when deriving operational business conclusions from corrupt (and therefore incorrect) data.

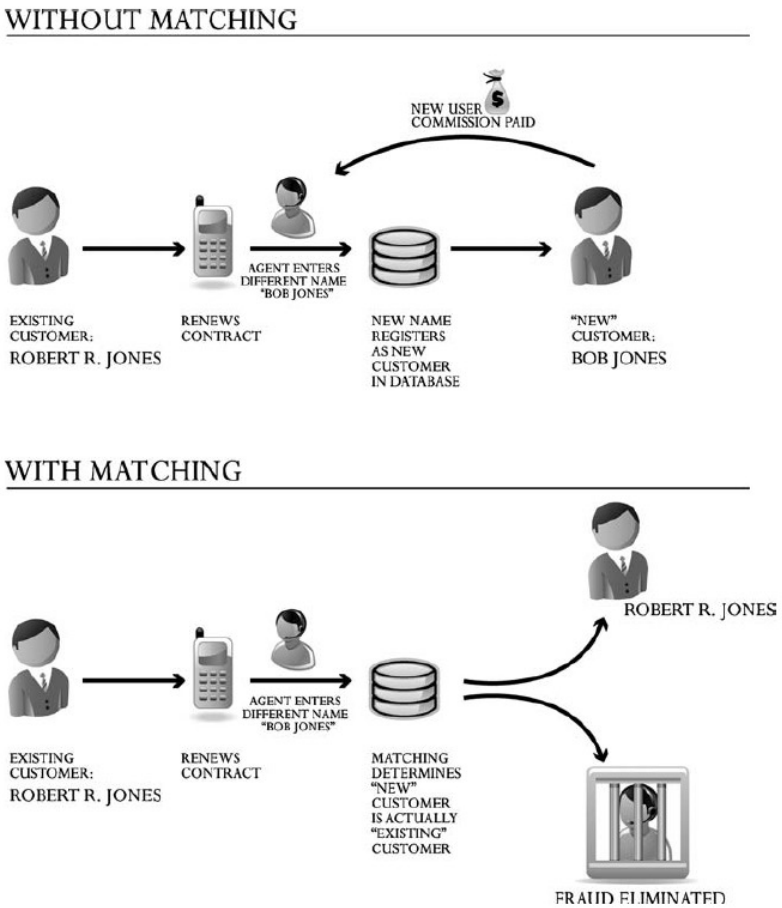
Risk Mitigation: One version of the truth helps retail bankers manage risk

- Many retail banks have product-oriented risk management systems
- If a customer fails to make a loan, the bank can often take up to several weeks to change the credit limits on credit cards held by the same customer



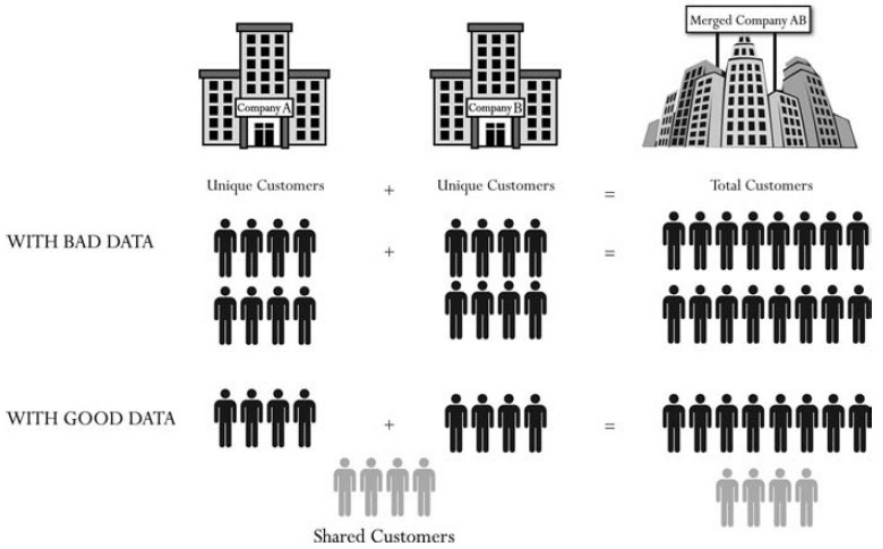
Fighting fraud with accurate data

- Without matching
  - Mobile sales agents were entering existing customers as new customers by using a slightly different name.
  - Higher commission being paid to the agent.
- With matching
  - The company was able to detect the fraud by reconciling the name with existing customer data already on file.



Reducing the risk in mergers and acquisitions

- Bad data can lead you to think you have more customers than you really do.
  - There could be shared customers of the companies being merged.
  - A merger won't achieve the financial gains that were expected.

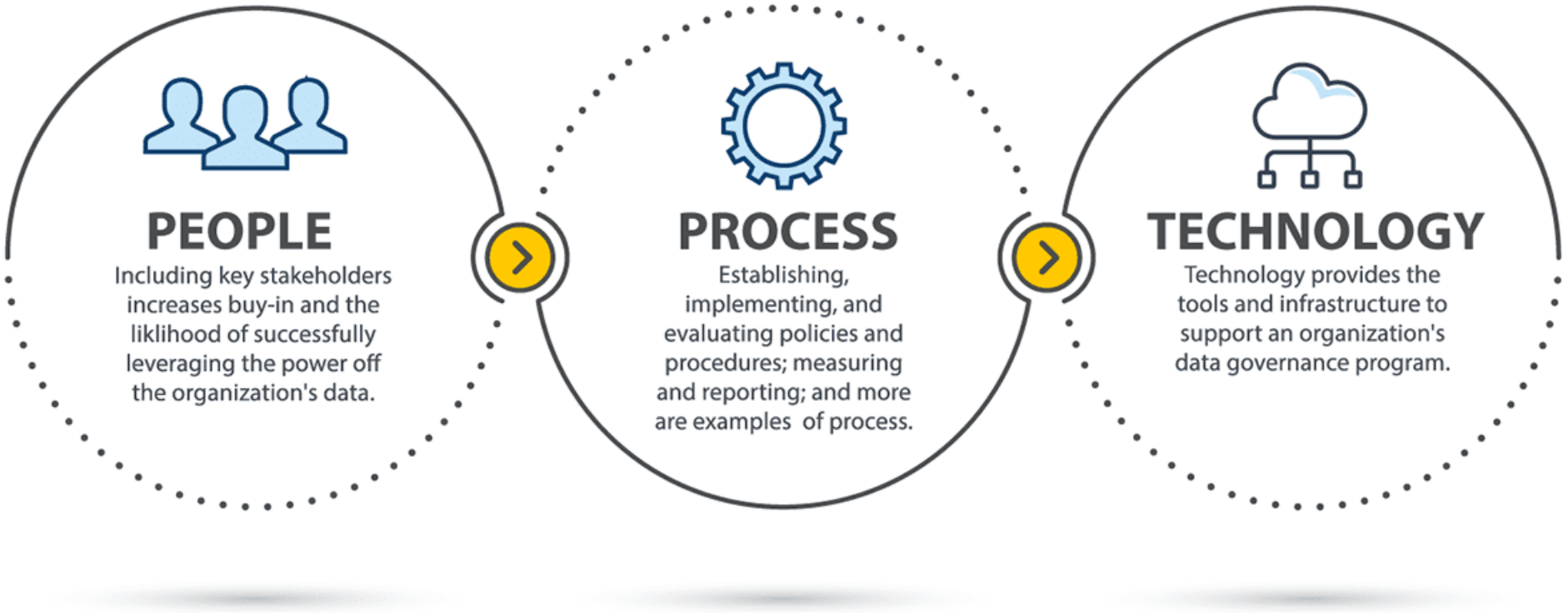


Regulatory compliance

- New regulations and laws around the treatment of data
  - EU's General Data Protection Regulation (GDPR) regulates data, data collection, data access, and data use.
- Regulation will usually refer to one or more of the following specifics:
  - Fine-grained access control
  - Data retention and data deletion
  - Audit logging
  - Sensitive data classes
- Ethical concerns around the use of data
  - 2018. a man was struck and killed by a self-driving car. Who was responsible?
  - 2014, Amazon developed a recruiting tool, however, it was found that the tool discriminated against women.

Data governance ingredients

Data governance ingredients

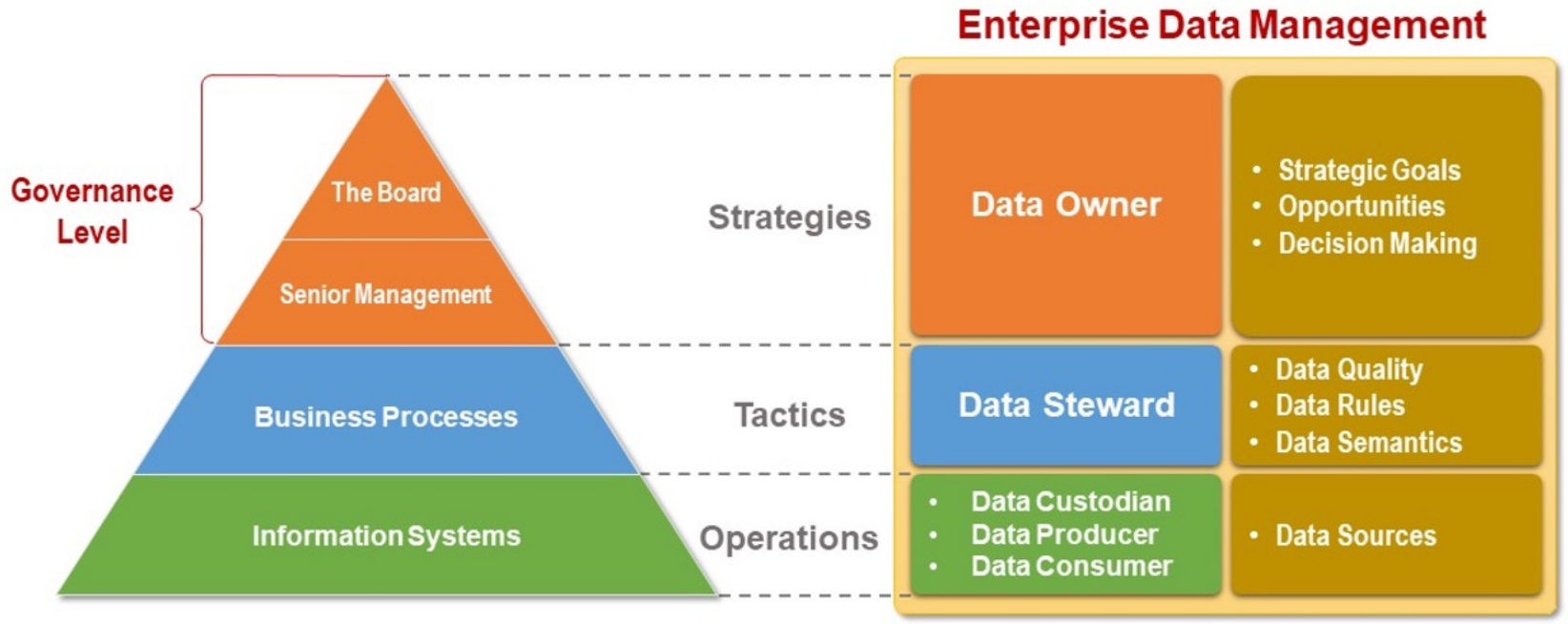


Data governance embodies three components: the right technology, used by the right people, in the right business process

The People: Roles and responsibilities

- Who sets success metrics and monitors how well the data governance program is working?
- Who are the data owners?
- Who defines and maintains a business glossary?
- Who creates and maintains policies on access security?
- Who is protecting data privacy for compliance with GDPR and CCPA?
- Who is looking after data quality across all brochures and partner websites?
- Who ensures customer data is consistent across all systems?
- Who is policing external subscription data usage vs the license?
- Who is policing privileged users like DBAs and data scientists?

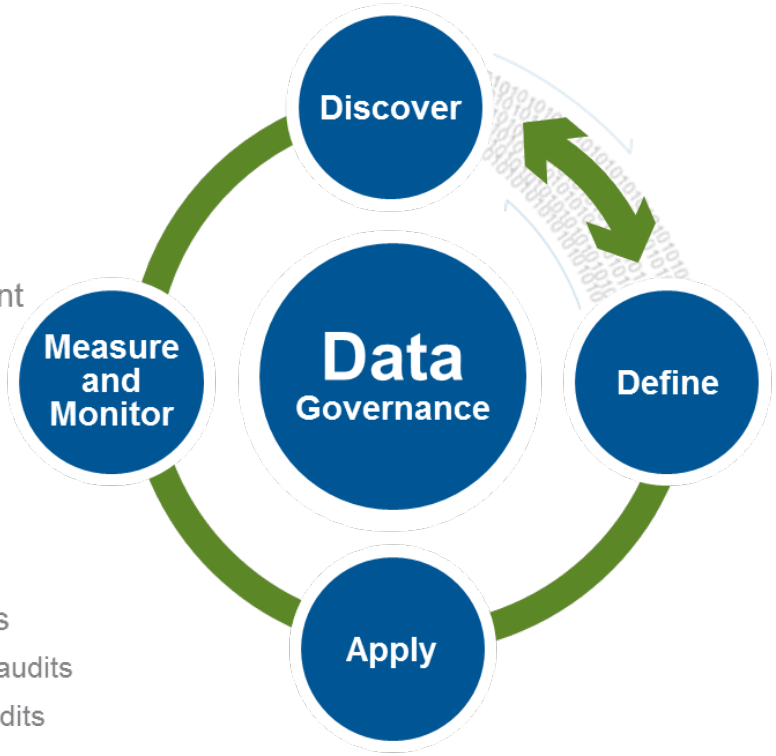
The people


Enterprise Data Management
Governance Level
The Board
Senior Management
Business Processes
Information Systems
Strategies
Tactics
Operations
Data Owner
Strategic Goals
Opportunities
Decision Making
Data Steward
Data Quality
Data Rules
Data Semantics
Data Custodian
Data Producer
Data Consumer
Data Sources

The process

Discover

- Data discovery
- Data profiling
- Data inventories
- Process inventories
- CRUD analysis
- Capabilities assessment



Define

- Business glossary creation
- Data classifications
- Data relationships
- Reference data
- Business rules
- Data governance policies
- Other dependent policies
- Key Performance Indicators

Measure and Monitor

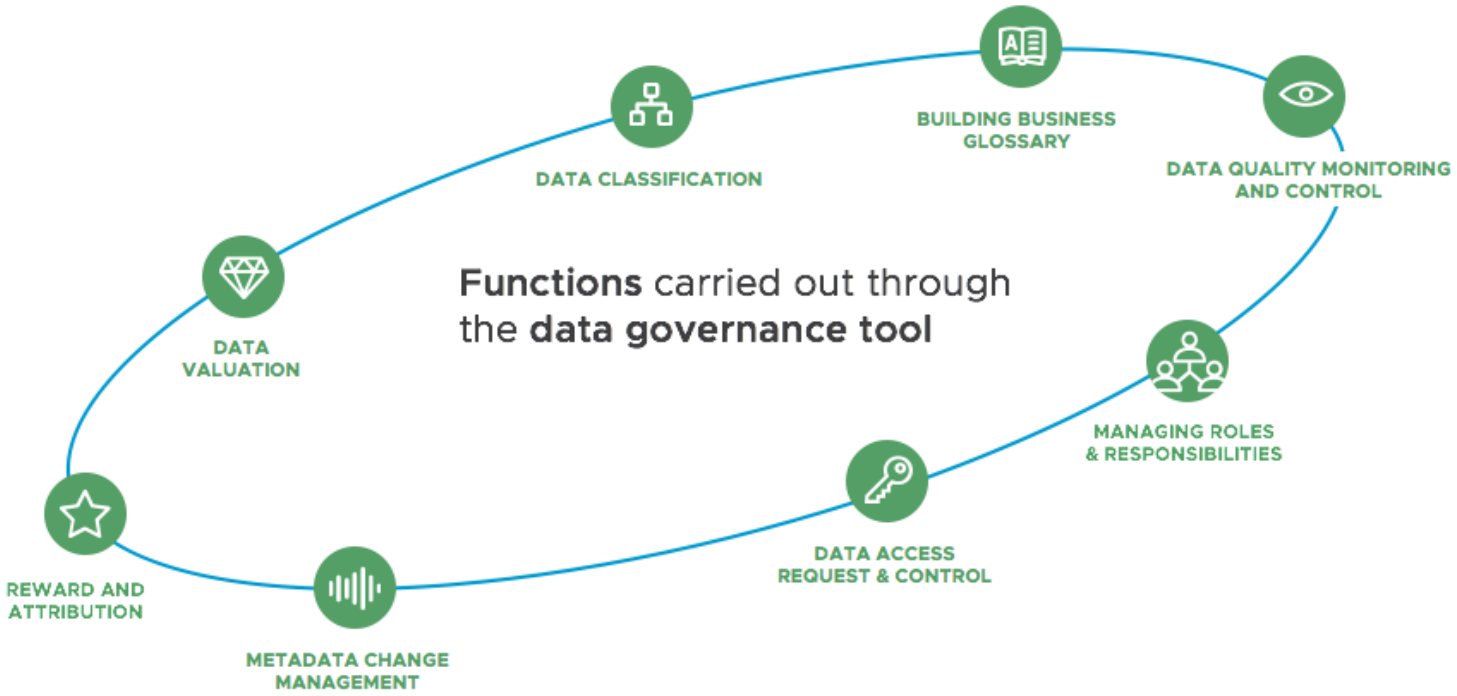
- Proactive monitoring
- Operational dashboards
  - Reactive operational DQ audits
  - Dashboard monitoring/audits
- Data lineage analysis
- Program performance
- Business value/ROI

Apply

- Automated rules
- Manual rules
- End to end workflows
- Business/IT collaboration

The technology/tools [1]

- Aids in the process of creating and maintaining a structured set of policies, procedures, and protocols that control how an organization's data is stored, used, and managed.



The technology/tools [2]

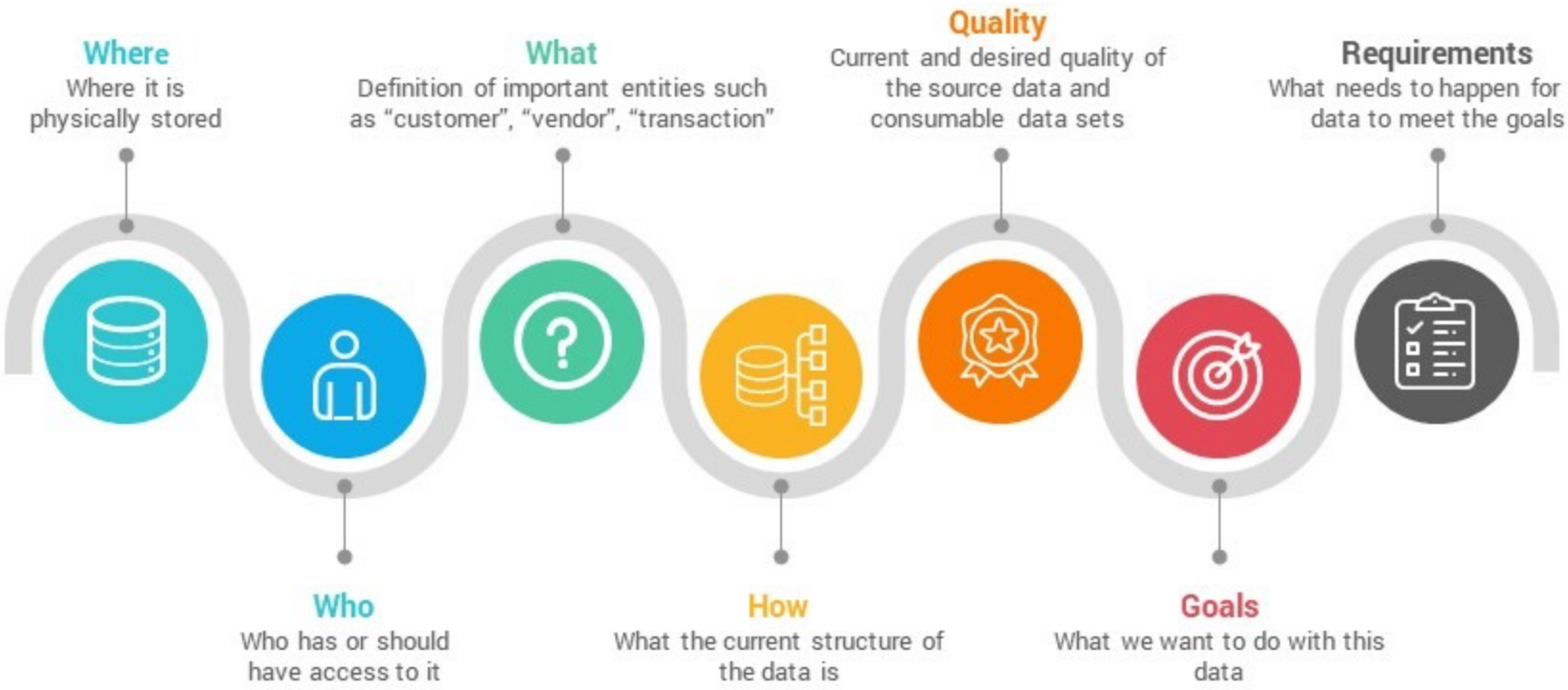
- Some of the key features to look for in a data governance tool include:
  - **Discovering, capturing, and cataloging data**
    - The catalog serves as a bird's eye view of each data entity, its profile, relationships, lineage, and the business glossary (with the decided common terminology).
  - **Data and metadata management**
    - Encapsulates the data integration application and controls the data lifecycle and tracking each data pipeline
  - **Data ownership and stewardship capabilities**
    - Enables both owners and stewards to do their jobs.
  - **Self-service tools**
    - Essential for organizations whose data governance goals are aligned more toward the business team.
    - These tools must provide an intuitive and clutter-free representation of all data, with reporting and alerting capabilities rolled into it.
    - A self-service station allows for consistent and clear decision-making.

The technology/tools [3]

- Some of the key features to look for in a data governance tool include:
  - **Data lineage automation**
    - Data lineage tracks the origin of each data entity, the changes that it went through, and its movement within the system. It helps with tracing and spotting any errors flagged by the system.
  - **Business glossary**
    - The starting point of every data governance plan is the creation of common data definitions and formats. Creating a common glossary of business terms helps maintain consistency.
  - **Compatibility with existing systems**
    - This means that the tool picked by your organization must be flexible and customizable.
  - **Compliance audit-ready**
    - must provide for external and internal audits, especially if compliance is one of the key goals of governance
  - **Policy management**
    - include configuration and management of policy controls. Once the controls have been set up, they are expected to automatically enforce policy management.

Data Governance Strategy

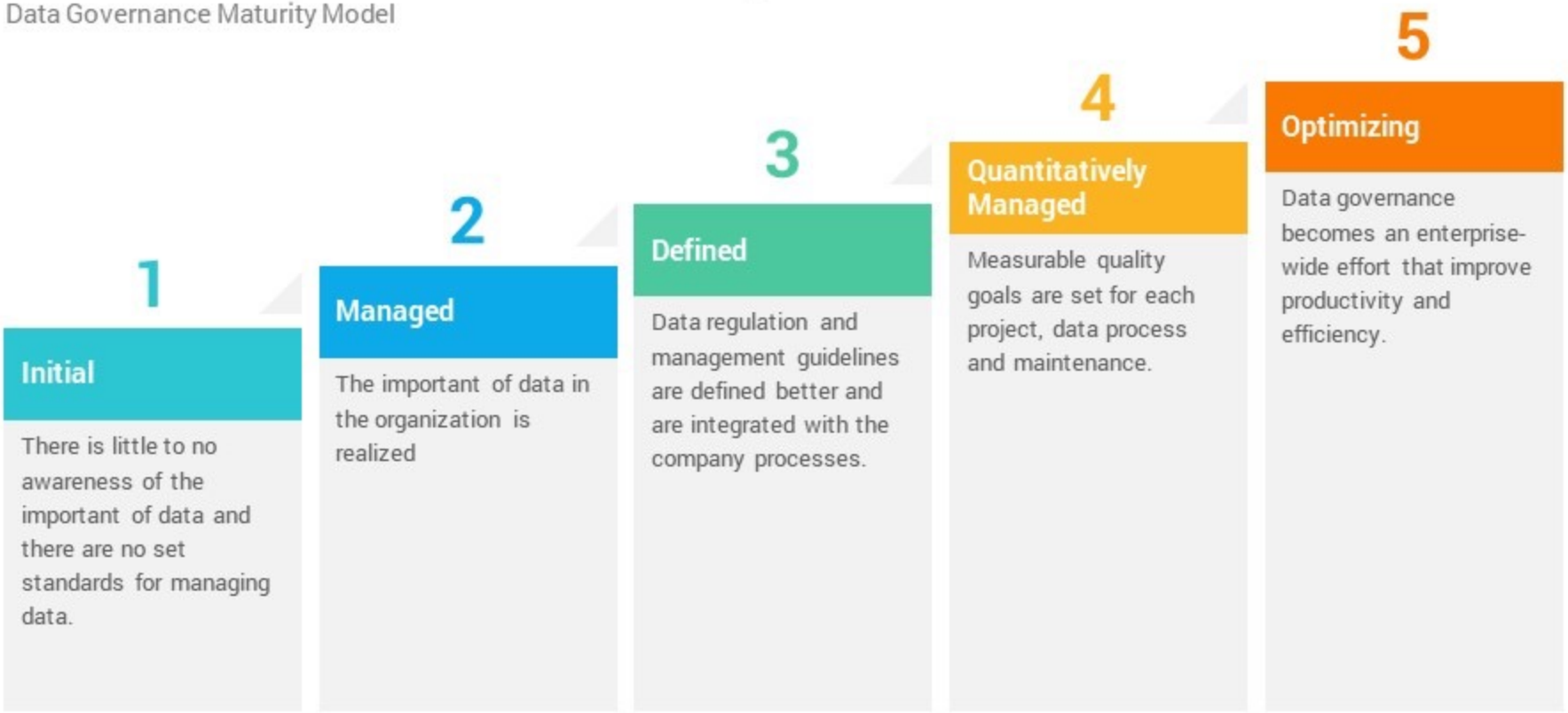
Data Governance Strategy



Maturity models

Data Governance Maturity Model

Data Governance Maturity Model



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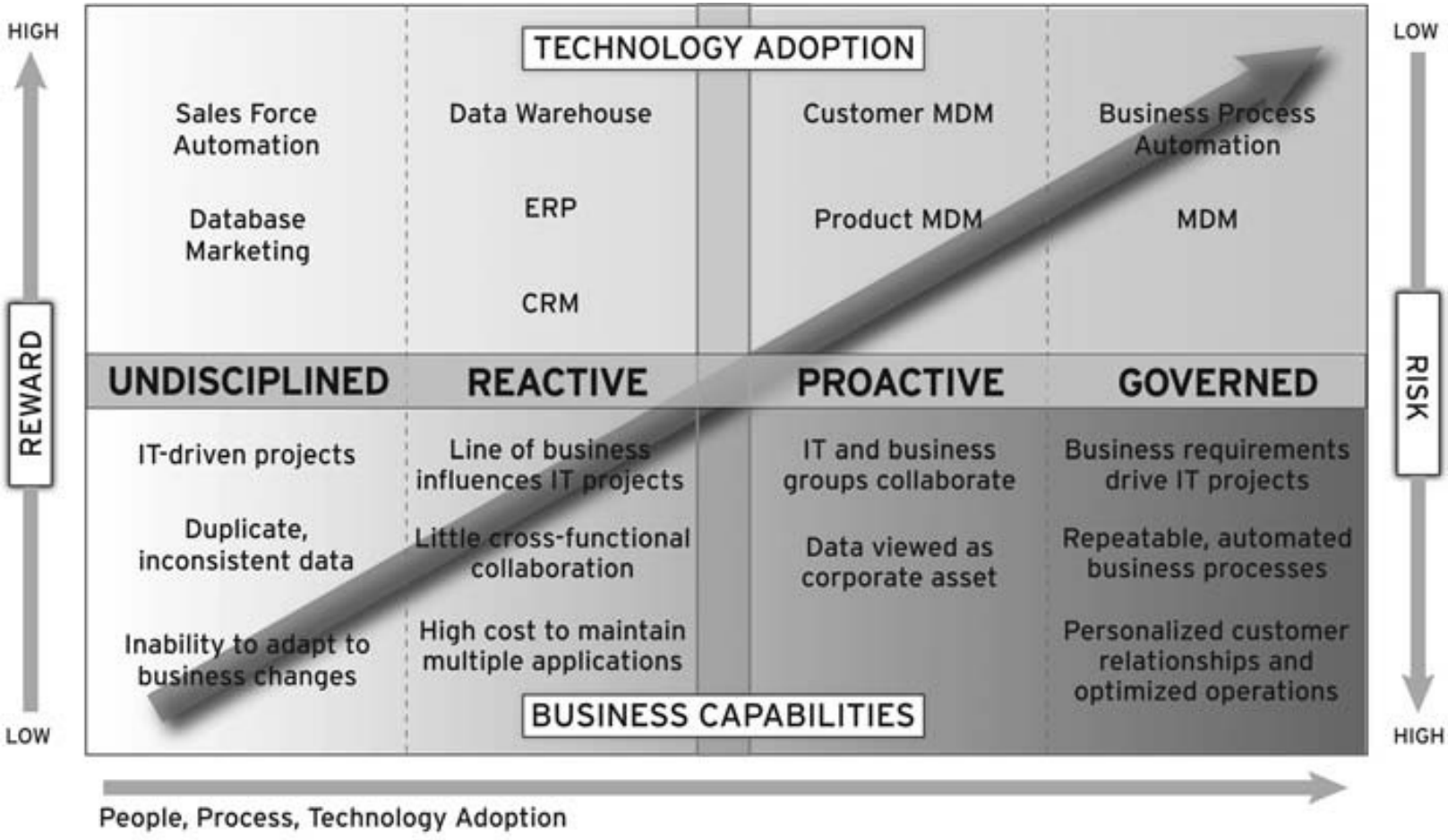
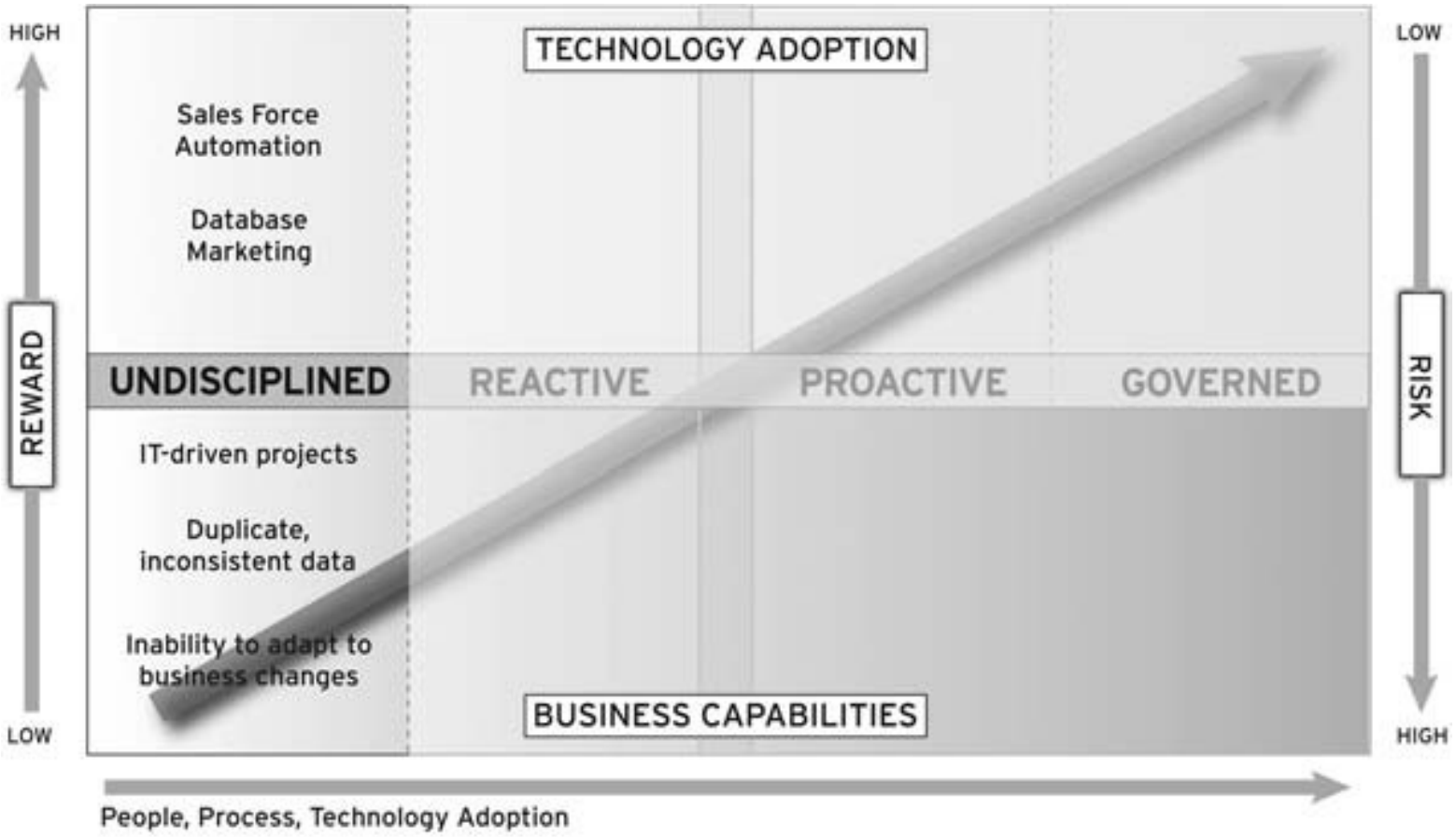
The data governance maturity model



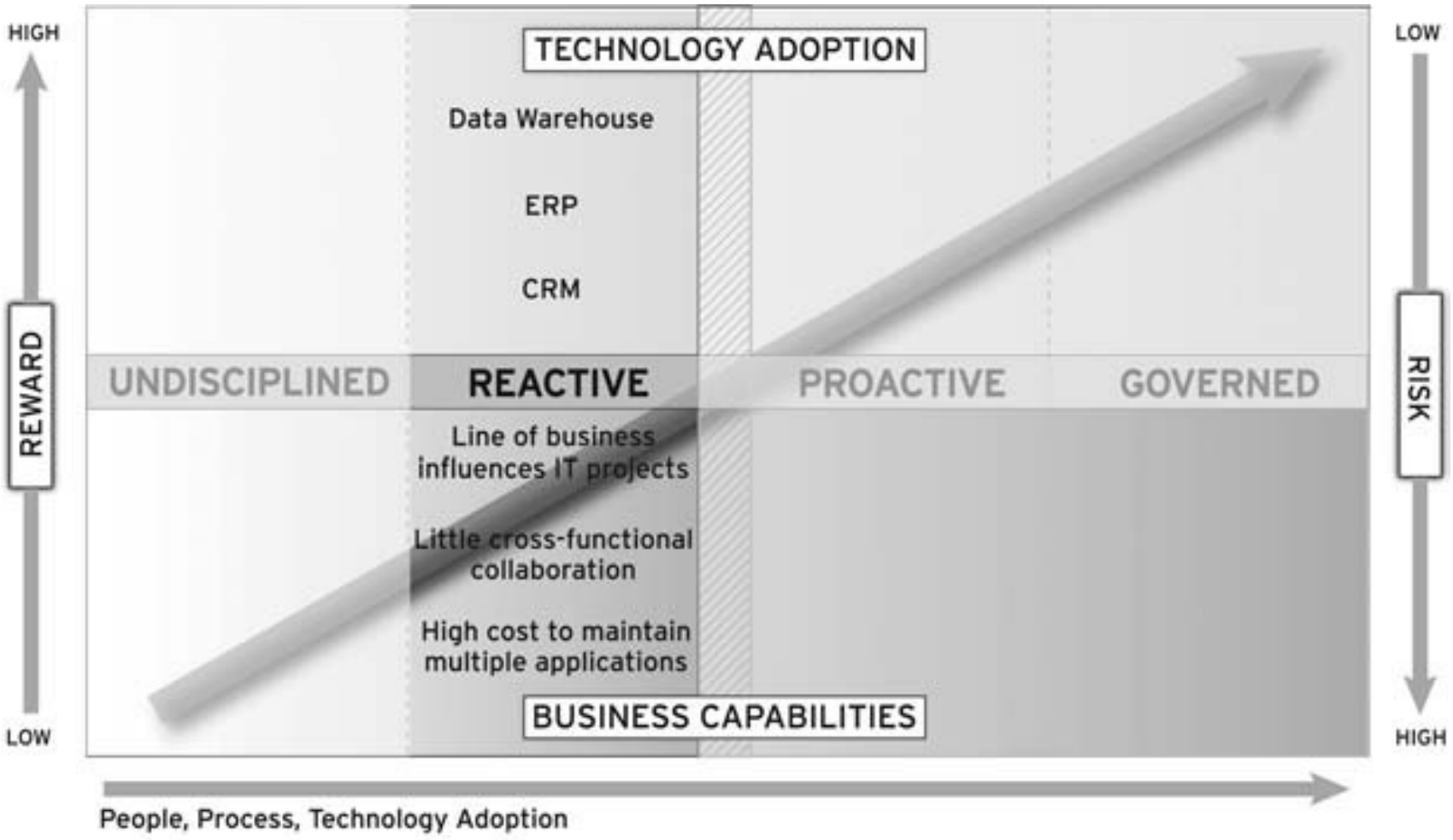
Undisciplined organizations: Disasters waiting to happen

- Characteristics of an Undisciplined Organization
  - Think locally, act locally
  - Few defined data rules and policies
  - Redundant data found in different sources
  - Little or no executive oversight
- Technology Adoption
  - Tactical applications to solve very specific problems: for example, sales force automation or database marketing
  - Very localized data management technology implemented within the tactical applications, if at all
- Business Capabilities
  - IT-driven projects
  - Duplicate, inconsistent data
  - Inability to adapt to business changes



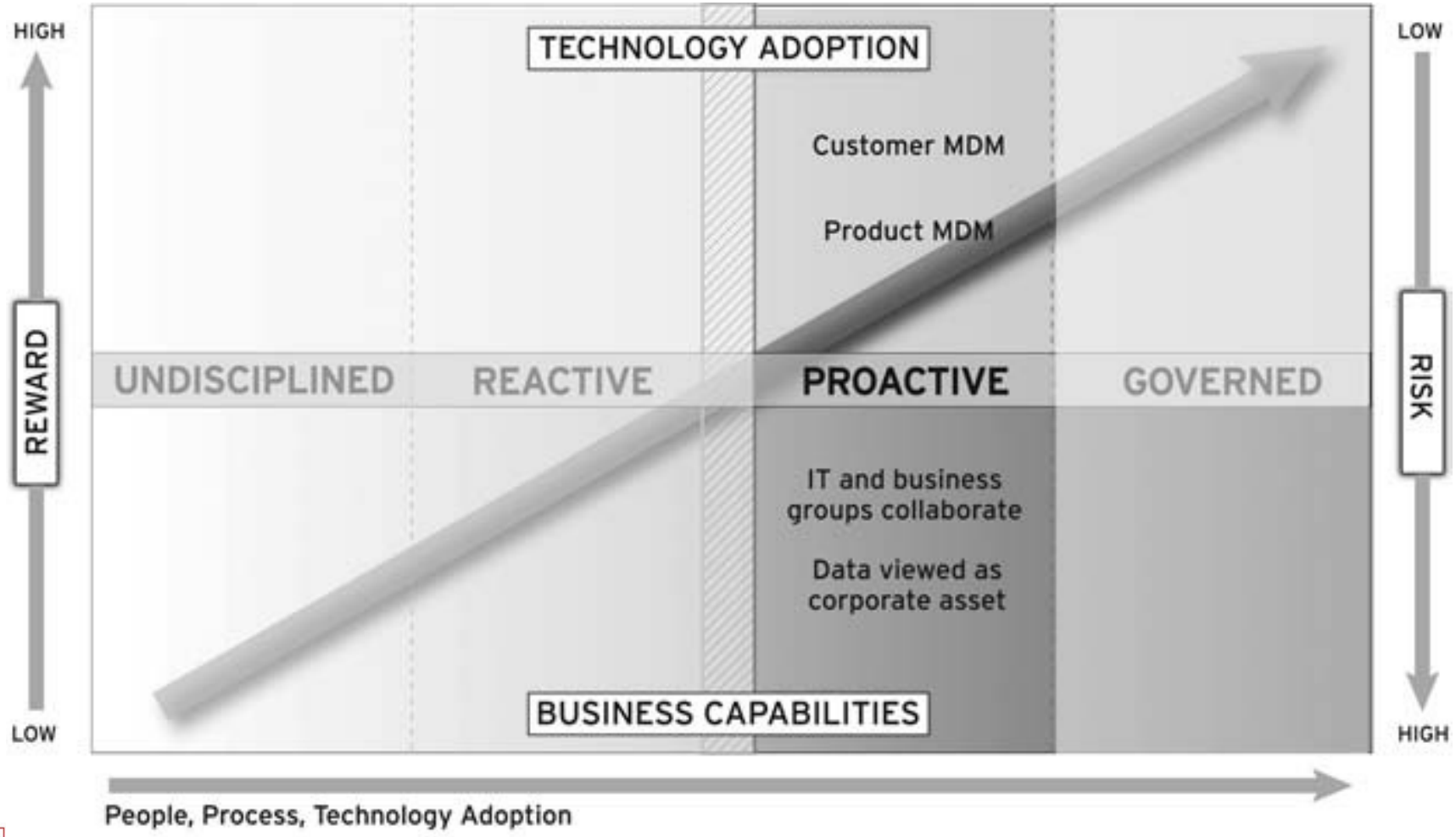
Reactive Organizations: Trying to get beyond crisis mode

- Characteristics of a Reactive Organization
  - Think globally, act locally
  - Presence of data management technology, but with limited data quality deployment
  - Siloed data leading to many views of what should be the same data
  - Awareness of data problems only after a crisis occurs
- Technology Adoption
  - Data warehouse
  - Enterprise resource planning (ERP)
  - Customer relationship management (CRM)
  - Data integration tools
- Business Capabilities
  - Line of business influences IT projects
  - Little cross-functional collaboration
  - High cost to maintain multiple applications



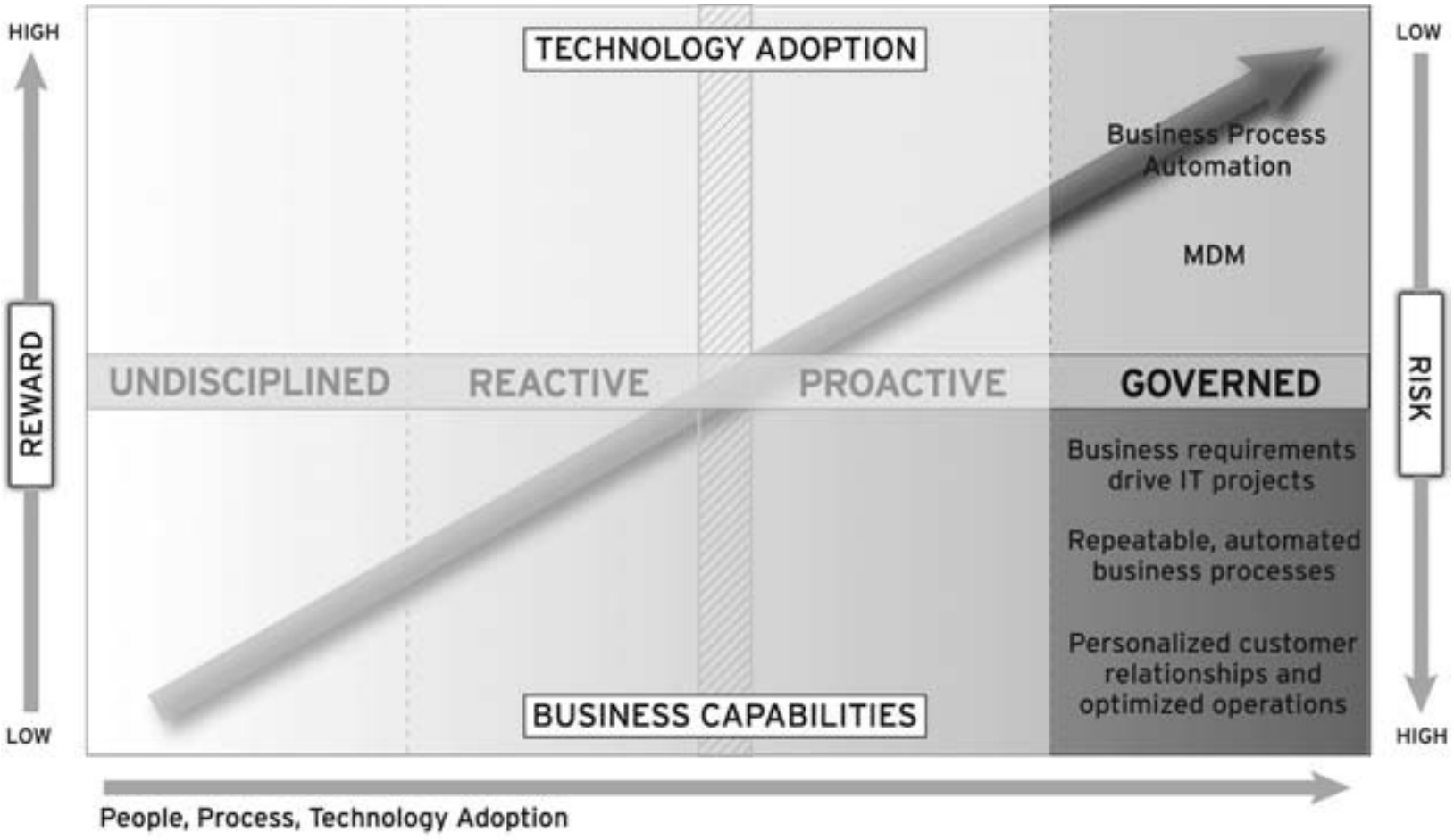
Proactive organizations: Reducing risk, avoiding uncertainty

- Characteristics of a Proactive Organization
  - Think globally, act collectively
  - Mastered use of enterprise resource planning (ERP), customer relationship management (CRM), and data warehouse technology
  - Executives who view data as a strategic asset
- Technology Adoption
  - Customer master data management (MDM)
  - Product MDM
  - Employing enterprise-wide data definitions and business rules
  - Enabling service-oriented architecture (SOA) architecture for cross organization data consistency
- Business Capabilities
  - IT and business groups collaborate
  - Enterprise view of certain domains
  - Data viewed as a corporate asset



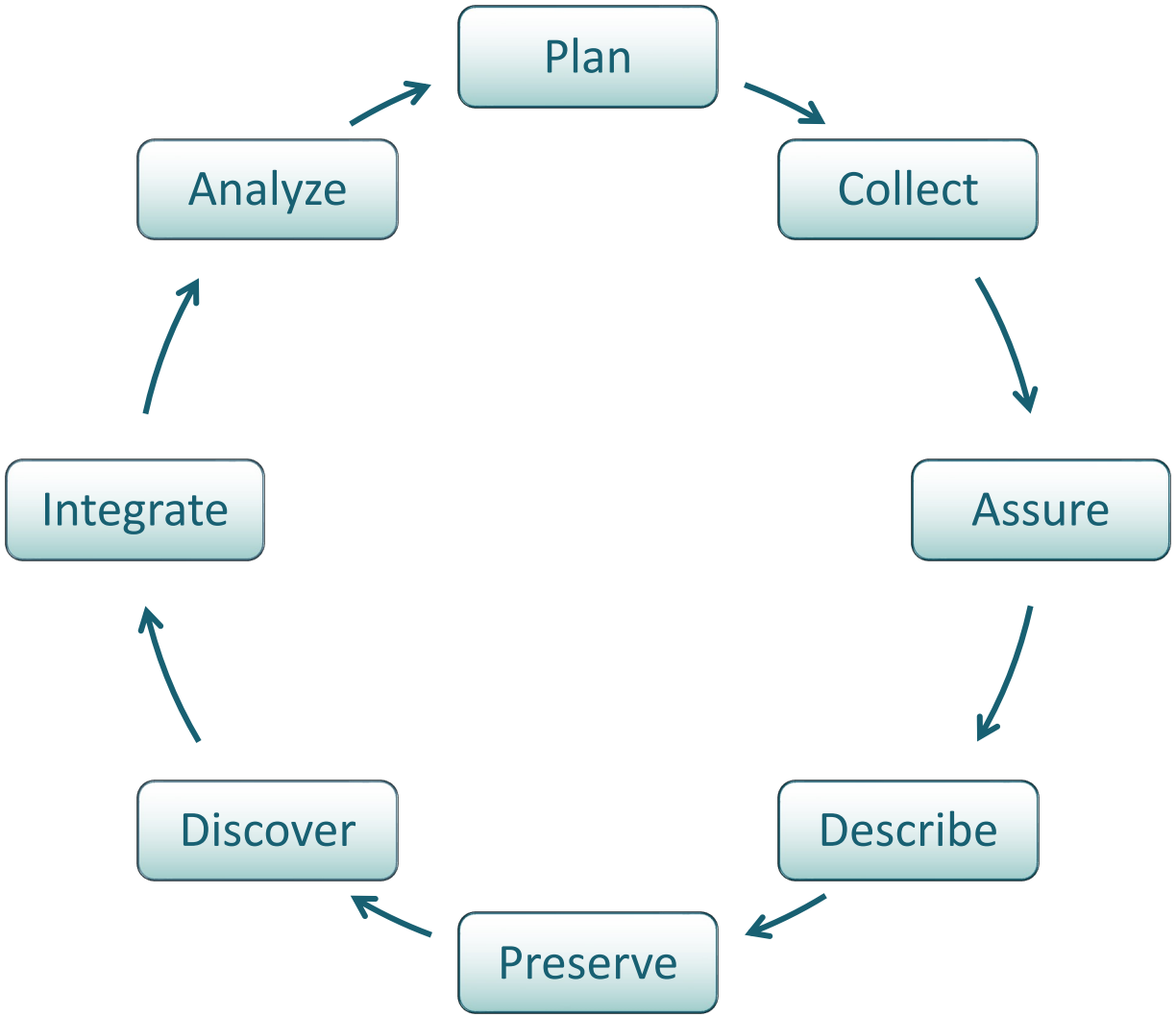
Governed Organizations: Trust in data pays multiple benefits

- Characteristics of a Governed Organization
  - Think globally, act globally
  - Unified data governance strategy
  - Comfortable incorporating external data without fear of corrupting existing, internal data
  - Executive sponsorship
- Technology Adoption
  - Business process automation
  - Master data management (MDM)
- Business Capabilities
  - Business requirements drive IT projects
  - Repeatable, automated business processes
  - Personalized customer relationships and optimized operations



Data life cycle management

Data Life Cycle



Planning

- Consider data management before you collect data
  - What kind of data will be collected?
  - Which methods will be used (sensors, samples, etc.)?
  - What data formats/standards are appropriate?
  - How will the data be used?
  - How will you share the data?
  - Will your methods satisfy
    - Funding requirements
    - Policies for access, sharing, reuse
  - Budget – most of the time tihis is overlooked!
- Output
  - Formal document

Collect

- What are some ways that we produce data?
- Experiments, observations, samples,
- Varying frequency, temporal and spatial coverage
- Data collection includes data entry
  - Transcribing notebooks into digital forms
  - Automated processing of data into a database

Assure

- Strategies for preventing errors from entering datasets
  - Standard data entry forms
  - Pre-specification of formats, units, etc.
- Activities to ensure quality during collection
  - Standard field and laboratory procedures
  - Automated rannge checks for sensor data
- Activities to clean collected data
  - Common to sensor data streams
  - Dependent upon variable and sensor
  - Graphical and statistical summaries

Describe

- Metadata
  - What metadata are needed?
  - What format for the metadata?
- Documentation and reporting of data
- Contextual details
  - What is it critical to know about the data?
- Description of temporal and spatial details, instruments/sensors, methods, units, files, etc.

Preserve

- How are you preserving your data?
  - What will be preserved
  - Where will it be preserved
  - Backup, version control?
- Policies for access, sharing, and reuse

- Does Your Office Look Like This?
- What are the potential problems?
- What are some potential solutions?

Discover

- Most data are not easily discoverable
  - Encapsulated in databases or files
  - Formats not compatible with web indexing technologies
- Conditions for effective data discovery
  - Highly curated data, well described via structured metadata
  - Standards for data and metadata formats

Integrate & analyze

- Integration
  - Combining data from different sources
  - Creating a unifying view of the data
  - Overcoming heterogeneity
- Analysis
  - To find out insightful values from data

Takeaways

- Data governance is more about people than data
- Process and written documents are essential
  - Leadership support
  - Broad-based consultation, including faculty
  - Opportunity for consultation
  - Representation
- Software can help, but it won't fix broken processes or organizations
- Starting data governance is hard work; sustaining it is harder

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Thank you for your attention!!!