

# Data Quality fundamentals



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# Agenda



1. Key Trends in Every Business
2. Ramifications of Poor Data Management Practices
3. What is Data Quality?
4. How Does Data Quality Affect Your Business?
5. EIM and DQ Strategy
6. Key take-aways

# Agenda



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## Improve operational efficiencies to drive down costs

- Lack of enterprise information management strategy affects data quality, which affects processes and initiatives
- Strategic focus on application consolidation

## Derive insight from corporate information

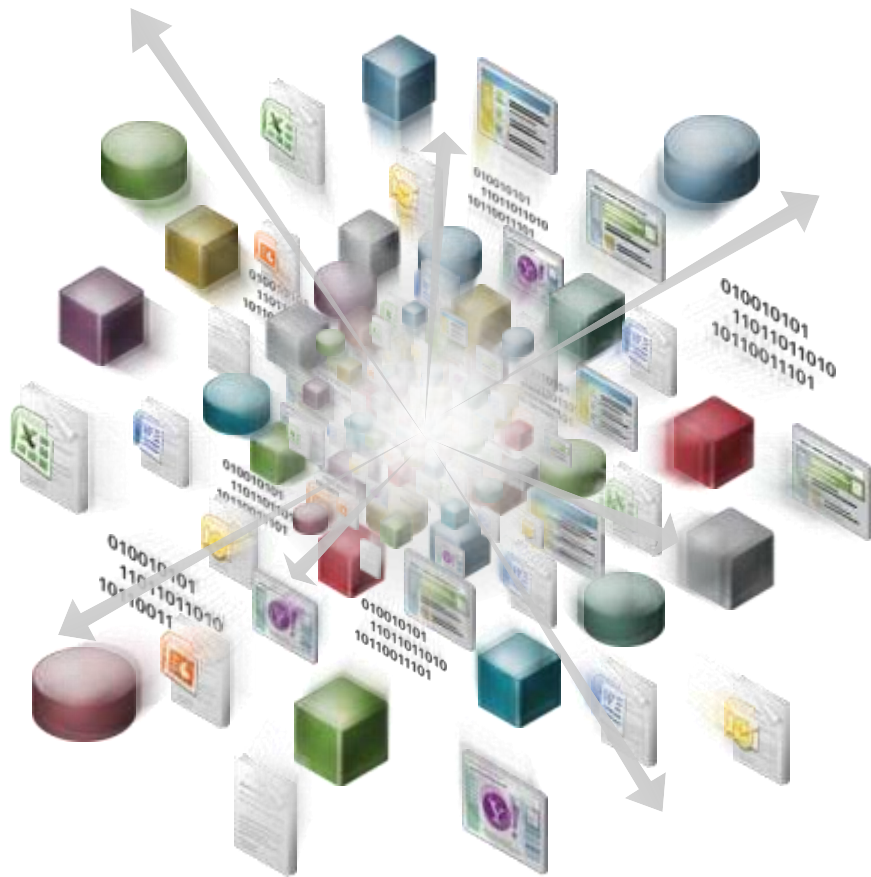
- Business intelligence recognized as top priority for most organizations according to studies
- Higher performing organizations leverage corporate information for competitive advantage

## Realize benefits from M&A faster

- Need for rapid data consolidation and data de-duplication
- 360 degree view of business activities across the enterprise essential for success

# Trusted Information is Elusive

## Key Problems in Managing Data



- The volume of data within enterprises is exploding – BIG data
- Application silos make it difficult for people to collaborate
- Users have little understanding of the quality of available data – No quantification
- Excessive time is spent on integration rather than innovation
- IT is struggling to address rapidly changing business requirements – strategic, operational, analytical compliance

# Is Your Organization Able to Keep Up With Information Demands?



## INFORMATION GAP

### Business

- Need timely access to trusted data
- Changing business requirements
- Making decisions with knowledge shadows



### IT

- Limited capacity to support users
- Competing priorities
- Lengthy ETL and DQ development cycles



# CIO, Information Architects, IT Leaders Must Take Action to Survive and Thrive

SAP

“ One of the top priorities of senior management during the next five years is managing information as a strategic asset.”

Survey from Gartner/Forbes

**Gartner**



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# Data Quality and Dilbert...



Source: Dilbert, May 2008  
<http://dilbert.com/strips/>

# You Need Trusted Data To Make Good Business Decisions

SAP

“

**90%** of upper level management feel they don't have the necessary information for critical business decisions; **50%** of them are afraid they are making poor decisions because of it.”

**Paul Kielstra**  
Economic Intelligence Unit (EIU) survey  
March, 2007



➔ **Lower Profits**

# How Does Data Management Affect You?

And Why You Should Care!



By year-end 2012, information assets will appear on the balance sheets of 25% of Global 2000 companies.”



By 2011, companies that adopt enterprise information management (EIM) best practices will be able to reduce operational costs at a rate two times greater than that of their competitors (and sustain reduced costs for a longer time).”

# Challenges to Effectively Managing Information

## IT Perspective

SAP



### Top issues

- How do I empower all users with the information they need to make better decisions?
- How do I help people to work across enterprise boundaries?
- How do I provide applications with accurate data to drive business operations?
- How do I implement data governance to ensure compliance and meet regulatory requirements?
- How can I minimize cost and manage complexity?

## Common problems experienced, when data quality practices are not used ...

- Difficult to determine the right recipients for marketing campaigns
- Inaccurate order information causes delayed or lost shipments and lower customer satisfaction
- Sales representatives are not able to identify relevant accounts
- Costs are high due to account duplications, while response rates are low
- Potential customers are annoyed by redundant mail, emails, and phone calls
- Reporting uses wrong data and this leads to wrong conclusions and decisions
- Total revenue and profitability of products and services



# Churn Management Dashboard



BEFORE

AFTER

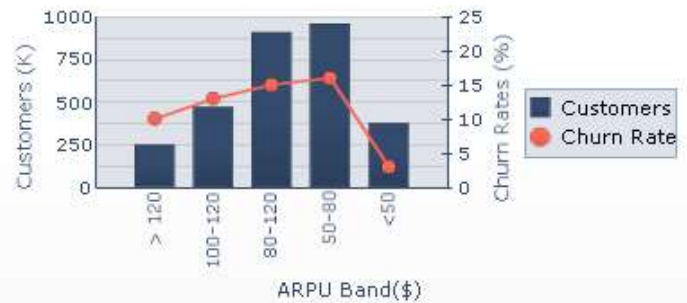
Churn Drilldown **Enhanced Churn Drilldown**

US Churn Rates (Q4 2008)



Current Customer Base - California

Customers and Churn Rates by ARPU Bands



Current Customer Base - California

Customer Satisfaction (surveys)

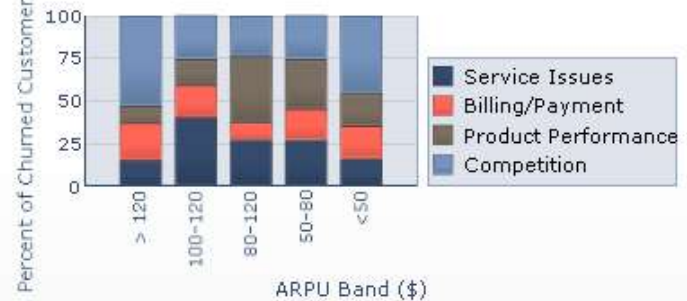


Issues Resolved On 1st Contact



Churned Customers - California

Churn Reason Codes by ARPU Bands



# Churn Management Dashboard



BEFORE

AFTER

Churn Drilldown    Enhanced Churn Drilldown

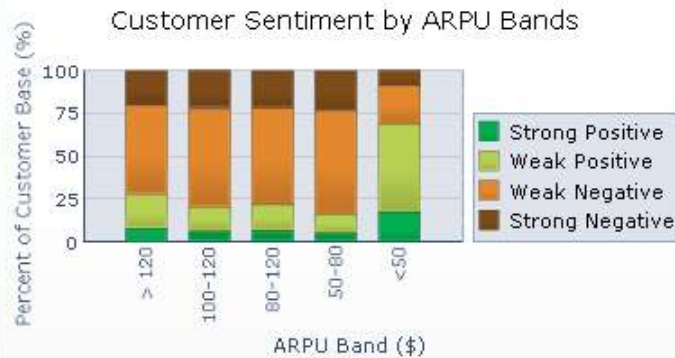
US Churn Rates (Q4 2008)



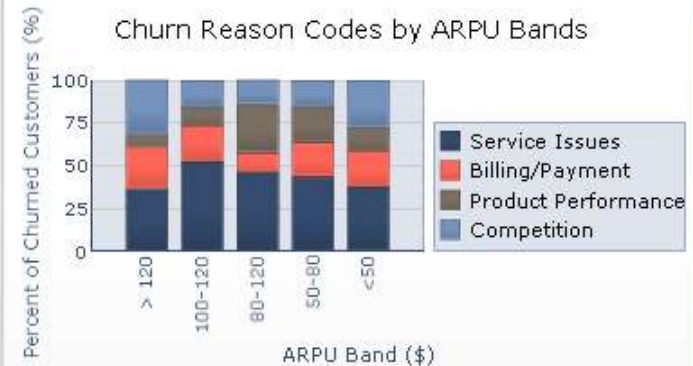
Current Customer Base - California



Current Customer Base - California



Churned Customers - California



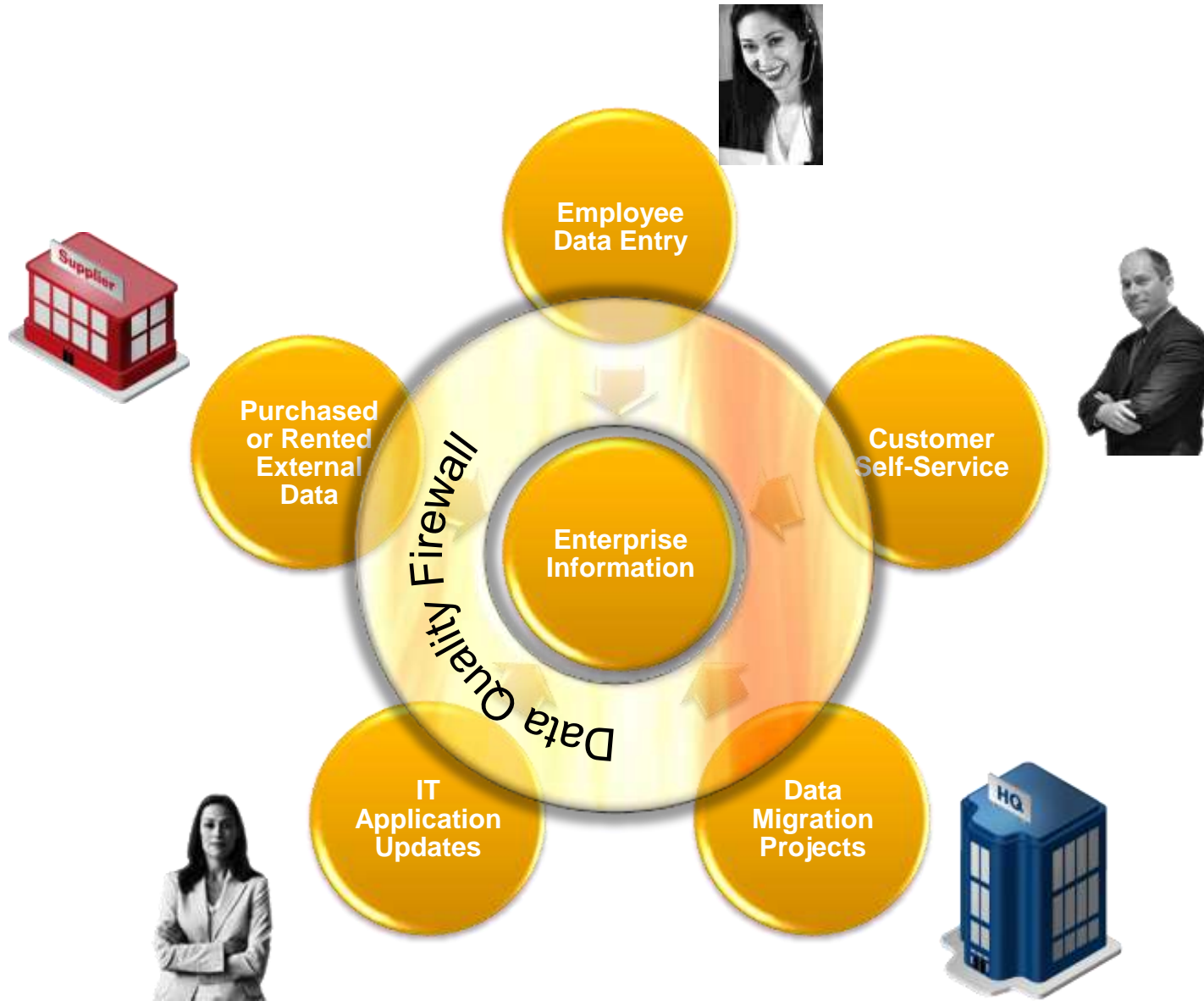
# What Kind of Data Are We Dealing with?



“What kind of data is most susceptible to data quality problems?”



# What Are the Sources of Bad Data Problems?



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## Data Quality - Definition

- Data that meets customer expectations!
- Degree or grade of excellence of data for its intended business use
- If the data content and structure has all the properties necessary to provide a reliable and trustworthy view of the business as needed by the community of people who use the data, then the data is of high quality.
- .....

## Data Quality Dimensions

- **Accuracy** - Determines the extent to which data objects correctly represent the real-world values for which they were designed. For example, the address of a customer is real-world address.
- **Completeness** - Determines the extent to which data is not missing. For example, an order is not complete without a price and quantity.
- **Conformity** - Determines the extent to which data conforms to a specified format. For example, the order date must be in the format YYYY/MM/DD.
- **Consistency** - Determines the extent to which distinct data instances provide non-conflicting information about the same underlying data object. For example, customer category in the CRM system is the same as that in MDM system.

## Data Quality Dimensions

- **Integrity** - Determines the extent to which data is not missing important relationship linkages. For example, product price is not in the master price list but product is showing available for sale.
- **Timeliness** - Determines the extent to which data is sufficiently up-to-date for the task at hand. For example, the inventory information for hats, mittens and scarves must be updated by November 1st.
- **Uniqueness** - Determines the extent to which the data for a set of columns is not repeated. For example, the new product name must be unique (not in the product master table).

## Validation Rules

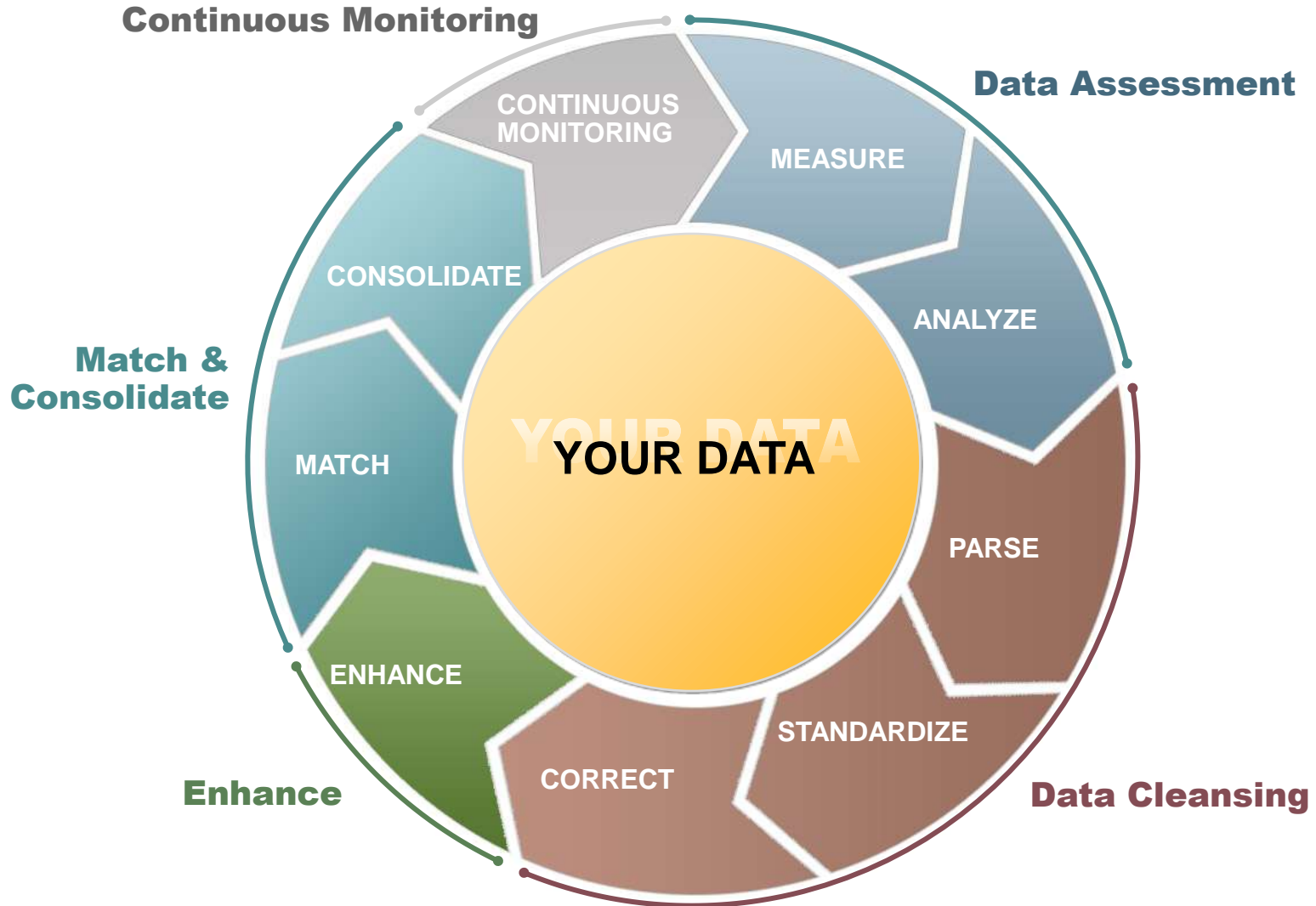
- Validate if there are any defects that violate the quality dimensions.
  - Simple rules such as `length(Lastname) > 0` or `IsNotNull(UnitPrice)`
    - Comparisons
    - Completeness validation
    - Data type validation
    - Format compliance
    - Regular expressions matching
    - Valid values
    - ....
  - Complex rules involving, look up into reference tables etc
    - Nested if conditions
    - Data conversions (string, date, number)
    - Lookups
    - Math functions, Validation functions, Logical operators
    - ...

## Data Cleansing Rules

Rules that govern how data is changed in order to comply with acceptable quality levels

- Parsing rules such as “John Smith” has “John” as first name and “Smith” as last name
- Standardization rules such as all dates are converted to follow MM/DD/YYYY format.
- Address cleansing rules to correct and standardize address data
- De-duplication rules such as if first name, last name, SSN and DOB are the same/similar these are duplicate records.
- Consolidation rules such as use SSN and DOB from DMV database, Address from USPS database, Credit score from Experian etc.
- Enhancement rules such as addition of Geocodes, DUNS numbers, verified phone, email etc

# Data Quality Concepts - Core Data Quality Framework



# Data Quality Approach

## Three Essential Steps to Data Quality



### Step 1: Analyze your data

Profile, query, extract and in every other way become intimately familiar with data content at a detail level. If you take a high-level approach to data quality, you will waste time discussing what the data might look like.

- What is the definition of “clean” data?
- Who defines “clean”?
- Who owns it over time?
- Which entities have the most issues?
- Where are the issues originating from?



### Step 2: Define your scope

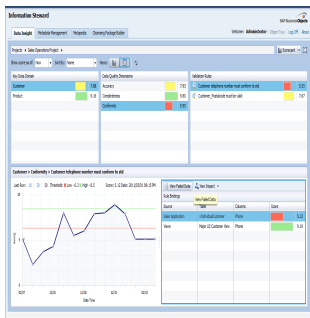
All data quality projects uncover hidden issues. Be very clear about what is, and is not, relevant to your current effort.

- Which business processes are affected?
- What business benefit can be achieved?
- How clean does it need to be?
- People, process, and tools?

### Step 3: Cleanse your data and track your results

Data quality is not a one-time process. It is an ongoing process of monitoring and correcting your data. You should know that: 1) new quality needs are being met and 2) new business processes are being monitored.

- Define stakeholders to analyze and clean
- Define processes to clean, monitor and maintain cleanliness
- Acquire necessary tools to assist



## Basic Profiling

- Value (high, low, average, median)
- String length (min, max, median, average)
- Completeness (# of null, zero, blank)
- DQ Indicators for Uniqueness, Low cardinality, Sparseness
- Value frequency distribution
- String pattern count & distribution
- Word frequency distribution

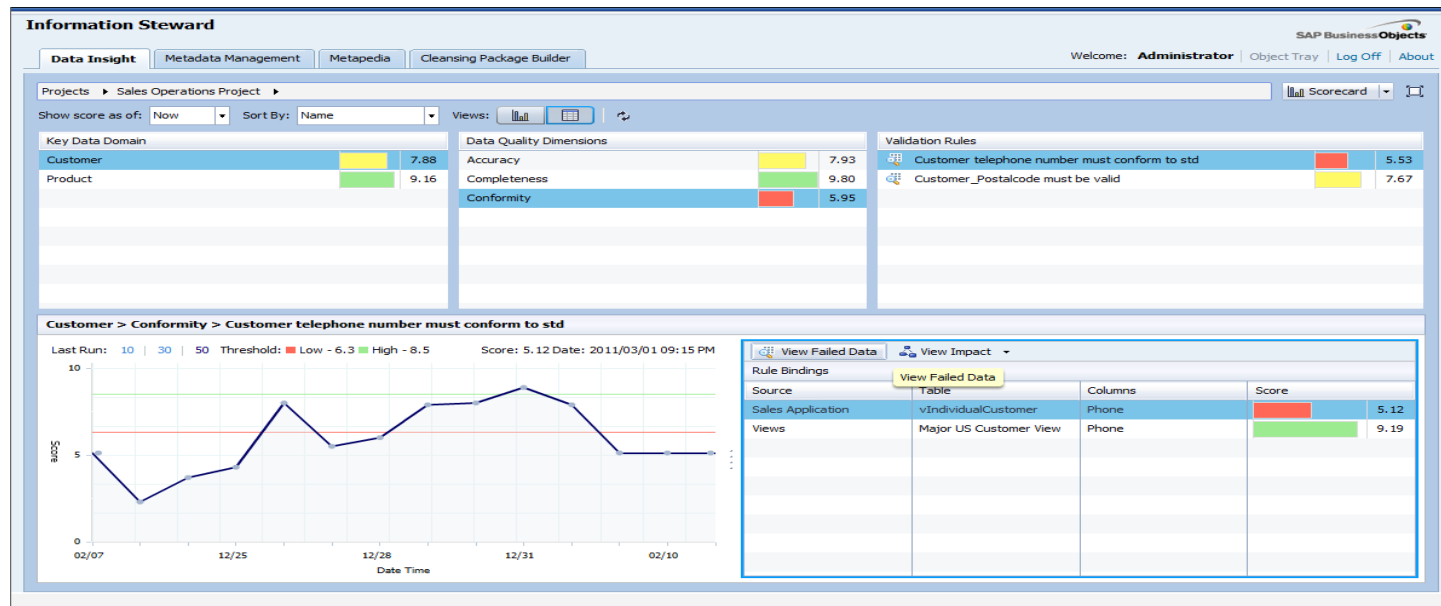
## Advanced Profiling

- Uniqueness (% of distinct and non-distinct values)
- Cardinality (# of distinct and non-distinct value)
- Redundancy analysis within one table or across-tables
- Primary key referential integrity test (primary key in parent table with no corresponding foreign key in child table)
- Cross table column value overlap
- Functional dependency analysis within a table or view across data sources
- Truth data validation - Address validation, Email, Phone validation etc
- Content Discovery – Primary key- Foreign Key relationship, data content inference



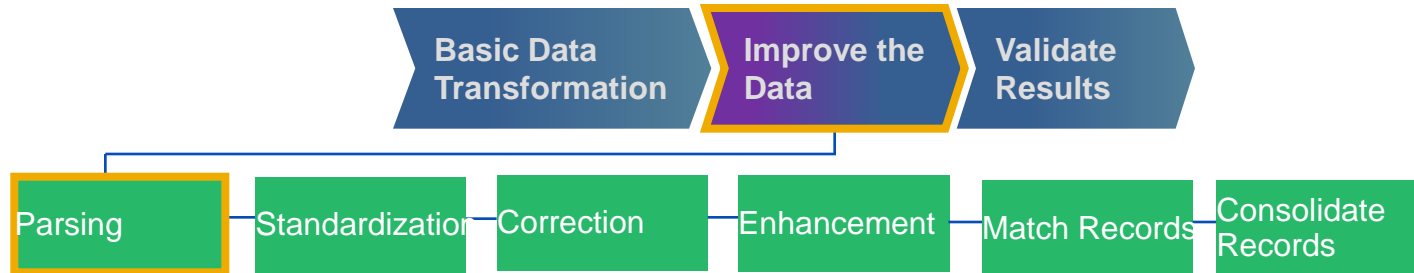
## Data Validation

- Validation against rules brings out the gaps between expectation and reality in data set
- Quality dimensions - Accuracy, Completeness, Conformity, Consistency, Integrity, Timeliness, Uniqueness
- Results of profiling assessment can be used for
  - Validation rules creation
  - Data Cleansing rule creation
- Number of records that pass or fail validation rules can provide quantification of the data quality.



# Data Quality Approach

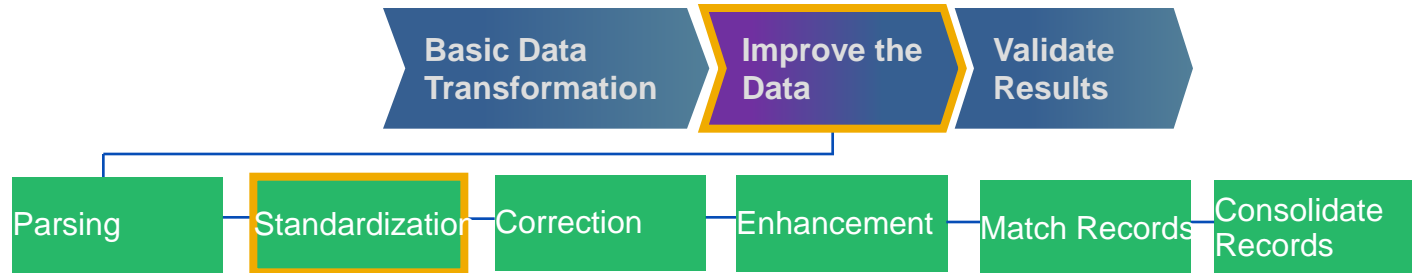
The Improvement Process in More Detail — Parsing



Input Record	Output Record
Mr. Dan R. Smith Jr. CPA	<b>Prenome</b> Mr.
Account Mgr.	<b>First Name</b> Dan
Jones Inc.	<b>Middle Name</b> R.
Dept. of Accounting	<b>Last Name</b> Smith
PO BOX 567	<b>Maturity Postname</b> Jr.
Biron, WI	<b>Honorary Postname</b> CPA
5594	<b>Title</b> Account Mgr.
	<b>Firm</b> Jones Inc.
	<b>Department</b> Dept. of Accounting
	<b>Locality</b> Biron
	<b>Region</b> WI
	<b>Primary Number</b> 567
	<b>Postal Code</b> 5594

# Detailed Data Quality

## Standardization



### Business Rules

Standardize purchase orders, dates, part numbers, diameter and lengths consistently:

**Rule 1:** Format the purchase order to include only the numeric portion and ensure that a ' - ' is only inserted after the second digit.

**Rule 2:** Convert dates to mm-dd-yyyy format with leading zero.

**Rule 3:** Apply upper case to alpha characters and insert ' - ' after the second and sixth alphanumeric characters of part numbers.

**Rule 4:** Use standard symbols to indicate feet and inches.

### Input Record

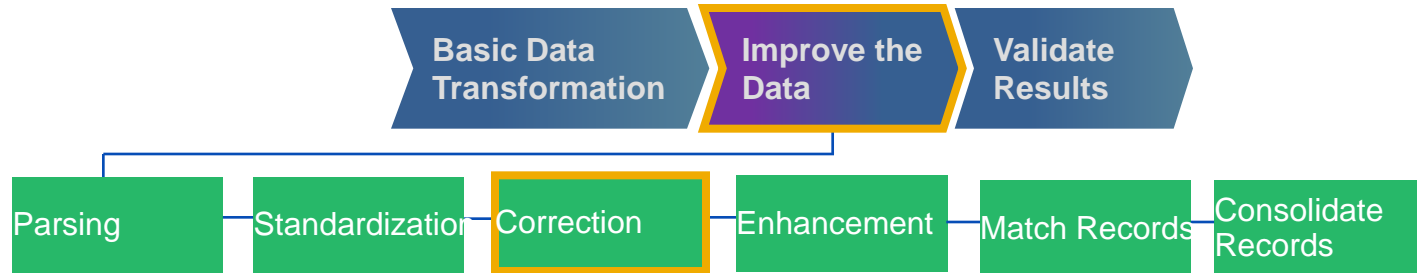
<b>Purchase Order</b>	PO345654
<b>Purchase Date</b>	3-01-02
<b>Part Number</b>	r20113245500
<b>Diameter</b>	3 inches
<b>Length</b>	52 ft

### Output Record

<b>Purchase Order</b>	34 - 5654
<b>Purchase Date</b>	03 - 01 - 2002
<b>Part Number</b>	R2 - 0113 - 245500
<b>Diameter</b>	3"
<b>Length</b>	52'

# Detailed Data Quality

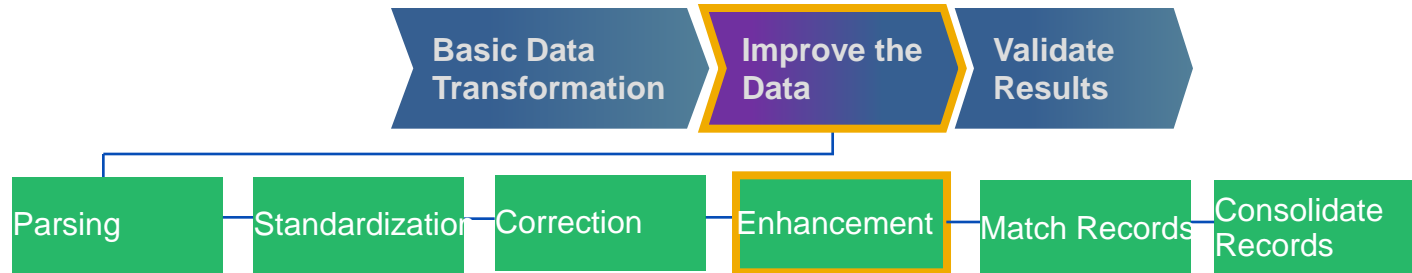
## Validation and Correction



Input Record		Output Record	
Mark Kessler		Name	Mark Kessler
117 - 138 St W	<b>Address is validated and corrected</b>	Address	117 Odell Clark Pl
Harlem NY		Locality	New York
10030		Region	NY
		Postal Code	10030

# Detailed Data Quality

## Enhancement



### Input Record

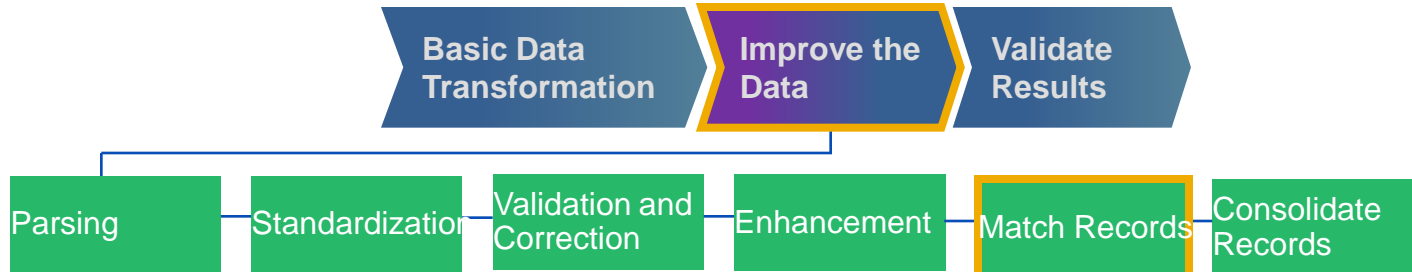
Margaret Smith-Kline, Ph.D.  
Future Electronics  
101 Avenue of the Americas  
New York, NY 10013-1933  
(222) 922-9922

### Output Record

<b>Address Latitude</b>	40.723175
<b>Address Longitude</b>	-74.004970
<b>Centroid Latitude</b>	40-723195
<b>Centroid Longitude</b>	-74.004977
<b>FIPS Country Code</b>	061 New York
<b>FIPS Postal Code</b>	51000 New York
<b>MCD Code</b>	44919
<b>BSA</b>	35620
<b>Metro code</b>	5600
<b>Section code</b>	0051001012

# Detailed Data Quality

## Match Records



### Input Record

**Margaret Smith-Kline Ph.D.**  
Future Electronics  
101 Avenue of the Americas  
New York NY 10013-1933  
maggie.kline@future\_electronics.com  
May 23, 2003



### Input Record

Maggie Smith  
**Future Electronics Co. LLC**  
101 6th Ave.  
Manhattan, NY 10012  
maggie.kline@future\_electronics.com  
**001-12-4367**



### Input Record

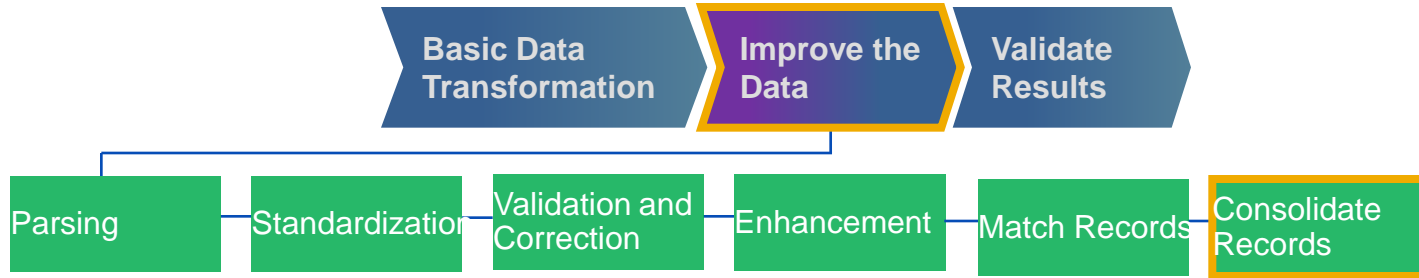
**Ms. Peg Kline**  
Future Elect. Co.  
101 6th Ave.  
New York NY 10013  
001-12-4367  
**(222) 922-9922**  
**5/23/03**



These three records have been deemed matching records based off of the business rules you define in the matching process.

# Detailed Data Quality

Consolidation of data and populate missing values



**Input Record**

Margaret Smith-Kline Ph.D.  
Future Electronics  
101 Avenue of the Americas  
New York NY 10013-1933  
maggie.kline@future\_electronics.com  
May 23, 2003



**Input Record**

Maggie Smith  
Future Electronics Co. LLC  
101 6th Ave.  
Manhattan, NY 10012  
maggie.kline@future\_electronics.com  
001-12-4367



**Input Record**

Ms. Peg Kline  
Future Elect. Co.  
101 6th Ave.  
New York NY 10013  
001-12-4367  
(222) 922-9922  
5/23/03

<b>Name</b>	Ms. Margaret Smith-Kline Ph.D.
<b>Company Name</b>	Future Electronics Co. LLC
<b>SSN</b>	001-12-4367
<b>Hire Date</b>	5/23/03
<b>Address</b>	101 Avenue of the Americas New York NY 10013-1933
<b>Phone</b>	(222) 922-9922
<b>Email</b>	maggie.kline@future_electronics.com



# Continuous Monitoring through DQ Metrics and Scorecards



**Information Steward** SAP BusinessObjects

**Data Insight** | Metadata Management | Metapedia | Cleansing Package Builder Welcome: Administrator | Object Tray | Log Off | About

Projects: Sales Operations Project Scorecard

Show score as of: Now | Sort By: Name | Views: [Bar Chart] [Table] [Refresh]

Key Data Domain	Score
Customer	7.88
Product	9.16

Data Quality Dimensions	Score
Accuracy	7.93
Completeness	9.80
Conformity	5.95

Validation Rules	Score
Customer telephone number must conform to std	5.53
Customer_Postalcode must be valid	7.67

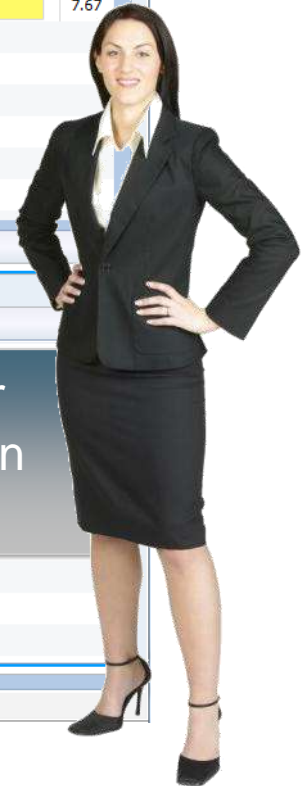
**IT can easily share data quality metrics to business users and involve them in owning the data problem**

Score: 5.12 Date: 2011/03/01 09:15 PM

Legend: Low - 6.3 High - 8.5

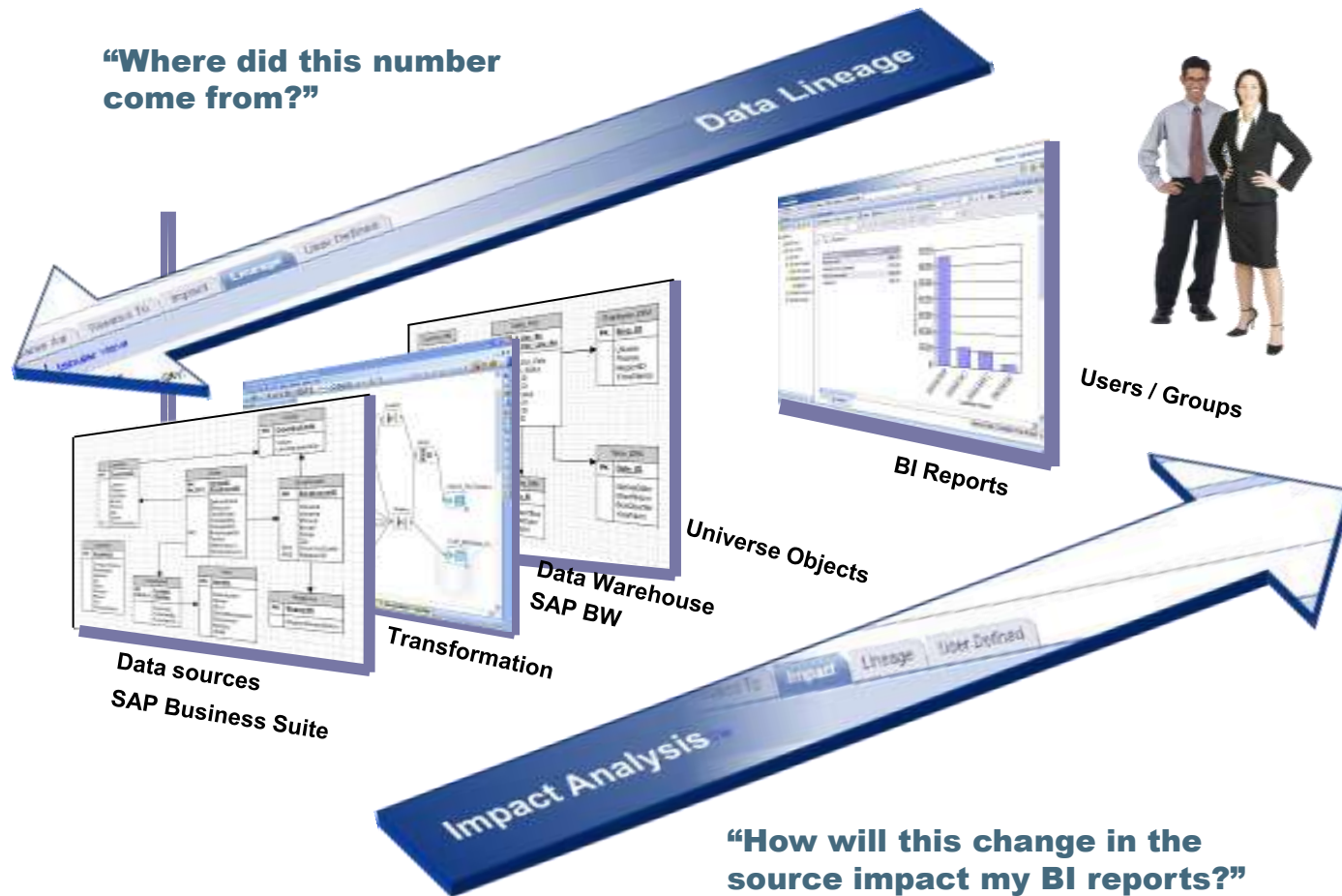
**Business users can easily see how their information measures up against information governance rules and standards**

View Failed Data | View Impact | Rule Bindings | View Failed Data



## What about Metadata?

- If a report is wrong, how can I track where the data came from?
- If the data quality is bad, how can I understand what it impacts?



## What about Business Term Repository?

- Common understanding and agreement on business concepts
- Central location for defining vocabulary (words, phrases, or business concepts)
- Organize business terms into categories that align with business subject matter or lines of business
- Link terms to business rules



The screenshot displays the SAP Business Term Repository interface. The top navigation bar includes actions such as 'Create Category', 'Edit Category', 'Delete Category', 'Create Term', 'Delete Terms', 'Add to Category...', 'Import from Excel', and 'Export to Excel'. On the left, a tree view shows the hierarchy: 'All Terms' > 'Categories' > 'Financial' (selected) > 'Insurance', 'Account Receivable', 'HealthCare', 'Radiology', 'Products', and 'AutoPart'. The main area shows 'Properties for Category: Financial' and a list of 'Associated Terms (35)'. A filter bar at the top of the list allows filtering by column (Name, Starts with, Pattern). The table below lists terms with their descriptions and data stewards.

Name	Description	Data Steward
Air Waybill	A nonnegotiable instrument of domestic and international air transport...	X
Annuity	A regular periodic payment made by an insurance company to a policyhol...	X
Back Order	A customer order for materials, goods in process, or finished goods th...	X
Balance Sheet	The difference between a country's total imports and exports over a se...	X
Capital Gain	The positive change in the value of an asset, a negative capital gain ...	X
Cash Flow	Cash generated by the firm and paid to creditors and shareholders. It ...	X
Consignment	Delivery of merchandise from an exporter (the consignor) to an agent (...)	X
Depreciation	1) The expense against earnings to write-off purchase price of an asse...	X
Direct Terms	The price of a unit of foreign currency in domestic currency terms, su...	X
Discount	The price of a unit of foreign currency in domestic currency terms, su...	X
Distributor	A foreign agent who sells for a supplier directly and maintains an inv...	X
Duty	A tax imposed on imports by the customs authority of a country.	X
Fixed Cost	A cost that is fixed in total for a given period of time and for given...	X
Income	The monetary payment received for goods or services, or from other sou...	X
Income Statement	Financial report that summarizes a firm's performance over a specified...	X

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# FEMA National Flood Insurance Program Better Service with SAP® BusinessObjects™



## QUICK FACTS

### Federal Emergency Management Agency (FEMA) National Flood Insurance Program

- Industry: Public sector – private partnership, public security
- Value: US\$3.034 trillion written premiums
- Stakeholders: 5.6 million policyholders; 10,000 federal, state, local, and private industry users
- Web site: [www.fema.gov](http://www.fema.gov)
- SAP® solutions and services: SAP BusinessObjects™ software
- Implementation partner: Optimal Solutions and Technologies Inc.

“For the first time we can get information presented in all the ways we need it – for reports, answering the public’s questions, developing documentation, and so forth – which lets us do our jobs better.”

Jack Way  
Senior IT Manager, National Flood Insurance Program  
Federal Emergency Management Agency

## Key Challenges

- Manage 5.6 million insurance policies
- Comply with government standards
- Accelerate claims processing and adjudication

## Implementation Best Practices

- Engaged Capability Maturity Model Integration (CMMI) level 3 contractor
- Employed CMMI project management methodology
- Adhered closely to change management best practices

## Financial and Strategic Benefits

- Reduced incidence of repetitive loss
- Increased speed and accuracy of processing claims and making quotes
- Enabled premium calculations to be based on actual claims data
- Empowered field personnel to quickly learn the status of individual claims

## Why SAP Was Selected

- Ease of accessing, using, manipulating, and generating reports
- Best look and feel
- Absence of restrictions and prerequisites

## Low Total Cost of Ownership

- Met project goals with small fraction of the project resources that large system integrators would have expended
- Reduced number of FTEs in IT dedicated to report generation by 50%
- Automated data verification and matching

## Operational Benefits

- Reduced postage and labor costs due to returned mail by 5% to 10%
- Cut end-user data analysis costs 50%
- Cut special report fulfillment time 80%



# Lexmark Makes Information a Business Asset

with SAP NetWeaver MDM and SAP BusinessObjects IM Solutions



## QUICK FACTS

### Lexmark International, Inc.

- Headquarters: Lexington, Kentucky
- Industry: High tech
- Products and services: Computer peripheral equipment
- Revenue: US\$4.53 billion
- Employees: 14,000
- Web site): [www.lexmark.com](http://www.lexmark.com)
- SAP® solutions and services: SAP NetWeaver® Master Data Management (SAP NetWeaver MDM) component, SAP BusinessObjects™ information management solutions
- Implementation partner: Wipro, SAP consulting

**“Prior to using SAP NetWeaver MDM and SAP BusinessObjects solutions, our heterogeneous IT landscape made it very difficult for us to view our total product line, what our customers were buying, and how we could serve those customers better.”**

Joe Young,  
Senior Manager, IT  
Lexmark International Inc.

## Challenges and Opportunities

- Growing competition
- Increased outsourcing of business functions to strategic partners
- Need to drive further cost efficiencies to maintain growth

## Objectives

- Provide single view of customer, product, supplier, and material data
- Make better decisions faster than the competition
- Integrate processes and systems with partners

## Implementation Highlight

Project encompassed data extracted from 9 core systems – 300,000+ customer, 75,000 material, 8,000 supplier, and 5,000 product records

## Why SAP

- Facilitates successful upgrades to existing SAP® software landscape
- Comprehensive set of enterprise data management tools
- Multi-domain master data management functionality

## Benefits

- Supported corporate strategy to make information a business asset
- Leveraged technology to optimize processes and drive cost savings
- Improved data quality and speed of access across the enterprise
- Provided information needed to proactively manage the business
- Delivered over 100,000 master data records and 1.5 million non-master records to company's SAP ERP application environment



# Build a Trusted Data Foundation for Successful BI Implementations



**Increase corporate confidence** – by providing information that is accurate and well-understood



**Reduce operating costs** – through elimination of rework by providing 360-degree view of all information assets across the enterprise



**Increase continuity of corporate strategy and execution** – by providing all employees access to right-time information for more effective decisions

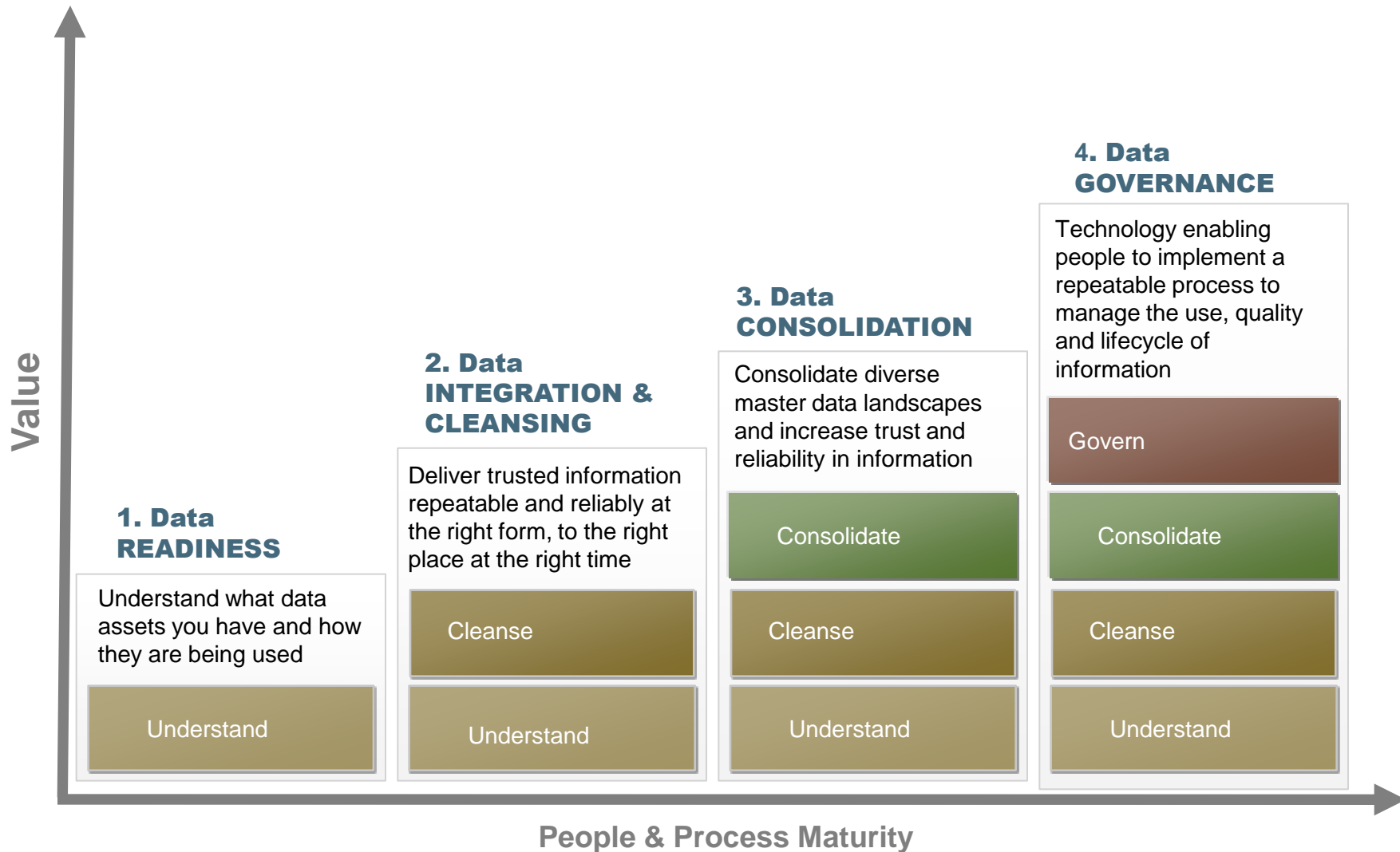


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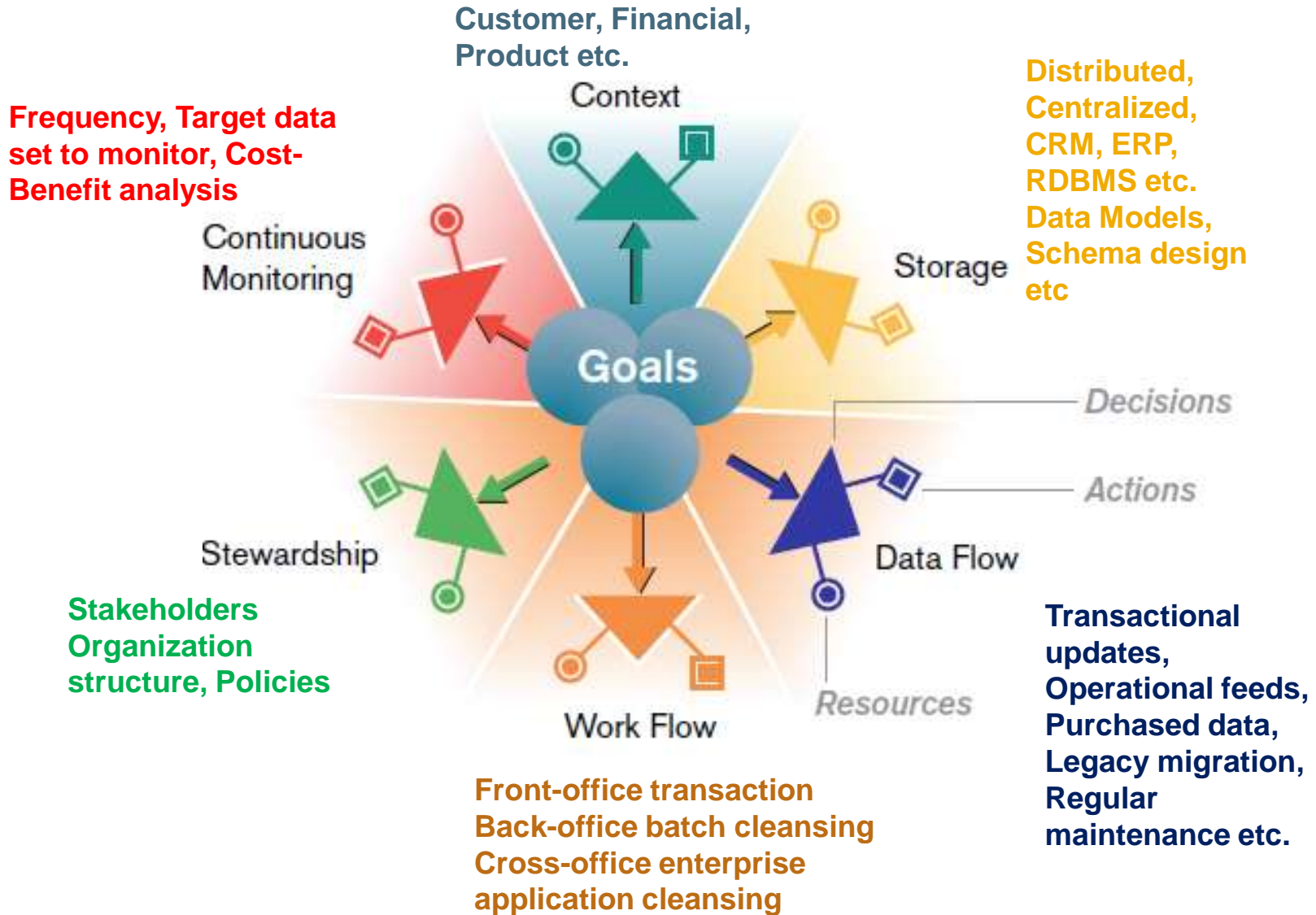


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# Building a Roadmap for Enterprise Information Management is Key for Success



# Data Quality Strategy Factors



## DQ Practitioner's Checklist

- Statement of the goals driving the project
- List of data sets and elements that support the goal
- List of data types and categories to be cleansed<sup>1</sup>
- Catalog, schema, or map of where the data resides<sup>2</sup>
- Discussion of cleansing solutions per category of data<sup>3</sup>
- Data flow diagrams of applicable existing data flows
- Workflow diagrams of applicable existing workflows
- Plan for when and where the data is accessed for cleansing<sup>4</sup>
- Discussion of how the data flow will change after project implementation
- Discussion of how the workflow will change after project implementation
- List of stakeholders affected by the project
- Plan for educating stakeholders as to the benefits of the project
- Plan for training operators and users
- List of data quality measurements and metrics to monitor
- Plan for when and where to monitor
- Plan for initial and then regularly scheduled cleansing

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- A trusted data foundation is a must for success of many strategic data management and BI initiatives.



- Data quality begins at the source within your systems



- Start thinking about proactive preventative data quality processes instead of reactive one-off solutions



- Data quality software applications help, but aren't the answer to all your problems



**Thank you!**

# Questions



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