Data Quality fundamentals

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SAP BusinessObjects
May 11th 2011
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
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Key Trends in Every Business

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?

- **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

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

Survey from Gartner/Forbes
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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

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).”

Source: 13 March 2009, Key Issues for Enterprise Information Management Initiatives, Debra Logan, Ted Friedman, Gartner, Inc.
Challenges to Effectively Managing Information
IT Perspective

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?
Data Quality Begins at the Source

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**

**Enhanced Churn Drilldown**

**US Churn Rates (Q4 2008)**

- **Current Customer Base - California**
  - Customers and Churn Rates by ARPU Bands
  - Churn Reason Codes by ARPU Bands

**Current Customer Base - California**

- Customer Satisfaction (surveys)
  - Issues Resolved On 1st Contact
  - Percent of Churned Customers (%)
What Kind of Data Are We Dealing with?

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

Materials/Products

Customers

Enterprise Information

Other
  Employee
  Financial

Business Partners
  Suppliers
  Distributors
  Retailers
What Are the Sources of Bad Data Problems?

- Employee Data Entry
- Customer Self-Service
- Purchased or Rented External Data
- Enterprise Information
- IT Application Updates
- Data Migration Projects

Data Quality Firewall
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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 Concepts - Dimensions

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 Concepts - Dimensions

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

- Continuous Monitoring
  - Measure
  - Analyze
  - Parse
  - Standardize
  - Correct
  - Enhance
  - Match
  - Consolidate

- Match & Consolidate

- Enhance

- Data Assessment

- Data Cleansing

YOUR DATA
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.

**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.

**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.

- 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?

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

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

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
Assessment with Validation

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

Basic Data Transformation

- Parsing
- Standardization
- Correction
- Enhancement

Improve the Data
- Match Records

Validate Results
- Consolidate Records

Input Record
Mr. Dan R. Smith Jr. CPA
Account Mgr.
Jones Inc.
Dept. of Accounting
PO BOX 567
Biron, WI 5594

Output Record
<table>
<thead>
<tr>
<th>Prename</th>
<th>Mr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name</td>
<td>Dan</td>
</tr>
<tr>
<td>Middle Name</td>
<td>R.</td>
</tr>
<tr>
<td>Last Name</td>
<td>Smith</td>
</tr>
<tr>
<td>Maturity Postname</td>
<td>Jr.</td>
</tr>
<tr>
<td>Honorary Postname</td>
<td>CPA</td>
</tr>
<tr>
<td>Title</td>
<td>Account Mgr.</td>
</tr>
<tr>
<td>Firm</td>
<td>Jones Inc.</td>
</tr>
<tr>
<td>Department</td>
<td>Dept. of Accounting</td>
</tr>
<tr>
<td>Locality</td>
<td>Biron</td>
</tr>
<tr>
<td>Region</td>
<td>WI</td>
</tr>
<tr>
<td>Primary Number</td>
<td>567</td>
</tr>
<tr>
<td>Postal Code</td>
<td>5594</td>
</tr>
</tbody>
</table>
Detailed Data Quality
Standardization

Business Rules
Standarize 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.

<table>
<thead>
<tr>
<th>Input Record</th>
<th>Output Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Order</td>
<td>34 - 5654</td>
</tr>
<tr>
<td>Purchase Date</td>
<td>03 - 01 - 2002</td>
</tr>
<tr>
<td>Part Number</td>
<td>R2 - 0113 - 245500</td>
</tr>
<tr>
<td>Diameter</td>
<td>3</td>
</tr>
<tr>
<td>Length</td>
<td>52 ft</td>
</tr>
<tr>
<td>Diameter</td>
<td>3&quot;</td>
</tr>
<tr>
<td>Length</td>
<td>52'</td>
</tr>
</tbody>
</table>
Detailed Data Quality
Validation and Correction

- Basic Data Transformation
- Improve the Data
- Validate Results
- Parsing
- Standardization
- Correction
- Enhancement
- Match Records
- Consolidate Records

Input Record
- Mark Kessler
- Address: 117 - 138 St W, Harlem NY, 10030

Output Record
- Mark Kessler
- Address: 117 Odell Clark Pl
- Locality: New York
- Region: NY
- Postal Code: 10030

Address is validated and corrected
Detailed Data Quality Enhancement

- Basic Data Transformation
- Improve the Data
- Validate Results

Steps:
- Parsing
- Standardization
- Correction
- Enhancement
- Match Records
- Consolidate Records

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

Output Record:

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

Basic Data Transformation → Improve the Data → Validate Results

- Parsing
- Standardization
- Validation and Correction
- Enhancement
- Match Records
- Consolidate 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 Electric Co.
101 6th Ave.
New York NY 10013
001-12-4367
(222) 922-9922
5/23/03

<table>
<thead>
<tr>
<th>Name</th>
<th>Ms. Margaret Smith-Kline Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name</td>
<td>Future Electronics Co. LLC</td>
</tr>
<tr>
<td>SSN</td>
<td>001-12-4367</td>
</tr>
<tr>
<td>Hire Date</td>
<td>5/23/03</td>
</tr>
<tr>
<td>Address</td>
<td>101 Avenue of the Americas</td>
</tr>
<tr>
<td></td>
<td>New York NY 10013-1933</td>
</tr>
<tr>
<td>Phone</td>
<td>(222) 922-9922</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:maggie.kline@future_electronics.com">maggie.kline@future_electronics.com</a></td>
</tr>
</tbody>
</table>
Continuous Monitoring through DQ Metrics and Scorecards

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

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

“Where did this number come from?”

“How will this change in the source impact my BI reports?”
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
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FEMA National Flood Insurance Program Betters 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
- Website: www.fema.gov
- SAP® solutions and services: SAP BusinessObjects™ software
- Implementation partner: Optimal Solutions and Technologies Inc.

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

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

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

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%

“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
Lexmark Makes Information a Business Asset with SAP NetWeaver MDM and SAP BusinessObjects IM Solutions

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

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
- 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.
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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Building a Roadmap for Enterprise Information Management is Key for Success

1. Data READINESS
Understand what data assets you have and how they are being used

2. Data INTEGRATION & CLEANSING
Deliver trusted information repeatable and reliably at the right form, to the right place at the right time

3. Data CONSOLIDATION
Consolidate diverse master data landscapes and increase trust and reliability in information

4. Data GOVERNANCE
Technology enabling people to implement a repeatable process to manage the use, quality and lifecycle of information

- Understand
- Cleanse
- Consolidate
Data Quality Strategy Factors

- Customer, Financial, Product etc.
- Distributed, Centralized, CRM, ERP, RDBMS etc.
- Data Models, Schema design etc.
- Transactional updates, Operational feeds, Purchased data, Legacy migration, Regular maintenance etc.
- Frequency, Target data set to monitor, Cost-Benefit analysis
- Distributed, Centralized, CRM, ERP, RDBMS etc.
- Data Models, Schema design etc.
- Stakeholders Organization structure, Policies
- Front-office transaction Back-office batch cleansing Cross-office enterprise application cleansing

Goals

- Customer, Financial, Product etc.
- Distributed, Centralized, CRM, ERP, RDBMS etc.
- Data Models, Schema design etc.

Continuous Monitoring

Stewardship

Work Flow

Decisions

Actions

Resources

Storage
DQ Strategy Checklist

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
- Catalog, schema, or map of where the data resides
- Discussion of cleansing solutions per category of data
- 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
- 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
Agenda

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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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