

The Role of Data Quality Monitoring In Data Governance

Aligning Data Quality Metrics with Business Insight

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Obsessive-Compulsive Data Quality

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Introduction

When the correlation between poor data quality and poor business performance isn't measured in a tangible way, data quality can be misperceived as a technical activity performed for the sake of the data, instead of an enterprise-wide initiative performed to provide data-driven solutions for business problems.

The common mistake is taking a data-myopic approach to data quality metrics, i.e., creating metrics that reflect the quality of the data in isolation. Without understanding how the organization is using its data, and how data quality affects business results, data cannot be called a corporate asset. Data is an asset only if the organization can qualify and quantify its value by connecting its usage to business objectives.

This whitepaper will examine these historical challenges and how the relationship between data quality and data governance can overcome them. This whitepaper is structured into the following three sections:

1. **Defining Data Quality** – Examines the two most prevalent perspectives on defining data quality, since how data quality is defined has a significant impact on how data quality is measured.
2. **The Role of Data Governance in Data Quality** – Examines how data governance provides the framework for a proactive data quality program, ensuring that data is of sufficient quality to meet the current and evolving business needs of the organization.
3. **The Role of Data Quality Monitoring in Data Governance** – Examines how compliance metrics associated with data governance policies align data quality with business insight, providing the historically missing link between data quality and business performance.

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Defining Data Quality

Historically, there have been two perspectives on defining data quality:

1. **Real-world alignment** – Reflects the perspective of the *data provider*
2. **Fitness for the purpose of use** – Reflects the perspective of the *data consumer*

How data quality is defined has a significant impact on how data quality is measured. Therefore, in the sections below, we will examine these two perspectives and how they relate to data quality metrics.

Real-World Alignment: The Danger of Data Myopia

Whether it's an abstract description of real-world entities (i.e., "master data") or an abstract description of real-world interactions (i.e., "transaction data") among entities, data is an abstract description of reality.

The creation and maintenance of these abstract descriptions shapes the organization's perception of the real world. However, these abstract descriptions can never be perfected because there is always a **digital distance** between data and the constantly changing real world that data attempts to describe.

The inconvenient truth is that the real world is not the same thing as the digital worlds captured within the organization's databases. And, of course, creating and maintaining these digital worlds is no easy task, which is exactly the danger inherent with the real-world alignment definition of data quality—when the organization's data quality efforts are focused on minimizing the digital distance between data and the real world, it can lead to a hyper-focus on the data in isolation, otherwise known as **data myopia**.

With a data-myopic focus, data quality can be misperceived as an activity performed for the sake of data. When, in fact, data quality is an activity performed for the sake of implementing data-driven solutions for business problems, enabling better business decisions, and driving optimal corporate performance.

However, even if we could create and maintain perfect real-world alignment, what value does high quality data possess independent of its use? Real-world alignment reflects the perspective of the data provider, and its advocates argue that providing a trusted source of data to the organization will be able to satisfy any and all business requirements. In other words, high quality data should be fit to serve as the basis for every possible use. Therefore, in theory, real-world alignment provides an objective data foundation independent of the subjective uses defined by the organization's many data consumers.

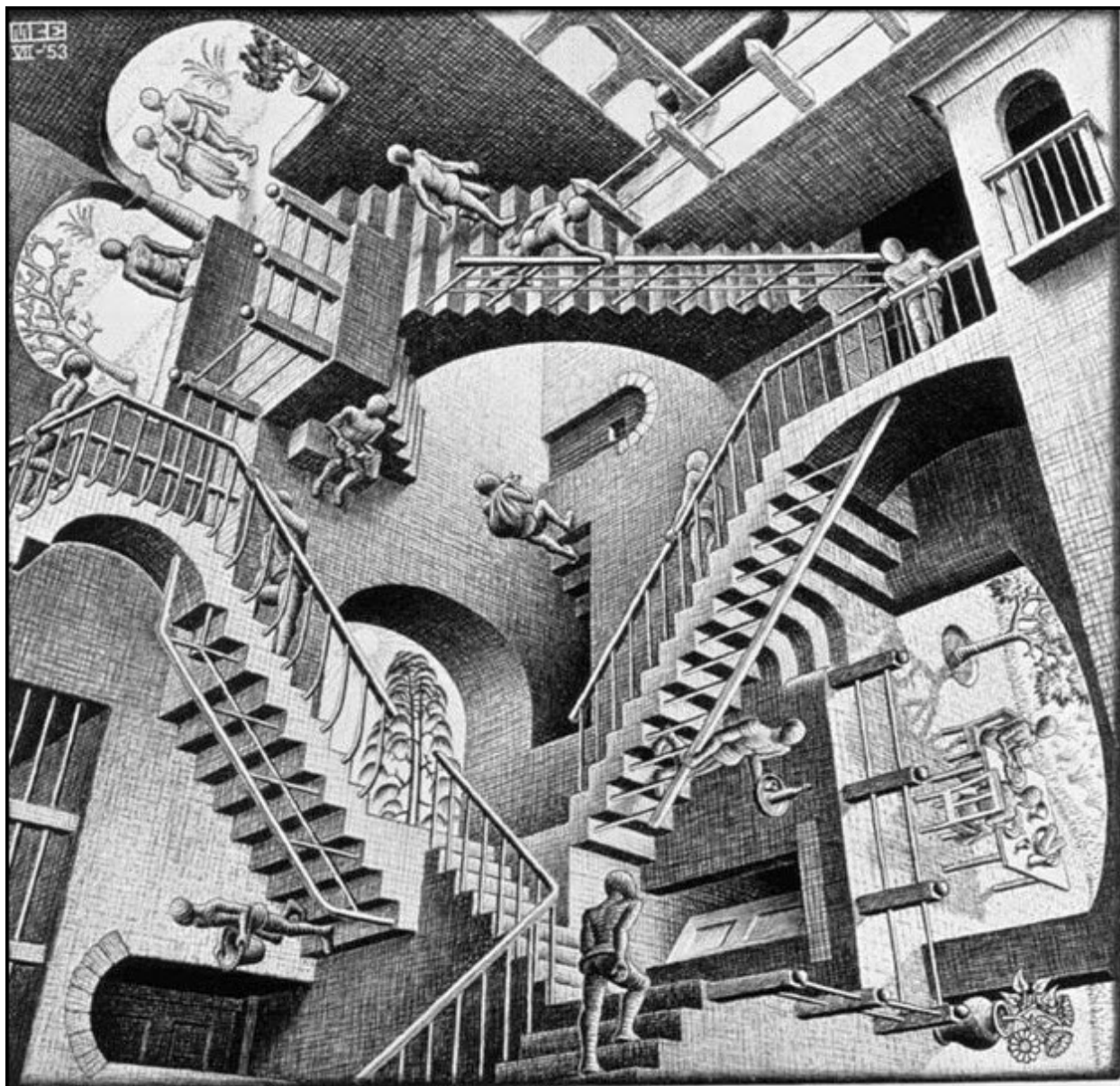
Providing the organization with a *single system of record*, a *single version of the truth*, a *single view*, a *golden copy*, or a consolidated repository of trusted data has long been the rallying cry and siren song of enterprise data warehousing (EDW), and more recently, of master data management (MDM). Although these initiatives can provide significant business value to the organization, it is usually poor data quality that undermines the long-term success and sustainability of EDW and MDM implementations.

A significant challenge for the data provider perspective on data quality is that it is difficult to make a compelling business case on the basis of trusted data without direct connections to the business needs of data consumers, whose business, data, and technical requirements are often in conflict with one another.

In other words, real-world alignment does not necessarily guarantee business-world alignment.

So if using *real-world alignment* as the definition of data quality has inherent dangers, we might be tempted to conclude that the *fitness for the purpose of use* definition of data quality is the better choice. However, as we examine in the next section, fitness for the purpose of use has its challenges as well.

Fitness for the Purpose of Use: The Challenge of Business Relativity



Relativity by M.C. Escher (<http://www.mcescher.com/>)

Shown above is M.C. Escher's famous 1953 lithograph *Relativity*, in which we observe multiple conflicting perspectives of reality. However, from the individual perspective of each person within the lithograph, everything must appear normal, since they are all casually going about their daily activities.

This is an apt analogy for the multiple business perspectives on data quality within most organizations.

Like truth, beauty, and art, data quality can be said to be in the eyes of the beholder, or when data quality is defined as fitness for the purpose of use—the eyes of the user. However, most data has both multiple uses and multiple users. Data of sufficient quality for one use or user may not be of sufficient quality for other uses and users. These multiple, and often conflicting, perspectives are considered irrelevant from the perspective of an individual user, who just needs quality data to support their own business activities.

The user (i.e., data consumer) perspective establishes a relative business context for data quality.

However, whereas the *real-world alignment* definition of data quality can cause a data-myopic focus, the business-world alignment goal of the *fitness for the purpose of use* definition of data quality must contend with the daunting challenge of **business relativity**—most data has multiple data consumers, each with their own relative business context for data quality, making it difficult to balance the diverse data needs and divergent data quality perspectives within the conflicting Escher-like reality of the organization.

This challenge inherent in the data consumer perspective on data quality often contributes to the data silo problem, the bane of successful enterprise data management prevalent in most organizations, where each data consumer maintains their own data silo, customized to be fit for the purpose of their own use. Organizational culture and politics also play a significant factor since data consumers legitimately fear that losing their data silos would revert the organization to a data provider perspective on data quality.

Data Quality Metrics

Therefore, how data quality is defined has a significant impact on how data quality is measured. When the correlation between poor data quality and poor business performance isn't measured in a tangible way, data quality can be misperceived as a technical activity performed for the sake of the data, instead of an enterprise-wide initiative performed to provide data-driven solutions for specific business problems.

Business-relevant metrics align data quality with business objectives and measurable outcomes. There are many data quality metrics—alternatively referred to as data quality dimensions. Some data quality metrics are more closely associated with *real-world alignment* and others are more closely associated with *fitness for the purpose of use*. However, most metrics can be applied to both data quality definitions.

In her great book *Executing Data Quality Projects: Ten Steps to Quality Data and Trusted Information*, Danette McGilvray provides a comprehensive list of data quality metrics, which include the following:

- **Timeliness and Availability** – A measure of the degree to which data are current and available for use as specified and in the time frame in which they are expected.
- **Data Coverage** – A measure of the availability and comprehensiveness of data compared to the total data universe or population of interest.
- **Duplication** – A measure of unwanted duplication existing within or across systems for a particular field, record, or data set.
- **Presentation Quality** – A measure of how information is presented to and collected from those who utilize it. Format and appearance support appropriate use of the information.
- **Perception, Relevance, and Trust** – A measure of the perception of and confidence in the quality of data, i.e., the importance, value, and relevance of the data to business needs.

Although there are many additional data quality metrics (as well as alternative definitions for them), perhaps the two most common data quality metrics are **Completeness** and **Accuracy**.

Completeness is generally a measure of the presence of an actual data value within a field or column, excluding NULL values and any non-NULL values indicating missing data (e.g., character spaces). Completeness can also be used as a measure of the absence of some of the sub-values that would make a data value complete (e.g., a telephone number in the United States missing the area code). Either way, completeness is *not* a measure of the validity or accuracy of the values present within a field or column.

There is a subtle, but important distinction between the closely related notions of validity and accuracy. Validity is the correctness of a data value within a limited context such as verification by an authoritative reference. Accuracy is the correctness of a *valid* data value within an extensive context including other data as well as business processes. Validity focuses on measuring the real-world alignment of data in isolation of use. Accuracy focuses on the combination of the real-world alignment of data and its use.

A good example of the distinction between validity and accuracy is postal address validation. Data quality processes certified by the United States Postal Service (USPS) serve as an authoritative reference for the validity of a United States postal address. Correspondence mailed to a validated postal address is guaranteed to be successfully delivered to that location. But postal address validation doesn't verify the accuracy of the relationship between the customer and the location, meaning whether or not it is an accurate home or work postal address for the customer. An important question is how concerned the organization is about the accuracy of postal address since it may vary with business use. For example, accuracy is more important when mailing customer bills than when mailing customer marketing collateral.

Most data quality dashboards create and monitor metrics based on the summary statistics provided by data profiling tools, attempting to elevate low-level data-myopic metrics up to the level of business relevance. However, at best, these disconnected summaries establish a correlation with business performance, but do not establish data quality metrics that drive—or should drive—the organization.

When data profiling is performed during data migration, data integration, or ETL (extract-transform-load) activities, the focus is mainly on conformance to target expectations, meaning that the data is being profiled to determine what data transformations might be necessary to prepare the source data to be successfully loaded into the target database. These aspects of domain and structural integrity analysis have an important technical context, but lack any relative context regarding the business uses of the data.

A common mistake made by those advocating that data needs to be viewed as a corporate asset is measuring data quality independent of its business use and business relevance, which is why most data quality metrics do a poor job in relaying the business value of data quality. Without data quality metrics that meaningfully represent tangible business relevance, you should neither expect anyone to feel accountable for providing high quality data, nor expect anyone to view data as a corporate asset.

Measuring data quality using the *real-world alignment* definition establishes a theoretical measurement of potential business impact. Measuring data quality using the *fitness for the purpose of use* definition establishes a practical measurement of actual business impact.

Therefore, every data quality metric you create must be able to answer two questions:

- 1. How does this data quality metric relate to a specific business context?**
- 2. How does this data quality metric provide business insight?**

If a data quality metric cannot answer these questions, then it is meaningless. Meaningful metrics provide business insight when they are created in relation to a specific business context. Instead of beginning with this relative business context in mind, many organizations begin with only the data in mind, which results in creating and monitoring data quality metrics that provide little, if any, business insight.

Data governance policies are the corrective lenses that resolve the organization's data myopia, bringing its data quality metrics into focus with clearly defined and measurable business context.

The compliance metrics associated with data governance policies align data quality with business insight, providing the historically missing link between data quality and business performance.

Before we examine some examples of how data governance policies improve data quality metrics, let's first examine how data governance provides the framework for a proactive data quality program.

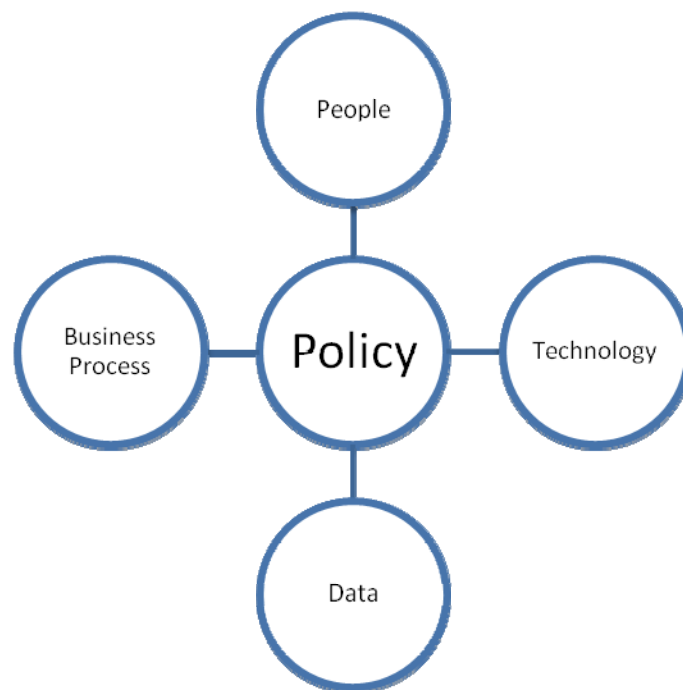
The Role of Data Governance in Data Quality

When the correlation between data quality and business performance isn't measured in a tangible way, the organization is blindsided by an event making it painfully aware of the negative business impacts of poor data quality. Some examples include a customer service nightmare, a regulatory compliance failure, or a financial reporting scandal. These events typically trigger a reactive data cleansing project where the only remediation will be finding and fixing the critical data problems, but without taking correction action to resolve the root cause—and in some cases, without even identifying the root cause.

Often the root cause of poor data quality can be traced to the lack of a shared understanding of the roles and responsibilities involved in how the organization is using its data to support its business activities.

Data governance provides the framework for a proactive approach to data quality, which requires going beyond reactive data cleansing projects, and establishing a pervasive program for ensuring that data is of sufficient quality to meet the current and evolving business needs of the organization.

Policy is the Central Concept of Data Governance



The central concept of data governance is its definition, implementation, and enforcement of policies, which govern the interactions among business processes, data, technology and, most important, people. It is the organization's people, empowered by high quality data and enabled by technology, who optimize business processes for superior corporate performance.

Data governance policies for data quality clearly define the business, data, and technical requirements that must be satisfied in to make data fit for the purposes of its operational, tactical, and strategic uses.

Data governance policies define and document all of these requirements in a straightforward and natural language that everyone can understand, with unambiguous definitions of the business, data, and technical terminology. Although documentation is a crucial aspect, it is just the beginning. Data governance must go beyond documentation. The data governance policies must be implemented as executable processes, which are directly embedded within the daily activities of the organization.

Ownership, Responsibility, and Accountability

Data governance policies clearly illustrate the intersection of business, data, and technical knowledge spread throughout the enterprise, revealing how interconnected and interdependent the organization is, and promoting awareness of the end-to-end process of how data is being used across the enterprise.

A data quality program within a data governance framework is a cross-functional, enterprise-wide initiative requiring that everyone, regardless of their primary role or job function, accept a shared responsibility for preventing data quality lapses, and for responding appropriately to mitigate the associated business risks when issues do occur.

Data governance not only reveals the business value of the organization's data but also reveals the communication and collaboration necessary to materialize that value as positive business impacts.

Data governance enables the organization to manage its data as a corporate asset, for which the entire enterprise has collective ownership and a shared responsibility, but also requires individual accountability for specific roles associated with the data, business process, and technology aspects of data quality.

Transparency and Throwing Stones at Glass Houses

Data governance provides the organization with a substantially improved view of how it is using its data, allowing data consumers to clearly see the data providers servicing their business needs, and allowing data providers to better align themselves with those business needs.

Data governance policies provide the framework for the communication and collaboration of business, data, and technical stakeholders, aligning data quality with business processes through relevant metrics, and establishing an enterprise-wide understanding of the roles and responsibilities involved, and the accountability required to support the organization's business activities.

Even prior to their implementation as executable processes, the definition, documentation, and publication of data governance policies is a significant deliverable because often they will help the organization catalog existing data sources, build a matrix of data usage and related business processes and technology, identify potential external reference sources to use for data enrichment, as well as help define the metrics that meaningfully measure data quality using business-relevant terminology.

The transparency provided by this combined analysis of the existing data, business, and technology landscape will provide a more comprehensive overview of the enterprise data management problems, which help the organization better evaluate possible solutions.

The transparency of data governance policies also provides an excellent basis for building strong business cases for continuous data quality improvements, and prioritizing critical business needs.

Additionally, data governance policies express the organization's business needs in a way that often reveals existing data and technology resources capable of meeting those needs that may never have been previously considered.

Impact analysis can be performed to evaluate any existing data and technology re-use and redundancies, as well as whether investing in new technology or new external reference data will be necessary.

Data governance can help topple data silos by first turning them into glass houses through transparency, empowering the organization to start throwing stones at those glass houses that must be eliminated. And even if data silos persist, they remain glass houses, clearly illustrating whether or not they have the business-justified reasons for remaining—i.e., are the data silos servicing truly unique business needs?

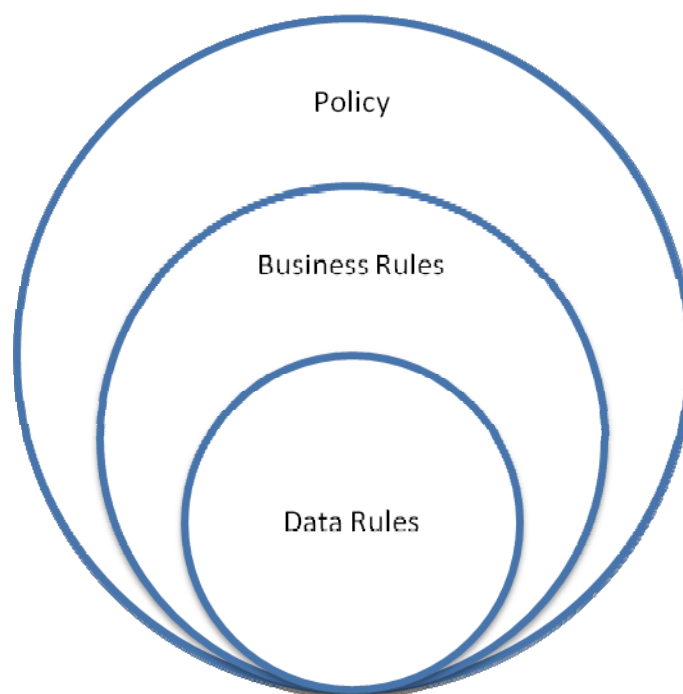
The Role of Data Quality Monitoring in Data Governance

The role of data quality monitoring in data governance is not to measure the quality of data in isolation, but to measure the quality of data within the relative context of a specific business use, or in other words, to measure the ability of a data provider to service the needs of a specific data consumer.

A data governance policy defines a relative business context for data quality. This business context has business, data, and technical requirements that must be satisfied in order to make data fit for a specific business purpose. These requirements identify a data consumer and the policy establishes a service level agreement (SLA) with a data provider. The data governance policy specifies the business rules and data rules to be executed. The associated metrics provide summary and detail level measurements and monitor the ability of the data provider to comply with the policy. Compliance metrics also help identify, assess, and prioritize data quality issues for remediation, alerting the appropriate people accountable for the business process, data, and technology aspects of the data governance policy.

The compliance metrics associated with data governance policies align data quality with business insight, providing the historically missing link between data quality and business performance.

Three-Level Hierarchy of Data Governance Metrics



There is a three-level hierarchy to the compliance metrics associated with a data governance policy:

1. **Policy** – A data governance policy is a set of business rules. At this level, the metric is asking the question: *Were all of the business rules associated with the policy satisfied?*
2. **Business Rules** – Each business rule is comprised of a set of data rules. At this level, the metric is asking the question: *Were all of the data rules associated with the business rule satisfied?*
3. **Data Rules** – Each data rule executes either a data quality check, or some other data evaluation. At this level, the metric is asking the question: *Was the data evaluation successful?*

Two Examples of Data Governance Policies for Data Quality

Let's imagine we work for the Soylent Corporation, which recently created a new MDM central repository. When the customer domain was loaded, data quality metrics for completeness and accuracy revealed:

- Customer Postal Address is 90% complete and 75% accurate
- Customer E-mail Address is 50% complete and 25% accurate

As we have previously discussed, data-myopic quality metrics appear meaningless to business users because of the absence of any connection with their business objectives and therefore do not measure the impact that data quality has on business performance.

So let's look at two examples of defining data governance policies for data quality, which will provide a relative business context for the data quality of these two customer master data attributes defined from the perspective of two data consumers using the MDM central repository as their data provider.

These two data consumers have different perspectives on data quality, each defining the fitness for the purpose of their own use. However, both data consumers have the shared business objectives to reduce the operational costs of printing and postage associated with paper delivery to customers in alignment with the Soylent Corporation's Green Initiative to reduce its environmental impacts.

The first data governance policy is for a Finance initiative called Green Billing:

| Data Governance Policy | Business Rules | Data Rules |
|--|---|--|
| Green Billing Finance requires 25% of customers have their billing method set as electronic delivery (via e-mail address) to reduce the operational costs of printing and postage from paper delivery (via postal address) and to align with the corporate initiative to reduce environmental impacts. | Verify Customer Billing Methods Verify customers who have their billing method set to paper delivery have an accurate postal address, and those who have their billing method set to electronic delivery have an accurate e-mail address. | Verify Accurate Postal Address for Billing Data Quality completeness and accuracy checks are executed to verify Customer Postal Address is accurate on MDM repository records where the Billing Method = 'P' |
| | | Verify Accurate E-mail Address for Billing Data Quality completeness and accuracy checks are executed to verify Customer E-mail Address is accurate on MDM repository records where the Billing Method = 'E' |
| | Track Green Billing Adoption Track the percentage of customers currently using the electronic billing method, as well as customers not currently using electronic billing to determine if an e-mail address is available and accurate. | E-mail Address Accuracy by Billing Method Data Quality completeness and accuracy checks are executed on Customer E-mail Address on MDM repository records and results are aggregated by Billing Method |

The customer billing business process is a data consumer establishing a relative business context for data quality completeness and accuracy metrics, revealing the following business impacts of data quality:

- Verify Customer Billing Methods
 - Customer Postal Address is 100% complete and 100% accurate *when the billing method is paper delivery*, so no billing disruptions are occurring because of undeliverable mail.
 - Customer E-mail Address is 100% complete and 100% accurate *when the billing method is electronic delivery*, so no billing disruptions are occurring because of an invalid e-mail.
- Track Green Billing Adoption – 15% of customers are using electronic billing, which is below the 25% target. However, 10% of customers using paper billing have an accurate e-mail address.

In part, this data governance policy is monitoring the customer billing business process for disruptions caused by poor data quality (currently none occur). However, the business objective of green billing is not being satisfied. One possible remediation plan would be to request that customers who are currently using paper billing switch to electronic billing in the next billing cycle (and we can track this progress).

The second data governance policy is for a Marketing initiative called Green Marketing:

| Data Governance Policy | Business Rules | Data Rules |
|--|--|---|
| Green Marketing Marketing requires 50% of customer cross-sell marketing collateral use electronic delivery (via e-mail address) to reduce the operational costs of printing and postage from paper delivery (via postal address) and to align with the corporate initiative to reduce environmental impacts. | <u>Verify Customer Marketing Methods</u> Verify confirmed opt-in customers who have their marketing method set to paper delivery have an accurate postal address, and those who have their marketing method set to electronic delivery have an accurate e-mail address. | <u>Verify Accurate Postal Address for Marketing</u> Data Quality completeness and accuracy checks are executed to verify Customer Postal Address is accurate on MDM repository records where the Marketing Opt-In = 'Y' and Marketing Method = 'P' |
| | | <u>Verify Accurate E-Mail Address for Marketing</u> Data Quality completeness and accuracy checks are executed to verify Customer E-mail Address is accurate on MDM repository records where the Marketing Opt-In = 'Y' and Marketing Method = 'E' |
| | <u>Track Green Marketing Adoption</u> Track the percentage of customers currently receiving electronic marketing, as well as customers currently receiving postal marketing to determine if an e-mail address is available and accurate. | <u>E-Mail Address Accuracy by Marketing Method</u> Data Quality completeness and accuracy checks are executed on Customer E-mail Address on MDM repository records where the Marketing Opt-In = 'Y' and results are aggregated by Marketing Method |

The customer marketing business process is a data consumer establishing a relative business context for data quality completeness and accuracy metrics, revealing the following business impacts of data quality:

- Verify Customer Marketing Methods
 - Customer Postal Address is 100% complete but 80% accurate *when the marketing method is paper delivery*, so some marketing collateral is wasted on undeliverable mail.
 - Customer E-mail Address is 100% complete but 66% accurate *when the marketing method is electronic delivery*, so some marketing collateral is rejected as invalid e-mail.
- Track Green Marketing Adoption – 25% of opt-in customers use electronic delivery, below the 50% target, only 10% of opt-in customers using paper delivery have an accurate e-mail address.

In part, this data governance policy is monitoring the customer marketing business process for the wasted operational costs of undeliverable marketing collateral, which is more significant with the inaccurate postal addresses (an impact not seen in customer billing and we can now quantify its financial impact).

The business objective of green marketing is also not being satisfied. Due to Marketing's significant use of customer e-mail address, remediation may need to consider enrichment from an external reference. A strong business case can be made since Finance would also benefit from this data quality improvement, and both data governance policies can measure and monitor the ROI of the data remediation efforts.

These two examples illustrate how the compliance metrics associated with data governance policies always frame data quality discussions within a relative business context, allowing the organization to qualify and quantify the business value of having high quality data as a strategic corporate asset.

Aligning Data Quality Metrics with Business Insight

A data governance policy is implemented as an executable process, comprised of business rules and data rules that allow the organization to create business-relevant data quality metrics, which can be monitored, measured, and reported to track compliance with the policy over time in order to drive continuous data quality improvement and link data quality to the achievement of business objectives.

By providing a framework of business context for data quality metrics, data governance policies can help make the business case for data quality improvement efforts and prioritize critical business needs.

The compliance metrics associated with data governance policies align data quality with business insight, providing the historically missing link between data quality and business performance.

Summary

Data quality can be defined as either *real-world alignment* or *fitness for the purpose of use*. Real-world alignment reflects the perspective of the *data provider*, and its advocates argue that providing a trusted source of data should be able to satisfy all business requirements. The danger inherent with real-world alignment is *data myopia*—the hyper-focus on data independent of business objectives. Fitness for the purpose of use reflects the perspective of the *data consumer*, and establishes a relative business context for data quality. The challenge inherent with fitness for the purpose of use is *business relativity*—most data has multiple data consumers, each with their own relative business context for data quality.

Historical approaches have relied on reactive data quality projects for correcting critical data problems, but without resolving their root cause, which often can be traced to the lack of a shared understanding of the roles and responsibilities involved in how the organization is using its data to support its business activities. Data governance provides the framework for a proactive data quality program, ensuring that data is of sufficient quality to meet the current and evolving business needs of the organization.

The central concept of data governance is its definition, implementation, and enforcement of policies, which govern the interactions among business processes, data, technology and, most important, people. It is the organization's people, empowered by high quality data and enabled by technology, who optimize business processes for superior corporate performance.

Data governance enables the organization to manage its data as a corporate asset, for which the entire enterprise has collective ownership and a shared responsibility, but also requires individual accountability for specific roles associated with the data, business process, and technology aspects of data quality.

The role of data quality monitoring in data governance is not to measure the quality of data in isolation, but to measure the quality of data within the relative context of a specific business use, or in other words, to measure the ability of a data provider to service the needs of a specific data consumer.

A data governance policy is implemented as an executable process, comprised of business rules and data rules that allow the organization to create and track business relevant data quality metrics. These compliance metrics associated with data governance policies align data quality with business insight, providing the historically missing link between data quality and business performance.

About Jim Harris

Jim Harris is a recognized industry thought leader on data quality with over 15 years of professional services and application development experience in data quality, data integration, data warehousing, business intelligence, master data management, and data governance.

Jim Harris is an independent consultant, speaker, and freelance writer, as well as the Blogger-in-Chief at Obsessive-Compulsive Data Quality, which is an independent blog offering a vendor-neutral perspective on data quality and its related disciplines.

More information about Jim Harris can be found at: <http://www.ocdqblog.com/>

About Kalido

Kalido is the leading provider of business-driven data governance software. Kalido enables companies to manage data as a shared enterprise asset by supporting the business process of data management. Kalido software has been deployed at more than 300 locations in over 100 countries, including 20 percent of the world's most profitable companies as determined by Fortune Magazine.

More information about Kalido can be found at: <http://www.kalido.com>