

Defining Information Quality

“Beauty is in the eye of the beholder.”

—MARGARET HUNGERFORD IN *MOLLY BAUN*

Before one can measure and improve information quality, one must be able to define it in ways that are both meaningful and measurable.

Information quality is defined in this chapter—what it is and what it is not. In order to understand *information quality*, *data* and *information* and their key concepts must be defined. Knowledge and wisdom are also defined, because this is where information impacts business performance, and where nonquality information can harm that performance.

In defining information quality, we differentiate between *inherent* and *pragmatic* information quality. Essentially, inherent quality is the correctness of facts; pragmatic quality is the correctness of the *right* facts presented correctly. Chapter 2 concludes with defining the three components required for information quality: data definition and information architecture quality, data content quality, and data presentation quality.

What Is Quality?

The best way to look at information quality is to look at what quality means in the general marketplace and then translate what quality means for information. As consumers, human beings consciously or subconsciously judge the “quality” of things in their experience. A conscious application of quality measurement is when a person compares products in a store and chooses one of them as the

“right” product. “Right” here means selecting the product that best meets one’s overall needs, not necessarily the best features in every category. After purchase, people determine quality based on whether that product for its price met their expectations for its intended use.

An unconscious application of quality measurement is the frustration one gets with a nonquality product or a service. Waiting in a long line at a store checkout while store clerks who are capable of coming to a checkout stand idly by, is an experience in nonquality service. It communicates that the store is not concerned about their customers’ time.

Quality Is Not . . .

First, let us define what quality is *not*. Quality is *not* luxury or superiority, nor is it “best” in class. Quality exists solely in the eyes of the customers based on the value they perceive on how something meets their needs. What is quality to one customer may be totally defective to another.

Take, for example, the diagnosis code of “broken leg” in 80 percent of the claims mentioned earlier. That was acceptable quality to the claims processors, because the only requirement to pay a claim was that it had a valid diagnosis code. But to the actuary, as a data warehouse customer and the ultimate “customer” of that data, it was nonquality and completely unusable for risk analysis. The second or so saved in the claim processor’s time was more than offset by the inability of the actuary to analyze the company’s risk or understand its own customer’s needs.

A far worse scenario exists. What if the medical diagnosis codes were indiscriminately applied to the claims? What if those incorrect codes resulted in no unusual pattern that called attention to itself that something might be askew? Then, what if the actuary determined risks based on that inaccurate data? What if insurance policies were then priced based on those (questionable) risks? What if the customer service group sent out form letters to find out how well their customers were recovering from their “medical diagnosis”? What if. . .

Quality is *not* fitness for purpose. The diagnosis code of “broken leg” was “fit for purpose” to pay a claim. But it was *not* fit to analyze risk. Quality is fitness for *all* purposes made of the data, including the *likely* future uses. Quality information will be used in many new ways in the intelligent learning organization. Information fit for one purpose but lacking inherent quality will stunt the intellectual growth of the learning organization.

Quality is not subjective or intangible. It can be measured with the most fundamental business measures—impact on the bottom line. The business measures of information quality are described in Chapter 7, “Measuring Nonquality Information Costs.”

Quality Is . . .

What, then, is quality? Total Quality Management provides a useful definition of quality: “consistently meeting customer’s expectations.”¹

When quality expert Philip Crosby defines quality as “conformance to requirements,”² he does not imply simply conformation to written specifications.

Customers’ requirements may be formal and written, or informal mental expectations of meeting their purpose or satisfying their needs. If a product meets formally defined “requirement specifications,” yet fails to be a quality product from the customers’ perspective, the requirements are defective.

If an application is designed and built to *meet* the functional requirements signed off by the business sponsors, and during final testing the business sponsors reject the application as not meeting their needs, what does that say? Either the requirements specification or the analysis and design process is defective.

Quality also means meeting customers’ needs, not necessarily exceeding them. The luxury automobile producer Rolls Royce went bankrupt in the early 1980s. Analysis revealed that, among other things, Rolls Royce was improving components that the luxury automobile customers felt were irrelevant and polishing parts they did not care about. This drove the price beyond what the luxury-automobile customer felt was value for money. Quality means improving the things customers *care about* and that make their lives easier and more worthwhile. On the other hand, when Lexus sought to make its first major redesign of its highly rated LS 400 luxury automobile, representatives of the company sought out their existing customers. They even visited the homes of a variety of LS 400 owners to observe home furnishings, what kind of leather they had on their attaché cases, and other minute details to get a sense of their customers’ subconscious expectations.

What Is Data?

Before we can describe information or data quality, we must understand what *data* is, what *information* is, and why information quality is required. To define *information quality*, we must define *data* and *information*. And because the ultimate objective of business is to achieve profit or to accomplish its mission, we must define what we mean by *knowledge* and *wisdom*. For it is in wisdom, or applied knowledge, that information is exploited, and its value is realized.

¹Larry English, *Information Quality Improvement: Principles, Methods, and Management*, Seminar 5th Ed., Brentwood, TN: INFORMATION IMPACT International, Inc., 1996, p. 1.2.

²Philip B. Crosby, *Quality Is Free*, New York: Penguin Group, 1979, p. 15.

Data

Data is the plural form of the Latin word *datum*, which means “something given.” It comes from the neuter past participle of the Latin word *dare*, “to give.” In the context of classical computer science the term *data* has come to mean numeric or other information represented in ways that computers can process. However, we define data from a business perspective and independent of information technology. The *Oxford English Dictionary* defines *fact* as something “that is known to have happened or to be true or to exist.” Simply stated, data is the representation of facts about things.

Data as Things or Entities

Data represents things or entities in the real world. *Webster’s Dictionary* defines *entity* as “something that has separate and distinct existence and objective or conceptual reality.” My son, Chancellor, is at the time of this writing a student at Middle Tennessee State University (MTSU). Chancellor and MTSU are entities; that is, they exist. When modeling data we represent the *classification* of entities that have similar characteristics as an *entity type*. For example, Student is an entity type that classifies the role that a Person such as Chancellor plays in his relationship to MTSU. MTSU is also an entity. MTSU is one occurrence of a classification of Organizations in a role called an Academic Institution.

The statement “Chancellor is a student at MTSU” is a statement of fact, or, in other words, data. This can be represented graphically in an entity relationship diagram as shown in Figure 2.1.

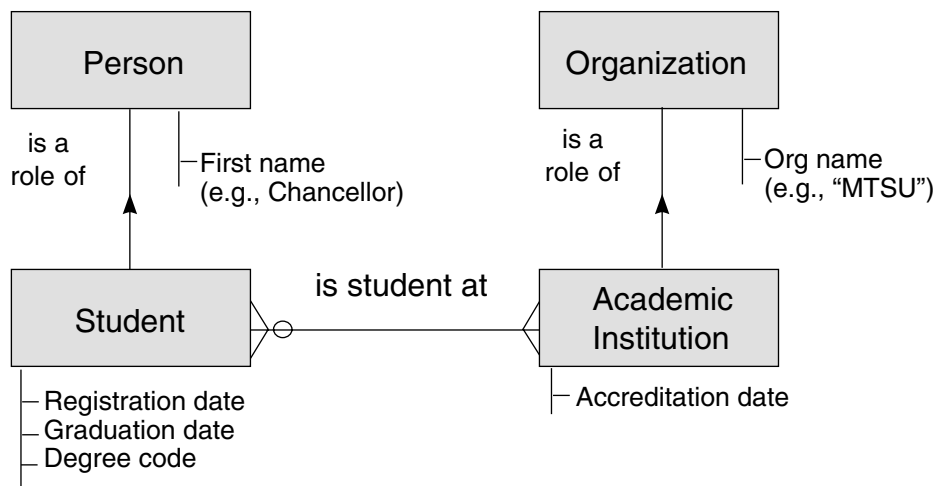


Figure 2.1 An entity relationship diagram example.

Data as Facts or Attributes

Data is a symbol or other representation of some fact about some thing. My son's name is Chancellor. That is a fact. The type of fact, *first-name*, is an attribute type. "Chancellor" is the actual value of the attribute type *first-name* for my son and is not to be confused with the value "Chancellor" of a different attribute type *Title* of an entity type *Employee* of *Academic Institution*.

Data is the raw material from which information is derived and is the basis for intelligent actions and decisions. As an example, 16155551212 represents a fact that is true. While it represents something real in the world, this data without a descriptive definition or a context is meaningless. Data is only the raw material from which information may be produced.

Information

If data is the raw material, information is a finished product. Information is *data in context*. Information is usable data. Information is the *meaning* of data, so facts become understandable. The previous example of data becomes understandable information when one knows that +1 (615) 555-1212 is the telephone number of information directory service for Nashville, Tennessee, and surrounding areas. It includes country code 1, area code 615, and telephone exchange 555 and number within exchange 1212.

Information quality requires quality of three components: clear definition or meaning of data, correct value(s), and understandable presentation (the format represented to a knowledge worker). Nonquality of any of these three components can cause a business process to fail or a wrong decision to be made. Information is applied data and may be represented as a formula:

$$\text{Information} = f(\text{Data} + \text{Definition} + \text{Presentation})$$

From a business perspective, information may be well defined, the values may be accurate, and it may be presented meaningfully, but it still may not be a valuable enterprise resource. Quality information, in and of itself, is useless. But quality information understood by people *can* lead to value.

Knowledge

Quality information becomes a powerful resource that can be assimilated by people. Knowledge workers plus quality information provide the potential for information to have value. A database without knowledge workers using it produces as much value as a product warehouse without ordering customers.

Knowledge is not just information known, it is *information in context*. Knowledge means understanding the *significance* of the information. Knowledge is applied information and may be represented as a formula:

Knowledge = f(People + Information + Significance)

Knowledge is the value added to information by people who have the experience and acumen to understand its real potential. With the continuing evolution of information technology, organizations are now able to capture knowledge electronically, organize its storage, and make it sharable across the enterprise. The advances in Internet, intranet, the World Wide Web, and data mining are expanding the horizons of sharable data in both data warehouses and in operational databases.

It is possible, however, to have a wealth of enterprise knowledge but still see an enterprise fail. Knowledge has value only to the extent that people are empowered to act based on that knowledge. In other words, knowledge has value only when acted on.

Wisdom

The penultimate goal in any organization is to maximize the value of its resources to accomplish its mission. The information resource is maximized when it is managed in a way that it has quality *and* when it is easily available to those who need it. People resources are maximized when they are trained, provided resources, including information, and *empowered* to act, carry out the work of the enterprise, and satisfy the end customers. Wisdom is applied knowledge and may be expressed in the formula:

Wisdom = f(People + Knowledge + Action)

The goal of information quality is to equip the knowledge workers with a strategic resource to enable the intelligent learning organization. Peter Senge defines the learning organization as one that “is continually expanding its capacity to create its future” through learning and shared learning.³

The intelligent learning organization is one that maximizes both its experience and its information resources in the learning process. The intelligent learning organization shares information openly across the enterprise in a way that maximizes the entire organization (see Figure 2.2).

In the Information Age, the dysfunctional learning organization is at a distinct disadvantage. The term *dysfunctional* means “impaired or abnormal functioning.” Dysfunctional organizations try to operate with inconsistently defined islands of proprietary data “owned” by business areas, whose quality serves to meet only “my” business area’s needs (see Figure 2.3). Dysfunctional organizations are hampered by nonquality information that prevents them from sharing information and knowledge. Nonquality information keeps these organizations from being effective and competitive because “it hinders knowledge of markets, customers, technologies, and processes that help any organization

³Peter Senge, *The Fifth Discipline*, New York: Doubleday, 1990, p. 14.

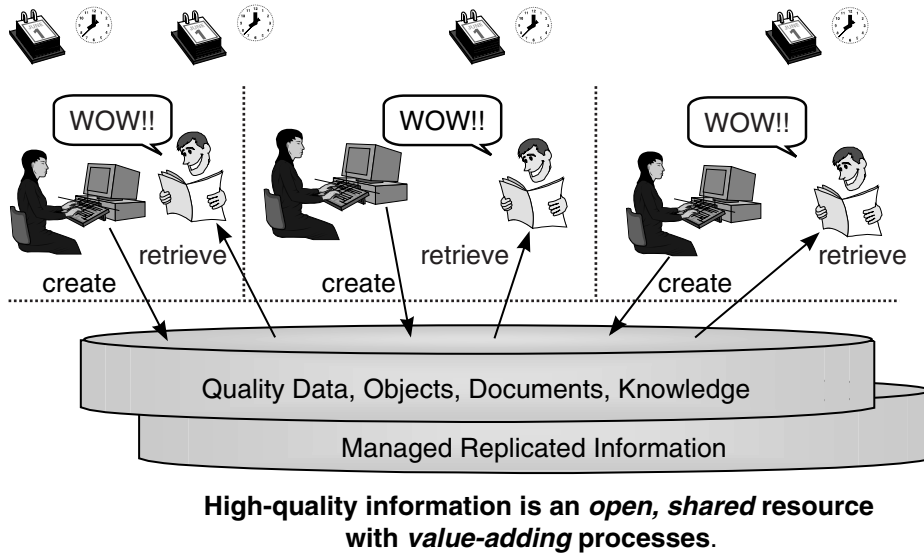


Figure 2.2 The intelligent learning organization.

grow. Knowledge gains added power when it is the primary ingredient of a business” to facilitate learning as a competitive weapon.⁴

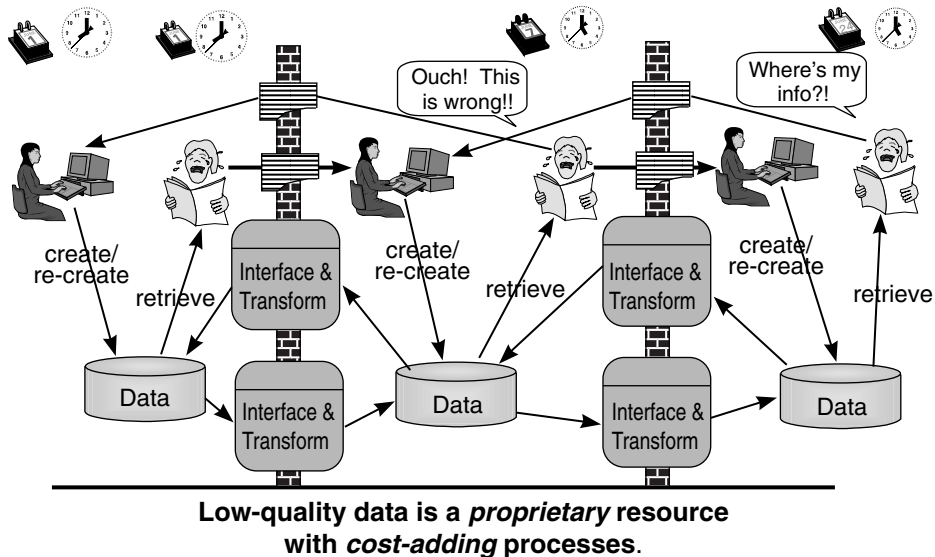


Figure 2.3 The dysfunctional learning organization.

⁴Thomas A. Stewart, *Intellectual Capital*, New York: Doubleday, 1997, p. 179.

Since the end result of data is to perform work successfully, the quality of that data will either hamper or facilitate correct business actions.

What Is Information Quality?

There are two significant definitions of information quality. One is its *inherent* quality, and the other is its *pragmatic* quality. Inherent information quality is the correctness or accuracy of data. Pragmatic information quality is the value that accurate data has in supporting the work of the enterprise. Data that does not help enable the enterprise accomplish its mission has no quality, no matter how accurate it is.

Inherent Information Quality

Inherent information quality is, simply stated, data accuracy. Inherent information quality is the degree to which data accurately reflects the real-world object that the data represents. All data is an abstraction or a representation of something real. Jean Baudrillard, the French semiologist,⁵ observes that “the very definition of the real becomes: that of which it is possible to give an equivalent reproduction.”⁶

Data is an *equivalent reproduction* of something real. If all facts that an organization needs to know about an entity are *accurate*, that data has inherent quality—it is an electronic reproduction of reality. For example, if someone has a data value of “October 24, 1976” for my daughter Ashley’s “Birth Date,” that data has inherent quality. Inherent information quality means that data is correct.

Pragmatic Information Quality

Pragmatic information quality is the degree of usefulness and value data has to support the enterprise processes that enable accomplishing enterprise objectives. In essence, pragmatic information quality is the degree of customer satisfaction derived by the knowledge workers who use it to do their jobs.

Data in a database or data warehouse has no actual value; it only has *potential* value. Data has *realized* value only when someone uses it to do something useful; for example, to ship an order to a customer, or to determine the correct location to drill a well shaft. Pragmatic information quality is the degree to which data enables knowledge workers to meet enterprise objectives efficiently and effectively.

⁵Semiology is the science dealing with signs or sign language.

⁶*The Columbia Dictionary of Quotations* is licensed from Columbia University Press. Copyright © 1993 by Columbia University Press.

Information quality lies in its ability to satisfy its customers, those who use the data in their work. For example, if a college has recorded a data value of “27” for my son Chancellor’s senior high school year “Composite ACT Score,” that data has inherent quality; it is correct. If that college uses “Composite ACT Score” values of 26 or higher as a means of automatic acceptance, and sends letters to those prospective students having a “Composite ACT Score” meeting that criteria, that data has *pragmatic* information quality. Having a correct data value and using it enabled Middle Tennessee State University to meet an objective of increasing its entering student average ACT scores for fall 1997.

It is possible to have *inherent* information quality without having *pragmatic* information quality. Data not required to support any business processes, or required to make any decision, or useful in trend analysis, is irrelevant. Even if the values are correct, and therefore have inherent quality, that data is useless, and has no value to the enterprise. In fact, it is actually nonquality information because it costs the enterprise money and resources to acquire and maintain but adds no value. It has a negative net worth. If my insurance company knows that the interior upholstery of my automobile is black, but that fact is not useful in any of its business processes, it lacks quality. In fact, it increases the company’s cost of doing business, and is passed on to me in higher insurance premiums.

Pragmatic information quality prevents people from:

- Performing work incorrectly or making a wrong decision
- Performing work over again because it was previously performed incorrectly
- Recovering from the impact of making a wrong decision
- Taking unnecessary time to investigate the integrity of the data before using it
- Performing calculations or reformatting the data before it can be used
- Hunting for additional information in order to use the data
- Losing customers because it caused work to be performed incorrectly
- Causing unrecoverable damage
- Missing business opportunities
- Miscommunicating within the business or with end customers and other information stakeholders

Information Quality Defined

The same premise of quality of consumer products holds true for information quality. To define *information quality*, one must identify the “customers” of data, the “knowledge workers” who require data to perform their jobs. Information quality is “consistently meeting knowledge worker and end-customer expectations” through information and information services,⁷ enabling them to perform their jobs efficiently and effectively. Information quality describes “the attributes of the information that result in user (customer) satisfaction.”⁸

Information quality exists when information enables knowledge workers to accomplish their “enterprise” objectives. Information quality is measured not just by the immediate beneficiaries, but also by the downstream knowledge workers. Quality information eliminates the need for transforming interface programs, because specific facts are defined and represented in the same way across the enterprise.

Let us now examine the elements of information quality:

“Consistently meeting knowledge worker and end-customer expectations.”

“Consistently”

When knowledge workers get information about a given entity or event, they expect consistent quality. They know ahead of time the level of quality of the data with which they work. For some decision support processes, knowledge workers can tolerate some degree of error and omission if they are aware of the degree and nature of error. If there are wide swings in the reliability of data in the data warehouse, knowledge workers may resort to gut feel as their decision support system, rather than trust what they perceive as unreliable data in an untrustworthy electronic decision support system.

Consistently means the information quality meets *all* knowledge worker needs, not just some. If one set of knowledge workers requires 95 percent accuracy and another 99 percent accuracy, then a 99 percent accuracy is required to consistently meet expectations.

Consistently also means that if knowledge workers have to use data about the same thing from two different databases, whether two operational databases or an operational database and the data warehouse, they expect the data to agree. If I get information about John Smith from our central database, from the marketing database, from the accounting database, and from the data warehouse, I expect consistency of the attributes that are supposed to be the same in all four data databases.

⁷Larry English, *Information Quality Improvement: Principles, Methods, and Management*, Seminar 5th Ed., Brentwood, TN: INFORMATION IMPACT International, Inc., 1996, p. 1.5.

⁸Madhavan K. Nayar, “A Framework for Achieving Information Integrity,” *IS Audit & Control Journal*, Vol. II, 1996, p. 30.

Failure to maintain consistency in redundant databases remains one of the most prevalent information quality problems. If there is a business case for building (and buying) redundant databases, there is a business case for maintaining its consistency.

“Meeting”

Some data is required to be zero-defect data. Domain reference data such as medical diagnosis codes and product prices must have 100 percent accuracy if medical claims and product sales are to be accurate. Zero-defect data is required when the consequences of nonquality cause major process failure or catastrophic consequences. Consider the consequences of an inaccurate temperature value to be set in a monitor of a steel blast furnace. The result may cause the furnace to overheat, resulting in a breakout of molten steel from its container.

However, not all data is required to be complete, or even to be precisely accurate. Many decisions may be made from warehouse data that is incomplete. Correct decisions may be made from data that contains some degree of error, when this is factored into the decisions.

Some data, especially data about business events, may not be able to be captured after the initial business event opportunity without extensive investigation and event re-creation. For example, variables in a scientific experiment not captured during the point of contact with the event, may not be able to be re-created at any expense. Even conditions that led to a customer inquiry about a product or service may be lost forever if not captured during that inquiry.

“Knowledge Worker and End Customer”

Who is able to discern quality information? Knowledge workers who require the data to do their jobs. The term *knowledge worker* as used in this book means the role in which one requires or uses data in any form as part of their job function or in the course of performing a process. Hence, a knowledge worker is a *customer of information*. Knowledge workers, as information customers, determine whether data is quality or not based upon how well that data supports their ability to do their jobs.

Virtually all employees are knowledge workers. Executives who make decisions are obviously knowledge workers. Business analysts who require accurate trend data are major customers of the data warehouse. Warehouse clerks who fill orders and builders who use architectural plans to build houses are knowledge workers. Even the order entry clerk who creates orders is a knowledge worker of product information.

Any function that calls itself a *quality* initiative must have the customer as its sole focus. A quality function that does not focus on the needs and requirements of its customers will ultimately fail.

Data warehouse architecture cannot be developed without understanding the needs of the warehouse customers. Who are the customers of the data warehouse? What questions do they need answered? What decisions do they make, and what information is required? To assume one simply needs to load data from the operational databases into the data warehouse guarantees a non-quality information product.

Immediate Information Customers

Immediate information customers are those knowledge workers who are in the same department or business area as the producer of the data. For example, order entry personnel are both producers and knowledge workers of customer data. One clerk may create John Smith's customer record when he first calls in an order. For subsequent orders, the clerk receiving John Smith's call becomes a knowledge worker, retrieving John's customer record in order to create a new order for him. Because the producers of the customer data also use the information, there is a high stake in getting correct data needed to take an order.

Downstream Information Customers

The departmental knowledge workers are not the only customers of data. Not only does the order entry department need `Customer` data, so does order fulfillment, customer service, accounts receivable, marketing, and possibly product research and development. These downstream knowledge workers also expect quality customer information to perform their processes of filling orders, invoicing and applying payments, marketing efficiently and effectively, and developing new products. Data in one database about a given entity is non-quality if it cannot be used by other knowledge workers who have a stake in that data.

A systemic problem has been caused by the past practices of developing applications from a myopic functional or departmental view of data requirements. The fact of the matter is that data created in one department by one application may have many more knowledge workers outside the originating department who depend on that information.

Quality information is data that satisfies not only the immediate customers, but also satisfies the downstream information customers without major transformation. If common data required in many different business areas, such as name and address, must be transformed by interface programs into different formats for different applications to use, an information quality problem exists. The cost of transformation interfaces diminishes the value of the data by reduc-

ing the profit derived from the use of that data. The interface programs also introduce another point of potential error into the process.

“Expectations”

The bottom line is that conscientious employees want to do their jobs well, and they expect to have the necessary resources available to carry out their work in exchange for fair pay. Knowledge workers who require information to perform their work expect and deserve to have the necessary information (resource) with the right quality available to perform that work efficiently and effectively.

The real goal of information quality is to increase customer and stakeholder satisfaction. In fact, information quality can be seen in and measured by end-customer satisfaction. Suppose a customer who orders three widgets but receives only two because the order taker entered “2” instead of “3.” The customer, expecting three black widgets, will be an unhappy customer because of nonquality information.

Information Quality Components

Earlier we indicated that information can be represented by the formula:

$$\text{Information} = f(\text{Data} + \text{Definition} + \text{Presentation})$$

The three components that make up the finished product of information are separate and distinct components that must each have quality to have information quality. If we do not know the meaning (definition) of a fact (data), any value will be meaningless and we have nonquality. If we know the meaning (definition) of a fact, but the value (data) is incorrect, we have nonquality. If we have a correct value (data) for a known (defined) fact, but its presentation (whether in a written report, on a computer screen, or in a computer-generated report) lacks quality, the knowledge worker may misinterpret the data, and again we have nonquality.

Data Definition and Information Architecture Quality

Data definition refers to the specification of data; that is, the definition, domain value set, and business rules that govern data. Data definition quality is the degree to which data definition: accurately describes the meaning of the real-world entity type or fact type the data represents *and* meets the needs of *all* information customers to understand the data they use. Information customers include both business and information systems personnel:

- Knowledge workers must know the meaning of information in order to perform their work.
- Information producers must know the meaning of information along with valid values and business rules in order to create it or keep it updated.
- Data administration staff must know the meaning of information along with valid values and business rules in order to develop accurate data models.
- Database administration staff must know the meaning of information along with valid values and business rules in order to design high-integrity databases and code triggers correctly.
- Systems analysts must know the meaning of information along with valid values and business rules in order to design high-integrity application models.
- Application developers must know the meaning of information along with valid values and business rules in order to develop high-integrity application logic.

Information architecture quality is the degree to which the data structure:

- Implements the inherent and real relationships of data to represent the real-world objects and events.
- Is stable, enabling new applications to reuse the original data without modification and only require new, non-redundant entity types (and files) to be created, and new attributes (and fields) to be added to existing data models or databases. Database stability means new applications can use data in existing databases without changes in the *structure* of the data model or database, only adding new data.
- Is flexible, supporting changes in how the enterprise performs its processes without significant change to the data model or database. Database flexibility means two lines of business can merge to eliminate duplicate overhead and to maximize cross-selling with minimal change to the database design. Database flexibility means businesses can reengineer processes with minimal change to the database design.

Clear, precise data definition is required to assure clear communication among all handlers of information. Data definition is to data (content) what *Oxford* or *Webster's Dictionary* definition is to an English-language word. Without knowing the meaning of words, how can people understand and use them correctly? Without knowing the precise meaning of data, how can anyone understand and use it correctly?

You cannot *assume* that others in the organization understand the meaning of business terms and data without having a definition. People in general must use a dictionary from time to time. Just as a language requires lexicographers to identify and define the meaning of words, so an enterprise requires business lexicographers to define the precise meaning of business terms and facts.

Business terms can mean different things in different contexts, so each definition and context must be maintained in an enterprise business glossary.

Data definition quality applies to concepts. Does the enterprise have a clear understanding of the *customer* or *order*? Does it have a clear understanding of *customer first service date* or *order date*? Without it, information producers will not know the correct values, and knowledge workers will not know the meaning of the data. And without that, business communication will fail and business performance will suffer.

Data definition quality is a characteristic and measure of data models produced by the application and data development processes. The measures of data definition quality are described in Chapter 5, “Assessing Data Definition and Information Architecture Quality.”

Data Content Quality

Information quality requires both data definition and data content quality. Data content quality is the degree to which data values accurately represent the characteristics of the real-world entity or fact, and meet the needs of the information customers to perform their jobs effectively.

Data content quality applies to actual occurrences of things. Does the enterprise have an accurate representation of Customer “John Smith” in order to maintain an effective customer relationship with John Smith? Does the enterprise have the accurate values for John Smith’s Order, number 12345, in order to fill it properly and identify the trends of product sales and customer needs?

Data content quality is a characteristic and measure of data created and updated by business processes and the applications that implement them. The measures of data content quality are described in Chapter 6, “Information Quality Assessment.”

Data Presentation Quality

Business processes can still fail even when data is accurate, complete, and conforms to a clear precise definition. Processes can fail if:

- Data is inaccessible.
- Data is not available on a timely basis.
- Data is presented in an ambiguous way or with a label inconsistent with the data name or definition, causing misinterpretation.
- Data is presented in a way that requires excessive work to interpret it, thereby introducing potential errors in the additional processes required to make the data usable.
- Data is combined with other data incorrectly, producing incorrect derived or calculated data.

Data presentation quality applies to information-bearing documents and media, such as a report or window presenting the results of a query of data from a database. Does the order filler have an accurate *presentation* of Customer “John Smith’s Order, number “12345”, in a format to efficiently and correctly fill the order?

Two microwave ovens flash a message to signal the conclusion of their heating processes. One message flashes “End,” and the other message flashes “Ready.” When I first saw each message I had different responses. With the “Ready” message I said, “Great, my food is done.” When I saw the “End” message my first thought was, “End of what?” The message “End” is a message presented from the view of the oven itself: “This is the end of my process.” The “Ready” message is presented from the customer’s perspective: “The food is ready for you.” Data presentation must focus on the needs of the knowledge workers and their purpose for knowing the information. Data presentation quality means knowledge workers can quickly and easily understand both the meaning and the significance of the information and apply it correctly to their work.

Because information is used for many different purposes, it will have different presentation formats. Quality of presentation means the format presented is intuitive for the use to be made of the information.

Data presentation quality is a characteristic and measure of data access by and presentation to business personnel for their use in performing their work. The measures of data presentation quality are described in Chapter 6, “Information Quality Assessment.”

Conclusion

Information quality is not an esoteric notion; it directly affects the effectiveness and efficiency of business processes. Information quality also plays a major role in customer satisfaction.

Information quality is not a subjective characteristic that cannot be measured. It is measurable in the most fundamental of business measures: the bottom line of the business.

Inherent information quality is the measure of how accurately data represents the real-world facts that the enterprise should know. Pragmatic information quality is the measure of how well information enables knowledge workers (the information customers) to accomplish business objectives effectively and efficiently, *and* to satisfy end customers.

To put it another way, information quality is:

QUALITY CHARACTERISTIC	KNOWLEDGE WORKER BENEFIT
The <i>right data</i>	The data I <i>need</i>
With the right <i>completeness</i>	<i>All</i> the data I need
In the right <i>context</i>	Whose <i>meaning</i> I know
With the right <i>accuracy</i>	I can <i>trust</i> and rely on it
In the right <i>format</i>	I can <i>use</i> it <i>easily</i>
At the right <i>time</i>	<i>When</i> I need it
At the right <i>place</i>	<i>Where</i> I need it
For the right <i>purpose</i>	<i>I can accomplish our objectives and delight our customers</i>

