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INFORMATION QUALITY AND REGULATION: A MANAGEMENT PERSPECTIVE

As the impacts of poor quality information affect society and consumers, laws and regulations tend to spring up for protection. While the motivation is to improve information quality and to minimize the impact of poor information quality, what are the real effects of regulation on information quality? This article is a management analysis, not a legal analysis, exploring some specific examples in the United States of legislation and regulation driven by the impacts of nonquality information on consumers and their impacts and effectiveness on the state of information quality.

We then describe fundamental principles of information quality and how they impact information quality, and how a sound quality management system influences the behavior of the organization and the resulting information quality. We describe how a proactive approach to information quality management can mitigate the need for legislation itself and protect the organization from regulatory actions for noncompliance to existing legislation.

Keywords: information quality, data quality, accuracy, IQ and legislation.

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1. Introduction: Information Quality and its Impact on Consumers

The problem of poor quality information does not just affect businesses; it affects society. As consumers are negatively affected by missing and inaccurate information and poor clarity of information presentation, an increasing number of laws spring up to protect them. This article addresses some specific laws in the United States and the impact they have on information quality. This article is a management analysis, not a legal analysis. While not a statistical study of the impact of regulation and information quality, it draws on statistical studies where they exist.

Quality is “consistently meeting customer expectations” in products and services they buy or receive. Products must be fit for *all* purposes for which the customers acquire them. This is also true for information. Information is a product itself, and as such must “consistently meet *all* information customer expectations” (English 1999: 24) for *all* of their purposes, whether an ad conveys the real characteristics of the product proposed, or the financial loan terms clearly communicate how much it will cost, or the order quantity accurately captures the quantity the customer ordered. One who gets directions from an Internet map provider expects them to be accurate and current. Investors reviewing a mutual fund prospectus or a company annual report expect accurate, complete and clear information to understand the risk. Companies make high-cost decisions to build new stores or facilities in a particular location based upon economic, environmental, or other factors based on government or information provider studies and reports, expect those trends to support their investment decisions and not be compromised by inaccurate forecasts and study conclusions.

Nonquality information is information that fails to meet one or more of the quality characteristics (or dimensions) consumers expect in information provided for and with the products and services they buy. Information quality characteristics include accuracy (the price charged is the price advertised), completeness (all financial terms of the loan are clearly disclosed), timeliness (I am able to buy mutual funds with the same currency of prices as all other investors), and presentation clarity (the information is in a form I understand and can easily use to make an informed decision), among others. Information quality is not just “fitness for purpose.” Because information is multi-purpose it must be fit for *all* purposes. Product price may be used to project revenue based on fore-

casts, providing an accurate revenue picture. But if the price is greater than the advertised price, that very same product price value can cause customer alienation and lost business.

It is well-documented that poor quality information takes a significant toll on business bottom line. "Information scrap and rework" (English 1999: 210) includes process failure and recovery, rework, hunting and chasing, verifying and correcting information, customer compensation and fines caused by defective information that costs organizations from 10 percent to more than 20 percent of their operating revenue or operating budgets (English 1999: 6-12; Eckerson 2002; Redman 2004: 22-23). The impact of this to the U.S. economy is a waste of some US\$ 1.5 - US\$ 2 *trillion* or € 1.2 - € 1.6 trillion (English 2003: 15).

Costs of nonquality information end up being paid by the consumers and citizens in the form of higher costs of goods and services, higher taxes, in inconvenience and wasted time, or in injury and death in extreme cases. Shareholders lose because the information scrap and rework steals from the profit. Employees and communities are affected when nonquality causes unhappy customers to leave, reducing revenue and costing jobs. These drivers have triggered legislation to protect consumers and other stakeholders.

When organizations' behaviors cause harm or potential harm to consumers, governmental and regulatory authorities may step in to protect them. Almost all regulation of business is based on good intentions of protecting citizens. The question is this: when regulation is required, does it produce the optimal effect on the regulated entities to make positive improvements, or does it merely create a minimal "compliance" to regulation?

For years U.S. laws such as, "Truth-in-Advertising" and "Truth-in-Lending" have evolved. These laws seek to prevent "exaggerated claims" (inaccurate or misleading information) that a product or service cannot reasonably deliver, or the withholding of pertinent information consumers need to make an informed decision. The first house I bought subject to "Truth-in-Lending" disclosure, shocked me that my total payments were more than three times the face value of the loan!

2. Legislation Directed at Information Quality: Examples

Legislation associated with information quality in the U.S. originates with the Uniform Commercial Code (UCC) dating to the 1950s. Its

purpose was to take the common law concepts of product quality in commercial setting and codify them. The UCC seeks uniformity among individual states for warranties of product quality (WERNICK 2004). The UCC is continually updated to keep up with the new products and technology developments such as software quality (ALCES 1999).

Early U.S. laws or regulations focus on products (“Truth-in-Advertising”) and services (“Truth-in-Lending”) and the quality of information—or misinformation—used to sell them. These laws relate to regulation of information as a “byproduct.”

In recent years, however, a shift has arisen that focus on quality of information as a product itself, where nonquality can lead to decisions or actions that are harmful to the “information consumers.” “The Information Quality Act” (OMB Section 515), and the Sarbanes-Oxley Act of 2002 are examples.

2.1. Truth-in-Advertising. Laws and Information Presentation Quality Origins of the Law

Truth-in-Advertising laws and regulations sprang up to protect consumers from unscrupulous sellers preying on unsuspecting consumers through misleading, inaccurate or missing information.

Key Concepts of the Law

Truth-in-Advertising laws provide specific requirements in the advertising and claims about consumer products and services. “Federal Trade Commission Act” rules call for the following (FTC 2004):

- Advertising must be truthful and non-deceptive (accurate and objective)
- Advertisers must have evidence to back up their claims; and (complete)
- Advertisements cannot be unfair (objective)

Application of the Law

Truth-in-Advertising rules provide guidelines for self-policing with intervention based on consumer complaints.

On a label of a popular mouthwash, the statement “Kills Germs By Millions on Contact” immediately preceded the statement “For General Oral Hygiene Bad Breath, Colds and Resultant Sore Throats.” This was judged to be *deceptive* because the close proximity conveyed the message that because it could kill germs by the millions it could also cure or prevent colds and sore throats (Miller 1983:10).

Impact of the Law on Information Quality

Truth-in-Advertising laws have been largely helpful for increasing IQ characteristics of accuracy, completeness and presentation quality and objectivity in sales, marketing and label information by scrupulous businesses.

IQ Lessons

Truth-in-Advertising addresses IQ characteristics of accuracy (“truthfulness”), completeness (presenting *all* pertinent information) and objectivity (not misleading) of information consumers use for buying decisions. Quality information is required to “consistently meet customer’s expectations” in products and services. Misleading information creates false expectations in consumers, and if they feel they have been “lied to,” they may not come back.

2.2. Product Pricing Legislation and Price Accuracy

Bar code scanning technology increases check out efficiency and eliminated inaccurate prices caused by cashier keying errors. However, new errors were introduced through processes that failed to maintain accurate prices in scanner databases.

Origins of the Law

Some state and local governments have stepped in to address the problem of inaccurate product pricing by requiring retailers to put price tags on most items or face fines.

Key Concepts of the Law

The principle behind these laws is to protect the consumer from being overcharged by allowing them to verify accuracy of the sale transactions.

Application of the Law

Various implementations require retailers to put price tags on products, so that consumers can assure they are charged properly for electronically scanned items. Failure to comply can result in fines.

The retail sector has been studied before and after the creation of pricing laws (Bartholomew 1992; FTC 1996; FTC 1998). In 1992 UCLA studied 1,200 sales transactions in three large retail chains in Riverside County, California, to compare electronic scanned prices against advertised prices. They found inaccurate pricing in 5% to 12% of the purchases (Bartholomew 1992: 27). The ratio of overcharges to undercharges was as high as 5-to-1 in some stores with an average ratio of 2-to-1. The study concluded this costs U.S. consumers nearly US\$ 2.4 billion (€ 1.9 billion) a year in overcharges.

The Federal Trade Commission's two major studies of barcode price quality found significant error. The 1996 FTC comprehensive study of 17,928 sales transactions found an error rate of 4.82%. Of the 294 stores studied, 77.55% had errors, and only 71 (24.15%) had an accuracy of 99% or better (FTC 1996:11). The average inaccurate overcharge amount was \$3.02 while the average undercharge was \$ 2.96 (FTC 1996:14).

Impact of the Law on Information Quality

A follow-on FTC study (1998) inspected 107,096 items in 1,033 stores. The study showed improved pricing accuracy, but concluded there is "considerable room for improvement" for some retailers (FTC 1998:2).

The error rate dropped to 3.35% from 4.58% of items with an incorrect price. The ratio of overpriced to under-priced items worsened for the consumer to about half and half, with items "on sale" overcharged twice as frequently. The value of the error increased from the 1996 study, from an average of \$3.20 to \$5.28 per error (FTC 1998:11). But the net loss to the retailer does not mollify the consumers overcharged.

IQ Lessons

Product-pricing legislation is reactive. It forces the *customer* to be the auditor. Because fines were imposed only if stores "failed to correct the overcharges" (Bartholomew 1992: 30), no motivation exists to improve the process of pricing. Scanner databases are generally separate from retailer's master databases, so inconsistency of redundant data is also a probable factor.

Fines for noncompliance is one cost of nonquality information. While the undercharges cost the company profit, the overcharges cost the companies in the form of fines and litigation costs and lost business. One grocery chain was "fined \$ 95,000 and agreed to pay \$ 6,000 for each future uncorrected overcharge" (Bartholomew 1992: 30). One major retailer was fined \$ 450,000 in LA County alone (Bartholomew 1992: 32). That retail chain, once a leader in its niche, filed for bankruptcy protection ten years later to reorganize in an attempt to survive. While neither the inaccurate data nor the fines alone caused the bankruptcy, they were symptoms of broken processes and mismanagement of information that contributed to the retailer's failure.

2.3. Truth-in-Lending. Laws and Information Presentation Quality

Origins of the Law

Less-than-ethical lenders have used confusing information presentation

to prey on unsuspecting borrowers. Truth-in-Lending laws emerged first to address unscrupulous lenders and then to address increased complexity of finance charges in mortgages and consumer loans that cause confusion to borrowers.

Key Concepts of the Law

Truth-in-Lending laws seek to assure that lenders communicate clearly the costs of a loan or a lease, such that the consumer clearly understands the real costs and can make an informed decision. “The main purpose of the Truth in Lending Act is to assure the meaningful *disclosure* of consumer credit and lease terms, including those in advertisements, so that consumers can easily compare terms and shop wisely for credit” (FTC Lending 2004b: 3).

Truth-in-Lending legislation addresses information content quality and information presentation quality so it is understandable to the consumer and does not mislead. The measurement of presentation quality for Truth-in-Lending compliance has tangible measures against the rules of presenting information and the use of such “trigger terms” without the required disclosure of information that must accompany the trigger terms in a way that is both clear and conspicuous.

Application of the Law

The law provides principles and disclosure requirements for presenting financial information to make loan information understandable to borrowers so that they know clearly how much their loan will cost them. Mazda found itself hit with a US\$ 5.25 million (€ 4.32 million) fine “to settle charges it violated government agreements requiring that the automaker clearly disclose important car leasing terms in its advertising...” (Mazda 1999).

Household International, a mortgage lender, made a US\$ 484 million (€381 million) payment to settle charges it misrepresented interest rates, showing them as lower rates but requiring extra payments and requiring balloon payments without disclosing the existence or amounts of the balloon payments among other charges (Johnson, 2004: 1B).

Impact of the Law on Information Quality

This law has provided positive impact on upstanding companies. The real benefits are not just in the accuracy of loan information, but in assisting borrowers to clearly understand their actual financial obligation.

IQ Lessons

Consumers require more than just base facts on certain types of information. Loan rates by themselves do not provide a clear picture of total cost.

The total “cost of ownership,” not just “cost of acquisition,” must be clearly presented (presentation quality) for consumers to make informed decisions.

2.4. The Health Insurance Portability and Accountability Act (HIPAA) and Medical Record Accuracy

Origins of the Law

In the U.S. citizens have healthcare insurance provided through their employers. Problems occur when employees are let go and subsequently move to another employer. In 1996, the U.S. Health Insurance Portability and Accountability Act (HIPAA) went into effect to provide rights to workers to carry their health insurance coverage to another carrier.

While this law provides for several privacy rights for patients, it also addresses information quality of medical record information.

Key Concepts of the Law

From an IQ standpoint, HIPAA provides rights to individuals to review their medical records for accuracy, completeness and clarity, and to file a request to amend deficient information.

HIPAA recognizes that it is important for medical providers not only to provide quality care, but also to provide quality (accurate, complete) information, because this information is the basis for providing medical care. An early medical care client’s reason for starting its Information Quality function was, “if we have poor quality information, people can die.”

Application of the Law

Patients may request to review their records, and to submit information to correct or “amend” the record. Providers must review the information for a decision to amend.

Impact of the Law on Information Quality

The right to correct errors or provide missing or clarifying information that may be necessary for correctly diagnosing a condition or determining the right medical procedure, or to clarify information to prevent misinterpretation is a critical need for quality health care.

IQ Lessons

This application of law to IQ is reactive. While it provides a means to assure quality medical record information, it requires the patient to suspect error or omission (“buyer beware”), review it, and provide updates, additions or clarification, without clues to know if something is wrong. HIPAA provides no guidance for the provider in how to create and assure

the accuracy and completeness of their medical record documentation. A principle of IQ management is to error-proof processes at the source to assure accurate and complete information capture.

2.5. OMB Section 515: The Information Quality Act

Possibly the first legislation directed specifically at the quality of information as a “product,” is the OMB (Office of Management and Budget) Section 515 that applies to all federal agencies that disseminate “influential” information. This law, known as “The Information Quality Act” (although incorrectly called “The Data Quality Act”), requires each federal agency to implement procedures to ensure quality of information provided to the public or to industry that is influential information. “Influential” means that errors or misinterpretation of the information can have costly consequences resulting from wrong actions or wrong decisions.

Origins of the Law

When the government produces influential information, such as the calculation of the inflation rate, it can affect many things from social security increases to consumer interest rates. Errors or inaccurate calculation can create enormous costs to those who make decisions based on that information.

Key Concepts of the Law

The Information Quality Act guidelines:

“(1) apply to the sharing by Federal agencies of, and access to, information disseminated by Federal agencies; and

“(2) require that each Federal agency to which the guidelines apply—

“(A) issue guidelines ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by the agency...

“(B) establish administrative mechanisms allowing affected persons to seek and obtain correction of information maintained and disseminated by the agency that does not comply with the guidelines issued ... and

“(C) report periodically to the Director [of the Office of Management and Budget]—

“(i) the number and nature of complaints received by the agency regarding the accuracy of information disseminated by the agency and;

“(ii) how such complaints were handled by the agency.” (OMB 2002: 8452)

The Information Quality Act is significant in that it recognizes the importance of information as a product and that nonquality in critical information has high costs associated with it. It further recognizes that quality information is not automatic; there must be policies and processes in place to ensure that information produced is of high quality.

This Act also recognizes multiple information quality characteristics (quality, objectivity, utility and integrity) required for information to be deemed quality by the information consumers. The term “quality” is an umbrella term that includes objectivity, utility and integrity. “Utility” refers to the usefulness of the information to its intended information consumers, including the public and not just for agency knowledge workers. “Objectivity” includes the accuracy and presentation quality of the information; it is presented in an accurate, clear, complete and unbiased manner, and if the information is scientific, financial or statistical, the original and supporting data must be created, generated and analyzed results made using sound statistical and research methods that are reproducible. “Integrity” refers to the security and protection of the information from unauthorized access and modification (OMB 2002: 8459-60).

The Information Quality Act further requires the federal agencies to have in place a procedure whereby information consumers have the ability to “file a complaint” about suspect information. Agencies must respond to those complaints and report to the Office of Management and Budget on an annual basis as to the complaints they receive and how they handled them.

Application of the Law

Every Federal agency that disseminates influential information has procedures, available on their websites outlining how they are assuring that such influential information is provided with quality, objectivity, utility, and integrity. They also have procedures for information consumers to “complain” should they believe information to be nonquality, and how the agency will handle those complaints.

Impact of the Law on Information Quality

The Information Quality Act has made Federal agencies address information quality. Some agencies, such as the U.S. Department of Housing and Urban Development, have implemented comprehensive IQ management methodologies that go well beyond the letter of the Information Quality Act.

IQ Lessons

It is possible to meet the letter of compliance with *back-end inspection* of

information prior to its release, but not assuring quality in the source acquisition processes. The weakness of this law is that it addresses quality of information *only* at the point of dissemination.

The Information Quality Act applies only to federal agencies now. However, it has the potential to be a prototype for the private sector where errors or biased presentation in important or “influential” information cause serious harm or injury to consumers. Information that may be considered influential is “credit history” and scoring information that lenders and retailers use to make credit-worthiness decisions. Other data collected and provided by information providers used for significant or high risk business decisions qualify as “influential” information.

2.6. Sarbanes-Oxley: Accountability for Financial Information Quality

The Sarbanes-Oxley Act of 2002 is such a law described in the previous paragraph.

Origins of the Law

Information quality problems caused by defective processes are significant. But IQ problems caused by deliberately manipulating financial data for personal gain while causing innocent people to suffer as we saw in Enron, WorldCom, Adelphia, Global Crossing and others are the most reprehensible Information Quality problems—Information Fraud. When stakeholders such as employees, shareholders and communities suffer as the result of the secret and nefarious actions of a few in power, severe criminal penalties should be enacted and aggressively enforced. The motivation of The Sarbanes-Oxley Act of 2002 (SOX) is the fraud of deliberate manipulation of financial performance information for personal gain.

As the true picture of Enron’s revenue and profit picture unfolded, coupled with a failed takeover bid, the top-Ten Fortune company saw its share price plummet 99% (Knox 2001). Investment decisions based on inaccurate financial data had pushed the stock prices well above the true value of the company. When exposed, the sell-side pressure sank the share price to where Enron’s market value could no longer support its debt. This dramatically illustrates the potential impact of nonquality information, regardless of the cause. Six companies (Adelphia Communications, Enron, Global Crossing, Qwest Communications Int’l, Tyco Int’l, and WorldCom) who inflated their revenue and income figures in their financial statements lost an aggregate market capitalization of \$ 417.5 Billion (WSJ 2003) from their 5-year highs, an amount equivalent to four percent of the annual U.S. Gross Domestic Product.

Key Concepts of the Law

SOX provides regulations that address the accuracy of financial performance information companies provide that brokers and consumers use to make investment decisions. SOX calls for public companies to have:

- Accounting oversight to provide “such quality control standards, and such ethics standards to be used by registered public accounting firms in the preparation and issuance of audit reports, as required by this Act or the rules of the Commission, or as may be necessary or appropriate in the public interest or for the protection of investors” (SOX 2002: 21).
- Independence of financial auditing such that an external auditor does not have conflict of interest in providing audit services while providing consulting services.
- Corporate executive accountability for the accuracy of financial reports and assurance of the efficacy of its accounting and audit quality controls. The principal executive officer(s) and chief financial officer(s), must sign and certify that the financial report “does not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements made, in light of the circumstances under which such statements were made, in light of the circumstances under which such statements were made, not misleading;” and that “the financial statements, and other financial information included in the report, fairly present in all material respects the financial condition and results of operations of the issuer....” (SOX, 2002: 65).

Application of the Law

The Act calls for both financial penalties up to US\$ 5 million and imprisonment for inaccurate financial information that can mislead investors.

While executives in the scandal-ridden companies cited above have been indicted or imprisoned under existing laws, Rica Foods became the first company penalized under SOX when the CEO was fined \$ 25,000 for errors in the financial statement in its annual report (USA 2003).

Impact of the Law on Information Quality

SOX has indeed made an impact on quality of reported financial information. Because the executives are held accountable, and because there is more independence in the audit processes, this law will increase shareholder confidence.

Will SOX increase financial information quality? Yes, up to a degree. It will make most fraud more difficult to carry off. But again, an organ-

ization can comply with SOX having costly information scrap and rework activities to produce the financial statements.

IQ Lessons

There are two key information quality components to SOX. The first addresses process management and quality control of accounting and auditing processes. The second is executive accountability for information quality.

SOX is significant in that it assigns accountability for the accuracy of information right to the top of the organization. No longer can organizations “blame” poor quality information on a “computer glitch,” a “clerical error” or other factor to wash ones hands of responsibility.

However, negative incentives without methods to improve quality tend to drive up fear and may only be short lived (Deming 1986: 69). Proactive IQ management seeks to improve and control source financial processes to minimize information scrap and rework so financial reports can be produced faster with higher quality information produced right the first time.

2.7. Fair and Accurate Credit Transactions Act and Information Accuracy and Completeness

Origins of the Law

The Fair and Accurate Credit Transactions (FACT) Act grew out of increasing incidence of inaccurate and missing credit history information that caused worthy borrowers to be denied credit. Inaccurate credit reports either:

- Allow nonqualified borrowers to receive loans that may end in default with loss to the lenders and new credit rating problems for the borrower
- Deny credit to credit worthy borrowers and possibly creating legal action by the consumer

Two Consumers Union surveys illustrate the problem with credit history accuracy. In 1991, 48% of 161 credit reports contained inaccurate information of some kind, and 20% (1 out of 5) contained major inaccuracy that could affect a consumer’s eligibility for credit. In 2000, the significant inaccuracy rate more than doubled to over 50% of 63 credit reports contained major errors that could result in credit denial or higher credit rates (CFA & NCRA 2002: 6-7).

This law also responds to increased problem of identify theft, minimizing the potential damage to credit ratings caused by stolen identify information.

Key Concepts of the Law

The Fair and Accurate Credit Transaction Act (FACT) goes in effect beginning December 1, 2004 and covers all states by September 1, 2005 (Wernick 2004).

The law requires the three nationwide credit reporting agencies to provide consumers a free copy of their credit report once every twelve months, upon request. The law requires the creation of a dedicated web site, a toll free telephone number and post address for consumers to request and submit reports.

Identity theft provisions include:

Requiring credit reporting agencies to stop reporting allegedly fraudulent account information of victims of identity theft

Requiring creditors or businesses to provide copies of business records of fraudulent accounts or transactions related to them for verification of fraud

Allowing consumers to report accounts affected by identity theft directly to creditors as well as credit reporting agencies to prevent spreading erroneous credit information. (FACT 2004)

Application of the Law

FACT enables consumers to verify that their credit report information is accurate and/or complete to allow "accurate" credit scoring and to identify potential fraudulent activity.

This law also makes the consumer the auditor of the credit reporting agencies information gathering processes.

Impact of the Law on Information Quality

In the past the consumer had to pay to receive their credit reports unless they were denied credit for a purchase to which they may have been entitled. While not yet in effect, the provisions of the law are reasonable to give consumers relief for nonquality or fraud in their credit history information.

IQ Lessons

This law attacks the symptom and not the root cause of defective processes for collecting proper information from financial and retail lenders.

A better approach is for the credit reporting agencies to analyze the root causes of process failure by examining consumer feedback as to the errors and omissions in the credit reports. Then credit reporting agencies should define and implement improvements that prevent or minimize the defects.

Credit reporting agencies should identify and implement methods to identify patterns of fraud and identify theft.

3. Relationship of Legislation for Information Quality and Effective Information Quality Results

What is the overall impact of legislation on information quality improvement?

3.1. Types of Legislative Action for Information Quality

There are three general forms of legislation that flow from the above examples.

To specify rules and requirements for information quality itself, with penalties for non-compliance. This is the legal concept of disclosure or full disclosure (Truth-in-Advertising; Truth-in-Lending).

To specify rules for business practices allowing consumers the ability to audit or inspect to identify errors for correction. This is the legal concept of notice and the right to amend (Item-pricing laws: compare item price tag to sales receipt, HIPAA: right to review and amend medical record, FACT: right to review and correct or amend credit history information, Information Quality Act: consumer complaint with response and reporting of complaint handling).

To specify rules and regulations that address internal processes that should cause and increase information quality, such as Sarbanes-Oxley (accounting quality controls, audit independence, independent oversight) and The Information Quality Act (procedures to ensure quality and for complaint and response). The motivation here is to require internal behavior that should improve the external outcome, quality information that is in the best interests of the end consumer or stakeholder.

3.2. Problems in a Legislative Approach to Information Quality

Legislation often fails to produce optimum information quality results:

If legislation produced optimum compliance results, there would be few fines for noncompliance and few complaints from consumers. With laws affecting information quality, we would expect to see information quality defects at close to zero defects (six sigma level quality of 3.4 defects per million items). Such is not the case.

With respect to item pricing, the error rates dropped from 4.58% to 3.35% between the 1996 and 1998 FTC studies. While this is 26.9% reduction, 3.35% error rate represents 33,500 inaccurate prices out of 1 million items. 22.45% of the stores in 1996 had *no* errors, compared to 43.14% of the stores in 1998. An interesting figure is to note the error

rate of the remaining stores in the study that had at least one incorrect price. The average error rate among the stores with at least one error in 1996 was 6.22% compared to 5.89% in 1998, a decrease of only 5.3%. Putting price tags on items does not in any way directly improve the item prices. It also costs retailers unnecessarily. Builders Square in Michigan spent \$ 2.4 million a year to price-tag its items, accounting for 11% of its payroll costs, and the FTC calculates that it costs the average supermarket \$ 154,000 per year to item-price (Beck 1997: 2E). All this cost just to allow consumers to audit their sales transactions.

The question is this. Was the improvement due to legislation? Were some stores more motivated by the regulation than others? Or was the change due to the FTC study that called attention to the problem? Or was the improvement due to quality management initiatives implemented by some retailers? Unfortunately, neither studies gathered information as to whether the stores had information quality management programs in place.

Legislation often attacks the symptom and not the root cause:

Both Fair and Accurate Credit Transactions Act and item-pricing laws attack the symptoms and not the causes of nonquality information. The heart of the two problems addressed in these laws are broken credit history information gathering and broken pricing processes.

None of the legislation described, including the Information Quality Act and Sarbanes-Oxley Act, provides guidance on how organizations can analyze *root causes* of the broken processes or techniques for process improvements that error-proof the processes and eliminate defective information. When one “improves” processes without understanding the root cause, they may get some improvement, but it will be sub-optimized, and it will probably *not* be sustainable.

While the Information Quality Act focuses on the quality of information provided to the information consumer, the implementation of quality actions could be performed as reactive “inspect and correct” rather than proactive, error-proofing process improvement. A truth in information quality management is that some errors produced at the source may not be correctable because of inability to rediscover facts about an event or the sheer cost of rediscovery.

Legislation sometimes puts the accountability in the wrong place:

Laws such as the Fair and Accurate Credit Transactions Act, item-pricing laws and HIPAA place the accountability for correct pricing in the wrong hands, the customer. With FACT, consumers must proactively ask for copies of their Credit Report, examine it and report back corrections. With item-pricing, consumers must “audit” their transactions to assure they were not overcharged. HIPAA enables the patient the ability to review medical records and to request amendments for that information about the medical encounter or their medical history information that they are more likely to be able to confirm than the medical provider. However, there are no guidelines providing clues to patients that there may be errors in their records.

The Sarbanes-Oxley Act has put accountability in the right place, holding executives accountable for financial information quality. In the Information Age, executives *are* accountable for information created and maintained by their organization just as they are for the enterprise financial and business results and just as the Chief Operating Officer is accountable for product or service quality and operating results.

Accountability without training or understanding of IQ principles and processes that attack the root cause often serves only to increase “fear” and reactive responses. People will generally only rise to meet the “letter” of the law.

Legislation alone rarely creates the culture change to make the “intent” of the legislation part of the organization values:

Externally imposed rules are rarely recognized and received as *opportunities* to rethink their processes and create a competitive advantage position. They are generally met with resistance, complaining and grumbling as organizations “react” to respond to them. The natural tendency is to implement the minimal requirement to meet the regulation.

None of the laws analyzed here, for example, mandate that organizations adopt a “customer is important value,” or conduct root-cause analysis of their information quality problems, or to engage in process improvement to error proof their information processes, or to provide training to information producers, or to challenge internal enterprise performance measures with incentives for speed rather than information quality for the sake of the customer.

4. The Real Solution to Poor Quality Information

The 1998 retail pricing study rightly concludes, “Implementation of good pricing practices requires a substantial commitment of resources, but, in the long run, is likely to provide net benefits to the retailer. Scanner pricing errors can reduce profits and sales. Stores can lose thousands of dollars through undetected undercharges, and can lose sales when consumers decide not to purchase items because the inaccurate advertised or posted price appears too high” (FTC 1998: 15).

The principles of effective information quality management are becoming known and implemented successfully. Effective information quality management minimizes the need for legislation, or mitigates the risk of noncompliance to existing legislation.

When a major bank found itself the target of a regulatory action, it used that opportunity to create an information quality function and implement rigorous processes for Total Information Quality Improvement.

Another major bank did not need the impetus of regulation as its driver for an information quality function. It has adopted Six Sigma as its approach to proactively measure and improve its information processes. There are four fundamental principles of sound quality management (English, 1994: 2.2) that are also true for IQ management:

4.1. The Obligation to the Customer Never Ceases

The consumer is the most important part of the assembly line, Deming says (1986). Organizations that make the customer its most important focus, next to its human resources and drive its products and services to meet their needs will thrive. Information quality has two sets of customers, internal knowledge workers who depend on information to perform their jobs effectively, and the end customers, through whom information from the organization creates “Moments of Truth,” in which customers have an opportunity to form an opinion, favorable or unfavorable, about the organization (Carlzon 1987). When customers find out they have been provided the wrong medical care, overcharged and have to waste their time to get reimbursed, or find their name misspelled, or do not get their mailing address corrected, or receive multiple catalogs, or receive promotional offers for products they already have, or cannot understand the meaning of the offer they have or how to fill out an order

form, it damages an organization's credibility. These "complaints" stated or unstated lead to lost customers.

Information producers must understand their information consumers' needs, including the end customers, and provide quality information to meet those needs. Management must provide information producers the resources and training and empower them to improve their processes to satisfy their information consumers (English 1999).

4.2. Focus on Process Improvement to Eliminate the Cause of Defective Data

World-class companies do not do "scrap and rework." They improve processes to prevent defects that require scrap and rework. Every valid quality management system concentrates on process improvement to meet or exceed customers' expectations. Organizations must learn the fundamental process improvement techniques in the Plan-Do-Check-Act (PDCA) cycle (Deming 1994: 131-133; English 1999: 285-310; Imai 1997: 228-233; Juran 1998: 5.1-73) or Six Sigma's DMAIC (Define-Measure-Analyze-Improve-Control) (Pande 2000: 150-152) to eliminate the problems requiring such legislation cited above.

An organization must train Process Improvement Facilitators to lead process improvements and to teach others how to improve their own processes. Process improvement will help organizations solve the root causes of their information quality problems, such as medical and financial data accuracy.

One major information provider discovered it cost ten times as much to correct information that was discovered by their customers than if their information producers verified it at the source. They have a rigorous information quality management function, with regular quality control assessment and process improvement.

One major telecom has eliminated US\$ 900 million (€ 700 million) in the costs of information scrap and rework through its six years of IQ improvement initiatives.

A major Japanese auto manufacturer who averages about 6,000 employee suggested process improvements per *day*, is now applying those same quality principles to improve its information processes.

4.3. Use Proven Scientific Methods for Information Quality Management

All sound quality management systems have a common set of quality management methods which have demonstrated effectiveness. These include:

- Plan-Do-Check-Act: The fundamental process improvement cycle
 - Root-Cause Analysis with Ishikawa Charts (Fishbone or Cause-and-Effect Diagrams): Get from the precipitating cause of nonquality information to the root causes to solve the problems and the source to prevent recurrence
 - Statistical Quality Control (Control Charts): Measuring the right things to assure processes are in control
 - Quality Function Deployment: The involvement of customers in the development of products, including databases and application systems.
- Eppler (2003: 78-157) cites four Principles for information quality of knowledge-intensive information products, such as credit history and scoring, scientific analyses or economic projections, mail order catalogs or product labeling. They include:
- The Integration principle. "Information must be integrated....Dispersed sources of information must be compiled to provide unified access and to provide the information [consumer] with a convenient way to identify and access relevant information.... Information has to be provided in a comprehensive and concise, convenient and accessible manner to be of high quality." This principle calls for a just-enough and just-in-time set of information specifically designed to meet the particular need of a knowledge worker.
 - The Validation principle. "In order to enable information consumers to evaluate information effectively, it must be validated, i.e., it must be checked for accuracy, consistency, timeliness and security. Indicators of a piece of information's validity must be provided with the information to facilitate this task." This principle provides for a "warranty" of the information's quality with information consumers able to self assure its reliability. This is especially important when information appears to be unreasonable, but accurate.
 - The Contextualization Principle. "In order to enable consumers to understand and adapt information correctly, i.e., to allocate it adequately, they need to be provided with the context of that information. The provided context should increase the clarity of the information (what it is about), the perceived correctness (where it applies and where it leads to false results), the traceability (where it comes from and how it originated), and its maintainability (where and how it can be updated)." Contextualization means that the information consumer is able to understand the meaning of the information *as well as* its significance.

- The Activation Principle. "In order to enable information consumers to use information effectively, it has to be provided in a directly applicable format, in its most current version, in a highly interactive process, and on a fast infrastructure. This assures that information is applied because it is available when needed and because it is easily noticed and remembered." Activation addresses the value proposition of information. Its value lies in the actions people take as the result of the message in the information. Truth-in-advertising laws have as their goal that consumers have the right information in a way to make the right decision.

4.4. Implement Management Accountability for Information Quality

Until people have accountability for information quality, there is no impetus to understand and implement quality principles and methods. The Sarbanes-Oxley Act explicitly assigns accountability for financial information quality to chief executives.

Because information is the strategic resource of the Information Age, every manager in the organization must have accountability for information written into their job description and for which they will be held accountable (English 1999: 406). This is the same kind of accountability managers have for their financial and human resources.

A Canadian mining company has accountability for information written in to their manager's job descriptions. They are accountable for the accuracy of the information the miners provide on their timesheets. Why? They must know where they have drilled and how much, so they can assure they have the right supports in the mine shafts for the safety of all.

At a world-class oil production company in California that has a strong information quality function, managers have accountability for information quality written in to their job descriptions. Their managers and staff alike are given training in how to improve their processes. Over 60% of their managers and 50% of all employees have gone through information quality training. This oil company has the lowest operating cost per barrel-of-oil equivalent, their industry's core operational measure.

A company that collects environmental data from its suppliers has written into their contracts information quality requirements. For some information, if there are errors and it has used the data to make decisions, the supplier must: 1) re-analyze and re-supply the information, and 2) must pay the company for costs of information scrap and rework caused by the defective data.

5. Conclusion

If organizations do not provide quality information, and the consequences of missing, inaccurate or misleading information cause consumers harm, the organizations—or their industries—are liable to face increasing legislation and/or regulation.

Organizations cannot eliminate information quality problems consistently without having proactive quality processes and leadership. The status quo is what produced the level of nonquality information an organization has today. To solve the problem requires new ways of managing processes that create and update data and that retrieve and present information to the information consumers.

If organizations only react to the “letter” of the regulation without adopting a proactive IQ management environment, they will probably sub-optimize their efforts. Without improving, error-proofing and controlling processes, and providing information producers the training and resources to provide consistent quality information, the internal results will increase fear without solving the root causes of the problem.

If organizations respond to the “spirit” of the legislation by putting in place a proactive, process-improvement focused information quality environment and culture, they will derive economic and customer-satisfaction benefits far beyond those of simply being compliant to the law.

The proliferation of electronic information without controlled, error-proofed processes is the precipitating cause of poor quality information and the problems caused to society. The customer losses, injury and inconvenience caused by nonquality information in turn precipitate the enactment of legislation to protect consumers. This legislation, in turn creates additional burdens on organizations in the form of compliance that causes them to allocate money and people resources doing additional work to comply with legislation that will generally be sub-optimal ways of attacking information quality problems.

The way out is for organizations to recognize there are proactive quality management and information quality management methods, such as the Baldrige Criteria (Baldrige 2004), Deming’s Fourteen Points (Deming 1986), Kaizen (Imai 1997), Six Sigma (Pande 2000) or Total Quality Information Management (English 1999), that organizations can use to solve their information quality problems and minimize their risk and exposure to noncompliance. It is in any private sector company

to assure that they do not alienate and drive away customers as the result of defective information. It is, after all, the customers who ultimately pay the bills.

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