

Information Quality Mandate for Election Reform



By Larry P. English

The U.S. presidential election 2000 is not just a strange and surreal experience in the U.S. electoral process – it is a warning to a free and democratic society in the information age. As many as three percent of the ballots in the close Florida presidential race were “defective,” throwing the country into a near crisis that required resolution by the judicial system.

“Florida’s mistake-riddled experience in the 2000 presidential election revealed flaws that for years had been known only by insiders in the voting process.”¹ The degree of error exposed mandates for true election process reform. True reform is not just substituting new technology for old. Real election reform

requires applying information process improvement principles and techniques to the processes and the technology.

Voting processes failed in every state, producing disqualified votes at unacceptable rates. At least five states, including Georgia and Illinois, had higher rates of unmarked, uncounted and disqualified ballots than Florida; and the cities of New York and Chicago had far higher “error” rates, according to a Caltech/MIT study.² Florida just happened to receive attention because it became the “swing” state upon which the presidential election would be decided because of the closeness of the race.

The Caltech/MIT study determined that 4 to 6 million voters were “dis-

enfranchised” from the presidential election due to “faulty equipment” [sic, should be “Faulty Processes”] (1.5 to 2 million lost votes), registration mix-ups (1.5 to 3 million lost votes) and polling place operation failure (up to 1 million lost votes), plus an unknown number of lost votes due to absentee ballot problems.³ The 4 to 6 million votes lost in the presidential election due to election process failures is the equivalent of throwing out the votes of the *entire* state of Florida!

The election processes, whether voter registration, voting or recounting, are pure “information production” processes. As such, the analysis of the Florida presidential election and the disqualified votes because of flawed ballot design and other election processes provides an excellent case study in information quality improvement.

Objectives

The purpose of the article is *not* to attempt to reopen the election results. The election is over. We have a duly and legally elected President of the United States. The purpose of this article is twofold:

1. To analyze the data from various analyses of the disqualified votes and other problems of the 2000 presidential election and to describe the information quality principles and process improvements that must be applied to the election processes. These improvements are imperative if we are to guarantee the most sacred right of a democratic society: the right to vote and to have our vote recorded and counted accurately.

Voters' Bill of Rights

1. Every eligible American citizen shall have easy access to a voter registration process that has integrity to assure the capability to vote.
2. Every legally registered voter shall have the unfringed right to vote.
3. Every voter shall have easy access to the voting process.
4. Every voter shall have access to a voter-friendly process for casting votes.
5. Every voter shall have a voting process that assures his/her vote is recorded accurately and unambiguously as intended.
6. Every voter shall have the right to validate his/her voting choices prior to his/her vote being recorded.
7. Every voter shall have the right to verify that his/her vote has been included in the final vote tally of the races in which the individual voted.
8. Every voter shall have the right to have voter registration secured and protected from fraudulent use.

Figure 1: Proposed Voters' Bill of Rights

2. To use the election process as a case study on information quality improvements that must be incorporated into all-important processes where the costs of failure are high.

The faulty election processes exposed during the November 7, 2000, presidential election threaten the right of every citizen to be able to vote and to have his/her voting intention recorded and counted accurately. Every American, regardless of political affiliation, should be concerned about the flawed election processes.

Information Quality (IQ) Lesson 1:

Deming's first point of quality says, "Create constancy of purpose for improvement of product and service."⁴ Management must solve the problems of tomorrow, not just concentrate on solving today's problems with short-term solutions. The obligation to the customer to constantly improve the design of product and service "never ceases."⁵ For the election processes, this means: The obligation to the voter never ceases.

The election processes, as with any critical processes, must be improved constantly to assure the customers' needs are met. Failed business processes cause dissatisfied customers who take their business elsewhere. When the election processes are faulty, a candidate for whom the majority of voters intended to vote does not get elected, thwarting Abraham Lincoln's vision that we have a "government of the people, by the people, for the people."⁶

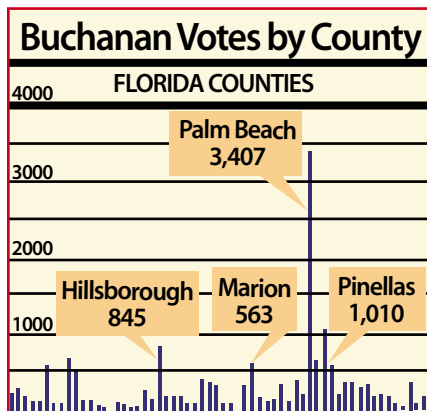


Figure 2: Buchanan Votes by County

America has various consumer protection rights. Truth-in-lending laws require financial institutions to disclose information about the costs of goods. The National Highway Transportation Safety Administration, the FDA and other consumer protection agencies seek to protect consumers from faulty products

Confusion Over Palm Beach County Ballot

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform Party.

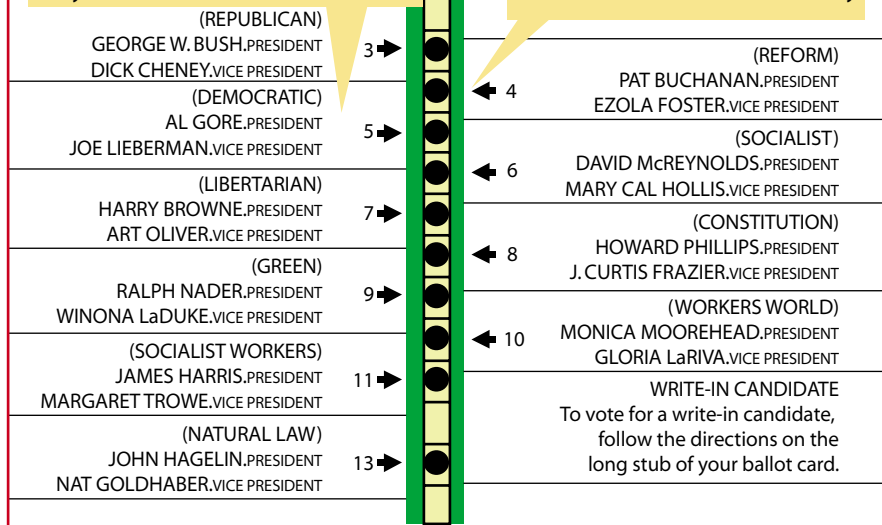


Figure 3: Palm Beach Butterfly Ballot. (Sun-Sentinel graphic/Daniel Niblock. <http://cnews.tribune.com/news/image/0,1119,sunsentinel-nation-82383,00.html>.)

that can cause injury or death. Congress is working on a "patients' bill of rights." The increasing lack of customer service in the air travel industry and lack of responsiveness by the airlines are causing many to consider a "passengers' bill of rights." With 4 to 6 million disenfranchised voters who tried to vote, but whose intended votes were rejected in one way or another by faulty election processes and technologies, should there not be a "voters' bill of rights" that guarantees every eligible American citizen the right to vote and to have his/her vote counted accurately?

The voters' bill of rights in Figure 1 states the fundamental rights that I believe the Constitution intends and that voters expect.

The only acceptable quality standard in the voting process is to assure zero defects in order to guarantee that the voting citizen will have his or her vote recorded and counted accurately.

Point 1 of quality requires that America's leaders create constancy of purpose for improvement of the voting process. This does not mean simply substituting one technology for another. Substituting optical technology for punch-card technology would simply exchange a one percent defective vote rate for a 2.9 percent defective vote rate. Optical technology without other quality improvement techniques, such as education and ballot design, would still produce some 60,000 disqualified votes from Florida's six million

voters. This would result in the disqualification of more than one million votes out of the more than 105 million votes cast in the 2000 presidential election. This one percent error rate – while 4 to 6 times better than the likely actual lost votes – is equivalent to throwing out every ballot from the two states of New Hampshire and Montana.

A rejected ballot or an incorrectly recorded vote that does not represent the intention of a voter is a disenfranchisement, regardless of the cause. Can America afford to disenfranchise this many of its voting citizens? The NASA Space Program has a goal of zero defects in its missions to put people in space. Should we not have a goal of zero defects in our election processes to put people in office?

Quality Improvement (QI) Recommendation: Adopt a quality standard of six sigma or zero defects (spoiled and disqualified votes). Philip Crosby correctly states, "There is absolutely no reason for having errors or defects in any product or service."⁷ Zero defects will not happen all at once. It requires a concerted effort to implement a culture of quality improvement. A twelve-year time frame is an achievable target. Six-sigma quality, the statistical version of zero defects, allows no more than 3.4 errors in one million opportunities for error – no more than 340 disqualified votes out of 100 million. Each state and voting

jurisdiction should adopt a stretch, but achievable, target such as a 50 percent reduction in disqualified votes in the next election. By halving the number of disqualified votes every two-year election cycle, zero defects (from 5 million disqualified votes in

organizations without a strong information quality management environment waste from 15 percent to more than 20 percent of their operating revenues or budgets in the direct costs of scrap and rework. They incur further opportunity costs in missed revenue

and reducing the costs at the same time.⁹ His point 5 states, “Improve constantly and forever the system of production and service. . .Downstream there will be a continual reduction of waste and continual improvement of quality.”¹⁰ The goal of process improvement is not just the elimination of the defective products (disqualified or unrecorded votes); the real goal is to eliminate the cost of the consequences.

Don't Fix Blame – Fix the Process

Particularly distressing was the acrimony over who was to “blame” – voters, ballot designers, election officials or the “other” party. Voters faced with poor and misleading ballot designs and inconsistent voting instructions were called “stupid” through no fault of their own. The press perpetuated this blame environment with story headlines such as, “Weakest part of any voting machine: People”¹¹ and “Florida voter errors cost Gore the election.”¹² The hard feelings remain. “At an acrimonious hearing that showed how bitter the fight remains over the Florida election last fall, two members of the United States Civil Rights Commission strafed each other today and called each other

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2000 to approximately 305) would be reached in 2028.

Both public and private sectors must work together to improve the election processes. Voting technology alone is not the solution. Every technology used within a process that has not been error-proofed will produce an inherent degree of errors. Americans have assumed and now expect error-free voting processes that guarantee votes are recorded and counted accurately. This requires designing quality into the process and technology.

IQ Lesson 2: To solve a problem, we must understand not just the precipitating causes but the root causes. Only when we understand the root causes can we make the right process improvements that will error proof the voting process. Otherwise, we will attack the symptoms and fail to make the optimum solution. Substituting one technology for another only attacks the symptoms.

The High Costs of Process Failure

For 36 days, the world watched the cliffhanger election unfold with chaos and confusion caused by faulty processes and lack of standards. Millions of dollars were spent trying to resolve the dilemma – counting, recounting, attorneys’ fees and overtime of courts and other entities. Much of the federal government was put on “hold,” unsure of the next directions that would be taken, resulting in lack of productivity. Beyond that, billions of dollars of productivity were lost as people debated and argued the issues at their workplaces.

IQ Lesson 3: Nonquality causes waste, process failure and scrap and rework. Most

and lost revenue by driving customers away with errors in addresses and spelling of names, inaccurate billings, etc.

In election processes, however, the cost of failure (disqualified votes that would have changed the outcome of the election) is change to the course of human history.

The American quality guru W. Edward Deming’s 14 Points of Quality⁸ apply to all electoral processes. While most people know Deming taught quality principles to the Japanese after World War II, few remember he applied his Points of Quality to the 1940 Census, increasing the quality

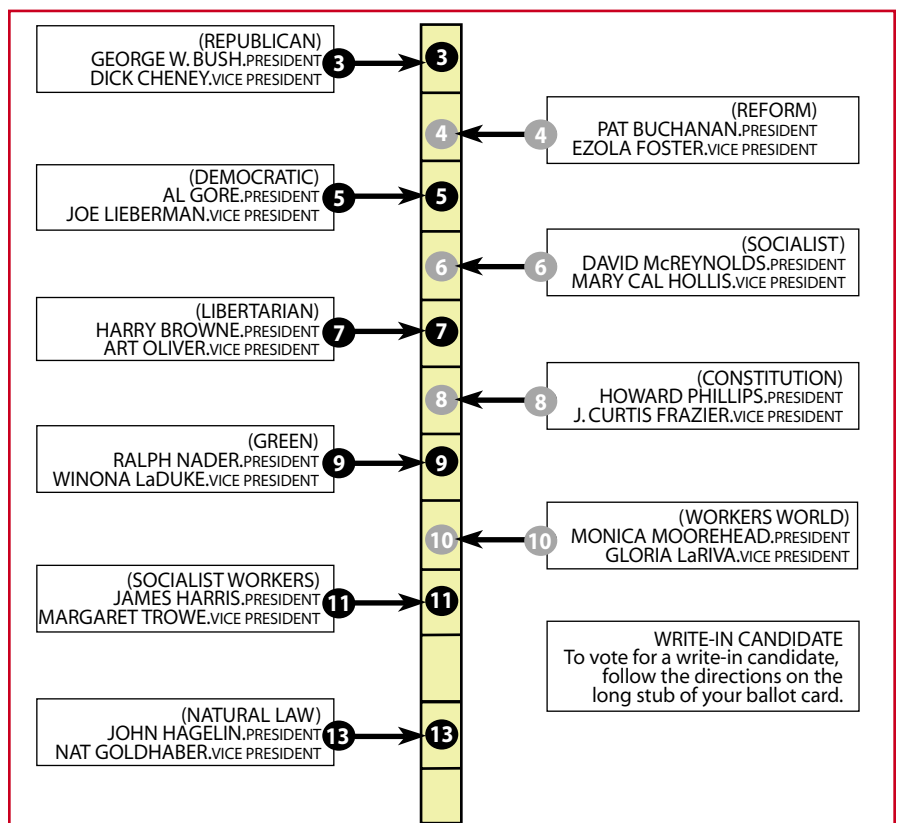


Figure 4: Improved Ballot Design

liars.”¹³ At issue was whether or not the higher incident of black voter ballot rejection was due to “voter error” or disenfranchisement.

A subgroup of the House Government Reform Committee conducted a review of approximately 200,000 ballots that went uncounted out of 9 million ballots cast in 40 congressional districts nationwide. One poor, mostly minority district outside Birmingham had the lowest rate of disqualified ballots in all 40 districts studied, contradicting the suggestion that the problem in poor districts is due to illiteracy and voter inexperience. Voters there, using an optical-scan voting system, had a disqualification rate of 0.3 percent – a smaller disqualification rate than any affluent district.¹⁴ This compared with an average disqualification rate in districts using optical technology or paper ballots of 1 percent in poor districts and 0.5 percent in affluent districts. This 0.3 percent error rate – three times better than the average in poor districts and nearly twice as good as in affluent districts – is explainable only by error-proofing techniques applied in that district.

IQ Lesson 4: A principle of quality management is that there is no “blame” or “fault finding” when seeking to solve a problem and improve processes. The voters of Florida were not stupid, nor were they “confused.” They are good, decent Americans like other voters; they were misled by defectively designed ballots and defective voting processes. Defective products are the results of defective processes – not defective people. Incorrect (wrong selection), unrecorded (undervotes) or disqualified (overvotes) votes are not the result of “confused” or uneducated voters – they are the result of confusingly defined ballots, error-prone technology, lack of training in the voting procedures and lack of feedback as to how votes were recorded. Human error is not a root cause. If human error were the root cause, you would have a consistent percentage of errors across all voting environments.

An environment of non-blame is clear in Deming’s point 8, “Drive out fear.” If workers, ballot designers or even voters have fear, whether fear of being blamed or because of lack of training or confusing information presentation “directions,” they

Standard Used for Undervotes	Strict	2-Corner	Palm Beach	Lenient
Starting Advantage*	+1,198	+1,198	+1,198	+1,198
Overvote	-682	-682	-682	-682
Undervote, Optical Scan	-384	-384	-384	-384
Undervote, Punch Card	+20	+275	-374	-464
Winner	Bush +152	Bush +407	Gore +242	Gore +332

*Bush’s starting advantage is his lead before hand counts from Broward and Volusia counties were added to the certified count. That allows USA TODAY to apply uniform standards to overvotes and undervotes in all 67 Florida counties.

Source: USA Today/The Miami Herald/Knight Ridder; USA TODAY 5/11/2001, p. 4A

Definition of Standards Used:

- **Strict:** Only clean punches counted. Perforated chad next to a candidate’s name is completely punched out. These ballots might have been misread when counted by a machine, or a chad might have fallen off since the machine count. Using this standard, Bush gains 206 votes, Gore 186.
- **2-Corner:** Used in many states, this standard requires at least two corners of a chad must be detached for a vote to count. Bush gains 1,068 votes, Gore 793.
- **Palm Beach:** Palm Beach County counted punch-card votes in which a presidential chad was merely dimpled, as long as dimpled chads were found in other races on the ballot. Gore gains 6,925 votes, Bush 6,551.
- **Lenient:** This was the standard Gore sought. Any change in a presidential chad would count as a vote, from a dimple to a clean punch. Gore gains 12,431 votes, Bush 11,967.

Figure 5: The Winner, Using Four Standards of Judging

USA TODAY/The Miami Herald/Knight Ridder newspapers examined 60,647 punch-card ballots and optical-scan ballots in Florida that didn’t register a vote for president by machine (undervotes) and 111,261 punch-card ballots and optical-scan ballots that registered more than one vote for president (overvotes). Of those 171,908 ballots, as many as 30,451 (18 percent) were credited to either George W. Bush or Al Gore. As shown in this Figure, Gore picked up 682 more overvote ballots than Bush (1,871 vs. 1,189) and 384 more optical-scan undervote ballots. The winner among punch-card undervote ballots depends on which of four counting standards is used.

cannot do their best in their work. In the workplace, workers who are afraid will work toward self-preservation rather than toward the goals of the enterprise and for the satisfaction of their customers. Workers who have been punished for making mistakes become reluctant to innovate or try to improve for fear of reprisal.

We must not blame the voters in Florida (or elsewhere) or the ballot designers who have not had training in quality principles or information presentation design. We must analyze the cause of the process failure and improve the processes to eliminate the defects seen last November. See IQ Lesson 14.

Improve Defective Election Processes

This past election exposed seriously flawed processes. This article will examine those processes and pertinent quality lessons:

1. Voter Registration
2. Ballot Design
3. Election Day Voting Registration
4. Voting Process
5. Vote Recounting
6. Absentee Voting
7. Election Process Improvement

There is a way forward. Quick fix panacea? No! Permanent solutions with quick wins and sustainable improvement? Absolutely! There are

proven quality process improvement methods that apply to information processes that can – and must – be applied to the election processes in order to achieve election reform that will be addressed in “Election Process Improvement.”

We now review the various election processes and the pertinent information quality principles and techniques for improvement in the form of *IQ (Information Quality) Lessons*, describing quality principles, and *QI (Quality Improvement) Recommendations*, describing specific recommendations.

1. Voter Registration

Citizens cannot vote unless they are registered. Citizens must have easy access to a process to register. The voter-registration process must have integrity to assure persons presenting themselves are qualified to vote. Voter registration data must be easily available on election day or during early voting. Processes must be in place to capture updates to citizens’ new addresses and voting jurisdictions to prevent denial of voting right and fraud. Currently, American residents have a mobility rate (change of address) of about 15 percent per year (with a high of 20 percent in 1984-85).¹⁵

IQ Lesson 5: *Process integrity and information quality begin with clear definition of the data that must be known and integrity of the design of the databases to house that information. States must have well-defined voter registration databases with easy, yet secured, access by each other.*

QI Recommendation: *Design the voter registration database and process to capture “identity attributes” such as birth date, mother’s maiden name, last four digits of Social Security number and driver’s license number, digital signature and fraud-prevention information such as deceased and other attributes that disqualify one from the voting privilege. The process and database must also be designed to capture and maintain name changes as well as previous addresses of individuals with relative effective dates to handle the “information quality decay” of address changes and disqualification events.*

QI Recommendation: *Processes should be in place to capture current addresses easily. National Change of Address (NCOA)*

data from the U.S. Postal Service and motor vehicle registration should be utilized to capture new permanent addresses. Access to a database of deceased persons will help prevent voting fraud.

Registered voters should be able to update their name and address data easily. Enable updates through the Internet using secured services and proper identification verification to reduce problems on election day.

2. Ballot Design

The Palm Beach County butterfly ballot called attention to the importance of ballot design. With some 19,000 overvotes, this one county accounted for 17 percent of the 111,000 overvotes in 67 counties as well as one fifth (19.5 percent) of the Florida’s total votes for Pat Buchanan, three times as many as the county with the next highest Buchanan vote (see Figure 2). This count represents a statistical outlier in a county where the demographics are not consistent in general with Buchanan’s positions and where Reform party registration is a fraction of the total number of votes recorded for him. This vote-count anomaly can be explained by the design of the ballot in which there is overlap between the candidates listed and the selection punch holes. The butterfly ballot in Figure 3 illustrates the ambiguous location of selection punch holes, overlapping the candidate boxes in that ballot. The arrows pointing to the selection punch hole are small, weakly calling attention to the correct punch. Figure 4 represents an improvement in presentation quality. The candidate boxes are separated from one another, center-justified so as to be closer to the action punch holes, with no ambiguity of relationship of punch hole to candidate. The color/shade separation and stronger pointing from candidate to selection box much more strongly associates the correct punch selection.

Palm Beach County was not alone in problems with ballot design. Gadsden County had a 12 percent spoilage rate with almost 2,000 double-punched ballots. The ballot had eight presidential candidates in one column and two in a second column that looked as if it could be a different election. Duval County had ballots spread over two pages, creating

a 7 percent reject rate in predominantly white precincts. Compare this to a reject rate of less than 2 percent in the District of Columbia.¹⁶ This violates the “information chunking” principle in which all information about a given subject is contained together in a cohesive group.

Furthermore, there were numerous problems with the printed procedures for voting. The Palm Beach ballot instructed voters to vote for their candidate by punching the hole “to the right” of the candidate’s name. However, the selection punch holes for all candidates on the right side of the butterfly, including Buchanan, were to the left of the candidates’ names. Refer again to Figure 3. The Duval county sample ballot (with presidential candidates spread over two pages) that was inserted in the Florida Times-Union contained voting instructions that stated, “Vote all pages.”¹⁷ This was corrected in the election day instructions to read, “Vote appropriate pages.”

Instructions on both optical ballots and punch cards usually state, “Vote for Group” when referring to the President/Vice-President pair. But where are these two ever referred to as a “group” in any typical context? This is confusing generally and is compounded by the often-accompanying text, “A vote for the candidate(s) [sometimes singular and sometimes plural] will actually be a vote for their electors.”

IQ Lesson 6: *There are three components to information quality: 1) Definition (you know the meaning of the data, e.g., “touching this button causes your vote to be recorded,” or “party” denotes an established political group that supports specific principles and to which a candidate belongs); 2) Content (accurate value, e.g., the name of the party by the candidate’s name is the correct party name); and 3) Presentation (information, such as instructions for voting, is presented in a way that is clear to the voter. When actions are required or information is requested, the information is presented in a way that leads the knowledge-worker to make a right action. Information presentation design is of utmost importance in any form for communicating information, requesting action or collecting information).*

QI Recommendation: *Design ballots with all candidates for one race chunked in*

a single space with unambiguous placement of candidate names with their selection mechanisms. After ballot design, write and test voting instructions and procedures against the ballot to assure consistency.

QI Recommendation: Review instruction wording for clarity. For example, the instructions “Vote for Group” should be replaced with a more clear, natural text, “Vote for one President/Vice President team by completely shading the oval next to their names.”

QI Recommendation: Use multi-sensory design techniques. For example, include candidates’ photographs as well as

cannot hold someone accountable if they have not been trained or taught the principles.

IQ Lesson 7: Point 6 of information quality states, “Institute training on information quality.”¹⁸ Deming asserts a universal truth that people cannot do a quality job if they do not know how.

Basic training in information quality principles must be provided for election officials, especially for ballot designers and procedure writers. This training can be standardized for general principles with modules that address the different voting systems. A key focus should be error-proofing

their right to have their intended votes counted in the presidential election.¹⁹ That many ballots were not counted by failure of the vote counting process to register a vote (undervotes) or were disqualified by having selected more than one candidate (overvotes). That represents as much as a three-percent “error” rate. In other words, the votes of as many as three out of every 100 voters who thought they voted for president were not counted. It is not possible to determine from an undervote with no perceivable mark whether the voter intended to vote for someone or not. National Election studies indicate approximately 0.73 percent of voters deliberately abstained from voting in the presidential races, and exit polls from Voter News Service captured sufficient data in 1992 to indicate 0.77 percent of voters abstained from voting in that presidential race.²⁰

IQ Lesson 8: The absence of information can never be inferred to mean, “I chose to leave out information.” There must be positive indication of a planned absence of information.

QI Recommendation: Implement a “no vote” or “abstain” option for the voter to select in order to assure that voter intent was to abstain from voting in a given race. This should be adopted especially for voting methods prone to high degrees of failure to sense a voter selection. This is the only way to assure that a “no vote” (undervote) was intentionally cast.

QI Recommendation: The term “residual vote” means “all uncounted votes, undervotes (whether the voter intended to abstain or not), spoiled votes and overvotes. Create a new term or redefine the meaning of “residual vote” to include only defective votes (unintentional undervotes, spoiled or overvotes). This is a more meaningful metric because it includes only defective votes for measuring voting process integrity. It requires the use of a means to identify a “no vote” in any election.

3. Election Day Voting Registration

Many problems were cited where qualified voters were turned away at the polls because of inaccurate, incomplete or non-current voter registration lists. Types of failure here include errors created during voter registration process, no process to capture address

Voting Method	Definition	# Using Method	% County Population
Punch Card	Punch-card ballots inserted into a holder that is labeled with choices; voters punch a hole through their choice. Includes the Votomatic used in Palm Beach County.	578	32.4%
Datavote	Punch card with choices printed on the punch card.	57	4%
Level Machines	Metal machines that record a vote when a voter turns a mechanical lever.	480	18.2%
Paper Ballots	Paper ballots which voters mark with a pen with votes hand-counted.	410	1.4%
Optical Scan	Paper ballot with spaces for voters to fill in with machine-readable marking instruments: Ballots are read electronically by scanners (fastest growing in popularity).	1217	27.2%
Electronic	Touch screen or electronic notepads that record votes electronically = 257 counties.	257	8.9%
Multiple Methods	More than one of the above .	141	7.9%

SOURCE: USA TODAY, WWW.ElectionDataServices.com (data as of 1998). www.usatoday.com/news/politics/votingindex.htm. (Author’s note: Both the counts and percentages differ from the USA TODAY article “Think election was a mess? Look at system,” 11/14/2000, p. 21A. In this story, the percents represent the percents of counties with each method.)

Figure 6: Voting Methods Used Across the U.S. Each of the 3,140 counties sets up its own system for voting and recording votes.

names for visual recognition. Electronic recording devices can use sound to indicate the selection of a candidate, to indicate when an incorrect choice is made and to indicate when the final recording of a vote has been made.

Again, we cannot “blame” the ballot designers or the people who signed off in approval of the ballot. A basic principle of accountability is we

techniques that help prevent common errors inherent in the different types of voting technologies.

Training must provide guidance in how to conduct a “usability test” of ballots for voter-friendliness by testing them in ways to simulate the experience voters will have in the voting booth.

As many as 178,857 voters in Florida alone may have been denied

change data, lack of access to the authoritative voter registration database or precinct voter lists created from non-current copies of voter registration data.

IQ Lesson 9: *No matter how well-defined or how accurate and complete, data is nonquality unless it is available to processes that require it when it is needed. Processes should have access to the authoritative source of data or downloaded or printed data from that authoritative source on a timely basis.*

QI Recommendation: *Jurisdictions that had election-day registration problems should analyze causes of missing information. If printed lists are used, assure they are from the correct source and are made after all updates have been applied. If electronic files are used at the polling place, assure they are downloaded with current data. The best solution is to have secure access to the single authoritative voter registration database.*

QI Recommendation: *In no case should a properly registered voter be denied the right to vote. If a voter attests that he/she is eligible to vote, he/she should be allowed to vote with a conditional or provisional ballot. These provisional ballots should have appropriate identity attributes to allow next-day verification. If the provisional voter is found to be eligible, the vote should be included.*

IQ Lesson 10: *The maxim “haste makes waste” applies in election day processes. When voters have to fit voting into their workday schedules, they have a tendency to rush, increasing opportunity of error. Polls tend to have “rush hours” that likewise contribute to operational errors.*

QI Recommendation: *Make election day a national holiday. This reduces the pressure for both poll workers and voters.*

If voter lists are used at polling stations, an additional scheduling technique can be used to “suggest” staggered times for voters based on the second letters of their last names, resulting in four or five relatively equal groups of voters spread across four or five time slots. For example, names with second letters of a-d might have a suggested voting time of 7:00 a.m. to 10:00 a.m. Persons with names Bach, Talbert, Edison and Udall would be encouraged, but not required, to go to the polls during that time to even out the demand at the polls.

QI Recommendation: *Take advantage of normally wasted wait times in lines at the polling places by passing out voter instructions and sample ballots.*

There were 2,036 possible overvote combinations. An analysis of overvote ballots showed these were the 20 most common combinations. The list is ranked by the number of ballots.

Combination	Ballots
Gore + Buchanan	10,234
Gore + Browne	9,321
Bush + Gore	8,956
Bush + Buchanan	4,957
Gore + Moorehead	3,989
Gore + McReynolds	3,976
Gore + Phillips	3,868
Gore + Nader	3,405
Gore + Hagelin	3,015
All candidates except Bush	3,007
Bush + Hagelin	2,442
Bush + Phillips	2,047
Gore + Harris	1,782
Bush + Moorehead	1,771
Bush + Browne	1,711
Bush + Nader	1,529
Gore + write-in vote	1,292
All 10 candidates	957
Gore + Nader + Hagelin + McReynolds + Moorehead	911
Bush + write-in vote	790

Source: USA Today/The Miami Herald/ Knight Ridder; USA TODAY 5/11/2001, p. 4A

Figure 7: Florida Overvote Combinations
There were 2,036 possible overvote combinations. An analysis of overvote ballots showed the 20 most common combinations. The list is ranked by the number of ballots.

Provide a videotape on continuous loop TV monitor(s) with “on-the-job” training that shows someone voting and validating a ballot. This should show types of problems the voter might encounter with the voting method used and what to do to prevent or correct those problems. Provide audio headsets for different languages.

QI Recommendation: *Make expert poll workers available for people needing additional assistance and a sample voting booth to practice the voting process. This should be required for first-time voters.*

4. Voting Process

The USA TODAY, *The Miami Herald* and Knight Ridder newspapers analyzed some 60,647 undervotes (ballots in which no candidate selection

was sensed by the technology). Along with five other newspapers, they analyzed 111,261 overvotes (ballots in which more than one candidate was sensed by the vote-counting systems). They found that up to 18 percent (around 31,000) of the total 171,908 “defective” votes analyzed would have been able to be counted as legal votes, depending on which of four acceptance standards were used.²¹

Indeed, the U.S. Constitution provides the mandate for information quality in the election processes.

Most of these 171,908 voters, except the minority, who intentionally abstained from voting, were disenfranchised. Regardless of the cause, thousands of voters in Florida were disenfranchised as a result of broken processes that caused their votes to be invalidated and not counted. This count does not include all disenfranchised voters. Some were turned away at the polling locations because of errors or omissions in the voter lists; others did not make it to the polls because of work schedules or traffic. Some polling places had long lines and voters left. Others heard broadcasts of “election winners” and did not go to the polls.

Lack of standards creates chaos in the recount process. Depending on the standard applied (strict, 2-corner, Palm Beach or standard), there was the potential for four vote differences had all 67 Florida counties agreed on one of the aforementioned standards for the recount. George W. Bush wins using two of the standards, and Al Gore wins with the other two, as depicted in Figure 5. However, because each county has jurisdiction over its own “standards” for determining “voter intention” of defective votes, there is the possibility for many different potential outcome counts. With four different standards as analyzed and only 12 counties with punch-card technology (Florida had more than 24), there would be 412; in other words, 4 (different standards) times itself 12 times (number of counties); or more than 16 million different possible outcome results. This is only one of the problems with punch-card technology.

The problem is compounded by the fact that different voting processes

have different inherent failure rates. This poses a problem for the “one person, one vote” principle. For jurisdictions with zero defects, this would be true; but for jurisdictions in which there was a 3 percent error rate, the one person, on average, has only 0.97 of a vote, according to Michael Grant, vice president of Tru-Vote International.

The Constitution of the United States of America warrants that “the citizens of each state shall be entitled to all privileges and immunities of citizens in the several states.”²² However, the 2000 presidential election saw a six – or sevenfold disparity between states with the lowest rate of residual or “defective” ballots (uncounted, undervote and overvote) and those with the highest. Maryland and Louisiana had the lowest rejected ballot rates (0.5 percent and 0.6 percent respectively), while Wyoming and Georgia had the highest with 3.6 percent and 3.5 percent rejected vote rates respectively.²³ Do the citizens of Wyoming and Georgia have equal “privilege” in their right to vote and to have their votes recorded and counted accurately? Indeed, the U.S. Constitution provides the mandate for information quality in the election processes.

Technology itself is not the solution. Utah, with mostly punch-card equipment supplemented by paper ballots,

produced a 1.8 percent defective vote rate, while New Mexico, with mostly electronic voting technology and optical technology for the remaining counties, produced a 2.8 percent defective vote rate (virtually equal to Florida’s 2.9 percent rate), according to the Caltech/MIT study.

The real solution to election process reform is to apply quality principles to improve the processes to eliminate errors.

IQ Lesson 11: Standards, including both process and data definition and technology standards, are required to produce consistent

The 4 to 6 million votes lost in the presidential election due to election process failures is the equivalent of throwing out the votes of the entire state of Florida!

results. Currently there are six different basic technologies for voting systems, as exhibited in Figure 6. Defining the election process is a state’s right charged to local jurisdictions. The more that processes and technologies can be standardized across the 3,140 county jurisdictions, the more consistent the results of the processes and the more easily a recount can be conducted successfully without turmoil.

QI Recommendation: States should create standards for technologies and process guidelines with the most error-free capabilities. States should have the same quality standards in every voting jurisdiction for state elections.

QI Recommendation: The Federal Election Commission should promote quality standards and guidelines for federal elections. The Federal Election Commission should provide training with such guidelines, standards and error-proofing techniques so that all jurisdictions have access to the best practices and quality improvements.

For 72 percent of the defective votes in Florida, voter intent was unable to be discerned with absolute certainty. However, statistical analysis of those votes and the companion votes makes a statistical likelihood of voter intent possible. Figure 7 lists the 20 most common overvote combinations. Anthony Salvanto, political scientist at The University at California-Irvine and specialist in analysis of voting patterns, examined voting patterns of 56,225 Florida overvotes. Findings:²⁴

- Of the total 111,261 overvotes, Gore was marked on 84,197 while Bush was marked on 37,731. Of the 56,261 overvotes Salvanto examined:
- 83 percent of overvotes that included Gore, but not Bush, voted Democratic in the U.S. Senate race.
- 69 percent of overvotes that included Bush, but not Gore, voted Republican in the Senate race.
- 45 percent of voters who marked both Bush and Gore voted Republican in the Senate race while 42 percent voted Democratic, a nearly even split.

Some problems in punch-card ballots included misaligning the ballot on top of the voter booklet. On Miami-Dade County ballots, candidates were assigned numbered chads with No. 4 for Bush and No. 6 for Gore. Chad Nos. 5 and 7 were not assigned to any candidate. Nearly 2,000 ballots had punched chads not connected to any candidate. The No. 5 chad was punched cleanly on 676 ballots, while the No. 7 chad was punched on 991. These invalid punches can best be explained by the fact that if the punch card is laid atop the voter booklet, rather than sliding it into the voting machine, Bush lined up with the No. 5 chad and Gore with



Figure 8: Tru-Vote Split-Screen Shot

the No. 7 chad, a vote difference of 315 votes.²⁵

5. Vote Recounting

The recount process has been required in the past because the processes of voting and vote counting themselves are flawed. Punch-card ballot recounts conducted with the same card readers frequently yield different counts because of the failure of the chads to be completely punched during voting and falling out between the first machine counting and the subsequent machine recount.

Manual recounts are required to attempt to decipher voters' intentions when the voting process fails to record a vote readable by the technology. Both punch-card and optical scanning technologies are subject to significant inadvertent undervote and overvote failures. Neither have the ability to prevent overvotes. Optical technology flaws exist in the form of failing to completely mark the selection space, marking with an "X" or check mark instead of shading the entire space or using a pen or pencil instead of the required marking device.

Electronic recording means have the capability to prevent voting for two candidates in one election and can be programmed to warn voters that they have not voted in a given election.

Manual recounts are dependent on clear definitions of standards for "interpreting" votes. The existence of four different standards for punch-card ballot recounts is a problem.

However, one problem with recounts in every voting method that is impossible to solve is to assure the vote, whether a cleanly punched chad or a completely marked optical vote, was for the candidate the voter intended.

IQ Lesson 12: *A recount is basically an assessment process. It is an inspection of the ballots to assure that the official vote counting process recorded an accurate result. The best way to solve problems requiring recounts is to design quality into the process to minimize the errors that require inspection and interpretation.*

Unfortunately, there is currently no process of assessing the accuracy of a ballot. Optical technology that is scanned while the voter is present allows such problems as

a failure to detect a vote cast or multiple selections for a single race, but it may not allow the voter to confirm he/she marked the candidate of his/her choice.

QI Recommendation: *As a long-term goal, replace voting methods that produce ambiguous voting results with voting systems that are designed with quality principles such as error-proofing techniques and audit verification capability. Even the use of optical technology with the one percent overvote rate in Florida would produce one million overvotes without other error proofing techniques applied. Additionally, many DREs (Direct Recording Electronic devices) that are designed similar to mechanical lever machines lack voter-friendly features. The Tru-Vote Validation and Verification Voting System is the best example of a voting system that implements quality principles with built-in voter quality assurance and audit verification to assure vote recording. Some of Tru-Vote's features are described in Section 7, Election Process Improvement.*

In the short term, examine the nature of defective votes and define and implement vote-counting and recount standards and error-proofing improvements for error-prone voting processes until they can be replaced. See Section 7.

6. Absentee Voting

The absentee ballot application process in at least two Florida counties, Seminole and Martin, had flaws. Forty-eight hundred ballot applications that were sent out by Republicans were not printed with voter ID numbers. When they were rejected, Republican volunteers filled in the numbers. Democrats objected, and the issue had to be resolved in court.²⁶

Information problems, such as missing voter registration ID number spaces in some absentee ballots, post-mark problems and the higher potential for fraud or coercion, suggest finding ways to minimize absentee voting such as early voting. Nashville, Tennessee (Davidson County) produced 29.9 percent of its 208,588 presidential votes in early voting with only 0.12 percent (254 votes) of its votes cast by absentee ballot.²⁷ On the other hand, Baltimore, Maryland, without early voting, had 12,422 absentee ballots out of 304,084 – a 4.19 percent rate,²⁸ 35 times the absentee ballot rate in

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	297
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	284	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312
Ballot											

Figure 9: Punch-Card Ballot

Davidson County. Not only does early voting minimize problem absentee votes, it increases overall voter turnout.

IQ Lesson 13: *Processes that are "controlled" are best able to provide consistent results.*

QI Recommendation: *Implement early voting to minimize absentee votes, maximize control over the voting process and increase accessibility to the voting process. This will also decrease demand at the polls on election day and increase overall voter participation.*

7. Election Process Improvement

The Quality Improvement Method is required for election process reform. To solve any problem, one must apply

a true problem-solving technique such as the Shewhart Cycle, also known as the Plan-Do-Check-Act or PDCA cycle, for process improvement. The Plan component must analyze and identify the root cause(s). Without understanding the root cause, you may only attack the symptoms and fail to accomplish permanent quality improvement.

IQ Lesson 14: *The various problems exposed during the 2000 election confirm chronic problems in the election processes. PDCA is required to obtain zero defects. Sample precincts with different technologies as prototypes should be selected for full and rigorous PDCA improvements, both before*

and during the 2002 elections. Prototype improvement initiatives can be overseen by neutral quality improvement experts or election commission personnel trained in quality improvement methods. Included in this are:

- *Cause-and-effect analysis to understand root causes. A simple but effective technique is to ask “Why?” until you get to the root cause.*
- *Definition of specific improvements that will eliminate the recurrence of defects (failure to know a voter has already registered, unintentional undervote or overvote, etc.).*
- *A controlled test environment using real*

voters to assure the improvements eliminate the defects encountered in the last election without creating negative side effects. The irony of the Palm Beach butterfly ballot was that this ballot design represented a “planned improvement” to the ballot to increase the print size for ease of readability by the elderly. Unfortunately, it produced the negative side effect (in which one improvement creates unintentional errors in other ways) of confusion.

- *Implement the improvements (or revised improvements as necessary) for the next election. Provide the training to ballot designers and election workers as to the new procedures.*

QI Recommendation: *Design tests to measure “accuracy” of votes (the voter actually cast a vote for the candidate he/she intended). This must include having the voters record their votes and then testing that the actual produced votes – whether punch card, optically scanned ballot or electronic vote – were what they intended. This must be conducted in a way to maintain the voters’ right to a secret ballot.*

QI Recommendation: *Have quality personnel observe registration, voting and counting processes to help analyze rejected votes. Attention should be paid to instances where voters request additional ballots because of spoiling the first. Observers who have quality training and who are not part of the traditional voting processes can see problematic procedures that seem perfectly normal to those who have “always done it this way.”*

QI Recommendation: *Provide voter (“customer”) satisfaction cards with standardized questions and space to allow for complaints and suggestions for improvement. This should be done for every voting precinct and sample voting reform studies, and should be a regular practice. The voter satisfaction card should be standardized so that the data can be analyzed across a broad set of voting environments. Analyze key quality indicators centrally that will allow general continuous improvement recommendations in the next election and at the local level for local improvements. These cards should be mailed or dropped in a separate box, to allow independent assessment, with feedback provided to precincts and election jurisdiction officials.*

1	27	53	79	105	131	157	183	209	235	261	287
2	28	54	80	106	132	158	184	210	236	262	288
3	29	55	81	107	133	159	185	211	237	263	289
4	30	56	82	108	134	160	186	212	238	264	290
5	31	57	83	109	135	161	187	213	239	265	291
6	32	58	84	110	136	162	188	214	240	266	292
7	33	59	85	111	137	163	189	215	241	267	293
8	34	60	86	112	138	164	190	216	242	268	294
9	35	61	87	113	139	165	191	217	243	269	295
10	36	62	88	114	140	166	192	218	244	270	296
11	37	63	89	115	141	167	193	219	245	271	297
12	38	64	90	116	142	168	194	220	246	272	298
13	39	65	91	117	143	169	195	221	247	273	299
14	40	66	92	118	144	170	196	222	248	274	300
15	41	67	93	119	145	171	197	223	249	275	301
16	42	68	94	120	146	172	198	224	250	276	302
17	43	69	95	121	147	173	199	225	251	277	303
18	44	70	96	122	148	174	200	226	252	278	304
19	45	71	97	123	149	175	201	227	253	279	305
20	46	72	98	124	150	176	202	228	254	280	306
21	47	73	99	125	151	177	203	229	255	281	307
22	48	74	100	126	152	178	204	230	256	282	308
23	49	75	101	127	153	179	205	231	257	283	309
24	50	76	102	128	154	180	206	232	258	284	310
25	51	77	103	129	155	181	207	233	259	285	311
26	52	78	104	130	156	182	208	234	260	286	312
Ballot											

Punches 106 and 109:
2 punches for a single race (overvote)

Punches 32 through 37:
Represent one race with no punch selection (undervote)

Punch 221:
Punch in hole not representing a viable choice

Figure 10: Punch-Card Ballot Validation Template

Immediate Feedback

In the 26 Florida counties that used punch-card ballots, approximately 4 percent were undervotes in the presidential race. However, in the 23 optical scan counties where ballots were checked as soon as the voters completed them, the undervote rate for president was less than 1 percent.²⁹ Information technologies are not immune to errors that may go unnoticed by distracted or preoccupied voters, and punch-card ballots can be validated by voters in the voting booths.

QI Recommendation: Establish a point-of-vote feedback mechanism for each voting technology and voting process so that a voter can provide quality assurance on his or her own vote. Examples include:

- **Electronic (DRE):** Provide a separate screen that isolates the voter's selections independently of the ballot selection screen for voter validation. The Tru-Vote Validation and Verification Voting System is the only system I know of that provides this capability.³⁰ Figure 8 shows the Tru-Vote split screen with candidate choices on the left screen and the actual voter selections as they are made on the right screen. The voter is visually alerted to the fact that he/she may have overlooked a specific race and can return to that ballot screen before confirming their vote.
- **Optical scan:** Have the voters scan their ballots or scan the ballots in the voters' presence to validate their choices.
- **Punch card:** Create a vote validation template and make it available in the voting booth. Voters would place their punched ballots on top of the template to validate. Voters can look for completely removed chads and for colors that show through to verify that they have one and only one color showing through for each race and that there is no red (or color representing an invalid hole punch) showing through. This would require assistance for color-blind persons. See Figure 9 as an example of a completed punch ballot and Figure 10 of a color-coded template illustrating how possible errors could be caught by the voter or poll worker.

An alternative is to have a template to place over the ballot after punching the ballot. The template would have open boxes, one for

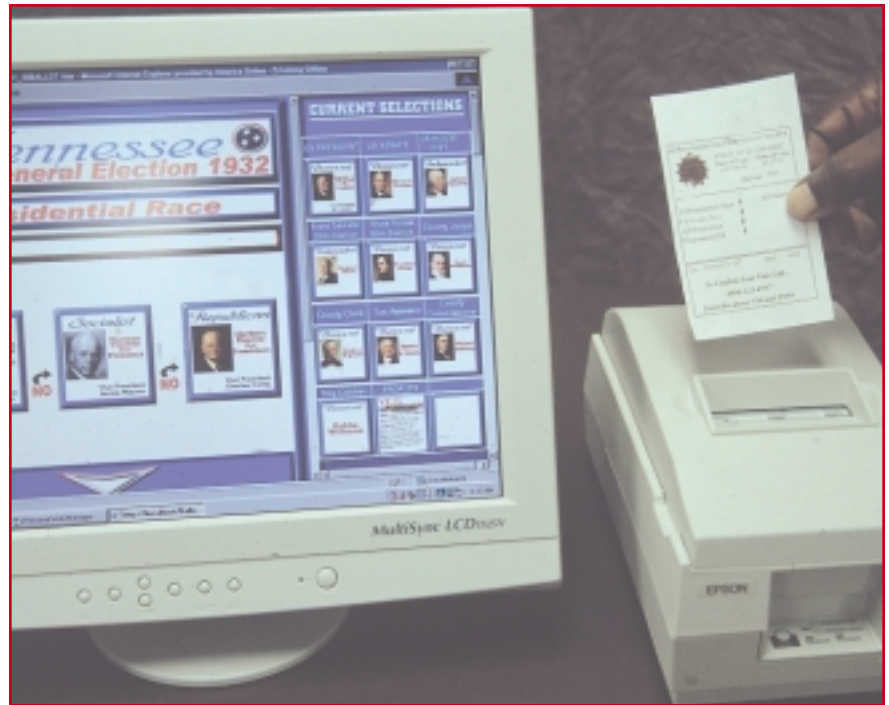


Figure 11: Tru-Vote Receipt

each race. Each box would be a unique opening exposing all punch options for one race only. Light would show through the punched chads into an open box around all the chads. If more than one punch hole shows light within one race box, the voter has created an “overvote.” No hole in which light shines through within one race box represents an “undervote.”

Subsequent Verification

The Report of the Caltech/MIT Voting Technology Project concludes, “Some day each voter will be able to verify that his or her vote was counted without compromising the security of the ballot.”³¹

IQ Lesson 15: Every voter should have the ability to verify that his/her vote has not only been cast at the ballot box, but also that it has been properly recorded in the vote tally. This requirement is the ultimate audit of the election processes.

QI Recommendation: Define a process whereby the voter can verify their vote was recorded as cast. This requires a unique identification of each vote and a secure identification of each voter such that it can query, without alteration, that the vote was recorded in the official vote tally. The Tru-Vote Voting System is the only system I know of with this feature; it creates a printed receipt with a unique vote ID number and a separate printed PIN number that the

voter can use to query an election database to confirm that the vote was included in the vote tally. Figure 11 illustrates the printed receipt. For more information about The Tru-Vote system, visit www.truvote.com. This audit capability assures voters that their votes are recorded. It can also be used to identify potential voting irregularities.

Training Required

The confusion surrounding last year's election identified the need for ballot-designer education, poll-worker education and voter education. Voter “training” is essential because voters perform the voting process only once every two years or so.

IQ Lesson 16: Two of Deming's 14 Points of Quality call for training and education. Point 6, described earlier, states that for people to do a good job, they need to be trained with training that is structured, not haphazard. Point 13, “Institute a vigorous program of education and self-improvement,”³² emphasizes it is not sufficient to know how to perform today's skills. We must continue to learn tomorrow's skills and constantly improve ourselves. While we need to develop stop-gap measures for the faulty election processes and technologies in place today, we must learn tomorrow's technologies and skills in order to reach a goal of zero defects, finally guaranteeing all voters the right to vote

and have that vote recorded accurately as they intended.

QI Recommendation: Provide training to all election staff and poll workers in quality improvement principles and techniques. Learn about state-of-the-art technologies such as Tru-Vote and the process improvements required to assure zero defects in the voting process.

QI Recommendation: Provide training to voters. This training should include understanding of the voting procedures, what to do if problems occur and especially the types of errors that are inherent to the voting methods they will be using and how they can prevent those errors.

QI Recommendation: Maintain a practice voting booth at voter registration and other public places available any time. Encourage school field trips to the practice voting booth for near voting-age students.

QI Recommendation: E-mail sample ballots and voting instructions to registered voters, encouraging feedback if instructions are not clear. E-mails can and should have links to candidates and their positions and referenda descriptions with "official" pros and cons.

Physical Security of Electronic Data

Electronic recording systems are not without potential problems. Besides assuring the integrity of the software, they must provide redundancy of vote recording that allows for recovery from any type of failure, including device failure or sabotage of the voting machine itself.

QI Recommendation: Implement redundant data recording and secure at least one of the vote recording devices that could serve as a backup should the primary device be damaged or destroyed.

Election Reform

- Election reform is demanded.
- Election reform is possible, but not by substituting technology.
- Election reform requires a vigorous program of information quality improvement.

Election reform can attain a goal of zero defects if we resolve to do so. Let us resolve never again to disenfranchise a single voter of his/her sacred right to vote because of defective electoral processes.

Long-Term Goals

1. Replace voting methods that produce defective and ambiguous voting results with voting systems that are designed with quality principles, such as error-proofing techniques and audit verification capability.
2. Implement a system of continuous process improvement to eliminate the causes of defects that are chronic in our electoral processes with the goal that no American citizen shall ever have his or her vote lost because of defective processes.

What do you think? Let me know at Larry.English@infoimpact.com or on the IQ Forum under IQ Resources at www.infoimpact.com.

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