SIX SIGMA, QUALITY, COMPLEX ERROR, I*I TECHNOLOGY, ETC.: EXTRACTS

Appendix I

FEDS MAY UNLEASH SIX SIGMA ON TERRORISM

Management tool could save lives

(Reference: Del Jones, "FEDS MAY UNLEASH SIX SIGMA ON TERRORISM: Management tool could save lives", USA Today, Thursday, October 31, 2002, Page 5B)

At a time when fighting the war on terrorism has become arguably the most important issue facing the USA, authorities are looking into an unlikely weapon to aid their fight: Six Sigma.

Six Sigma is nothing like a laser-guided smart bomb but rather a statistics-heavy regimen of analyzing problems that has saved corporations billions.

Can an arcane management process save lives by helping prevent terrorist attacks? Mikel Harry, often called the father of Six Sigma, says it can, in a major way. He estimates the USA would be safer from terrorist attacks by a factor of hundreds or thousands.

Companies like to brag about improving efficiency, but as a matter of policy, the secretive Central Intelligence Agency (CIA) won't say whether it is investigating Six Sigma as a way to strengthen its terrorism-fighting arsenal. However, Six Sigma experts say they have been called in to consult with various homeland security agencies.

Whether corporate success can be repeated in a federal bureaucracy is an open question. Six Sigma is "powerful stuff" that could work even in the sprawl of the U.S. government, Dell computer CEO Michael Dell says.

Finding more uses

First used by Harry and the late Bill Smith at Motorola in the mid-1980s, Six Sigma symbolizes 3.4 mistakes per million opportunities. The process was originally used to eliminate assembly-line defects but has expanded into almost every corporate operation. It uses a complicated approach to problem solving called DMAIC (define, measure, analyze, improve and control).

Experts say it can be used in thousands of homeland security projects.

Consider the mountain of information that floods into the CIA, such as intercepted phone calls, applications to pilot schools, etc. Suppose an e-mail is intercepted that includes a disguised threat on the Golden Gate Bridge. A quick decision must be made to discard the e-mail or take it seriously. (Comment: Is it a dynamic or static decision situation? Compare this decision situation with that in the healthcare case involving an adult patient with signs of congestive heart failure discussed in the CIIR White paper). Discarding bad (low integrity) information is crucial because useless (information with poor I*I) can paralyze decision makers further up the line.

There may be 50 points where such pass-fail decisions must be made about the usefulness of a piece of information (Comment: Decisions in fact are required to be about the usefulness, usability and integrity of the information. Information envelope models this as a multistage decision process with each decision stage *cognizing* respective environments (open system decisions that go beyond mere pass-fail cases), taking the activity beyond the mere statistical interpretations as applicable under the extended, closed system view of the decisions). In Six Sigma talk, these points are called "decision nodes" (Comment: Is it a decision error in a fixed information decision? Analyze critically.) If each of those 50 nodes passes judgment on 60 pieces of information each day, there are 300 opportunities for a decision error each day as intelligence moves up the chain to Security chief Tom Ridge and President Bush.

If decision nodes average 99.38% accuracy, they are at Four Sigma, which is about the accuracy of service such as prescription writing by doctors and airline baggage handling (Comment: Please note that the concern here is that of noise and not distortion).

If improved to Six Sigma, accuracy is 99.99966%. That means only one of about every 294,000 pieces of vital information would be erroneously discarded. (Comment: How well does this account for the implications of the local knowledge, i.e., environmental factors, which are very much the reality in a complex and changing environments).

Even 99% accuracy falls short

Six Sigma is a set of statistical and management tools that can make leaps in improvement. When something reaches Six Sigma, it has a failure rate of 3.4 per million, or 99.99966% accuracy. However, being just 99.0% accurate can sometimes spell disaster. It means.

- At least 200,000 wrong drug prescriptions each year.
- Two short or long landings at major airports each day.
- 5,000 incorrect surgical procedures every week.
- 20,000 lost articles of mail per hour.
- No electricity for almost seven hours each month.
- 50 dropped newborn babies each day.

Source: American society for Quality

At Six Sigma, there is a 99.9% chance that all 300 decisions are accurate on a given day. There is a 97% chance all decisions in a month will be right. Where there is only a 15% chance that decisions are right on a given day at Four Sigma, there is a 15% chance that all decisions will be right over a five-year period at six Sigma. (Comment: Will this be the case even when the information is experiencing shift due to interdependent, evolving, conflicting environmental factors?).

Such efficiency would be invaluable when lives are risk. "A quantum difference indeed," Harry says. That's how attaining Six Sigma in the war on terrorism could make the USA 1,800 times safer, Harry estimates.

Skepticism remains

Not everyone is optimistic. Even fans like Michael Dell warn it could take years for U.S. intelligence agencies to fully implement Six Sigma but adds, "It's possible".

Six Sigma is lousy at fixing rare and random problems, says Elizabeth Keim, president of the American Society for Quality and a Six Sigma consultant. And terrorism, at first glance, seems to be the very definition of rare and random.

But Keim and others schooled in Six Sigma see events like the Sept. 11 attacks as the catastrophic result of a breakdown in the millions of frequent and mundane preventive steps that must be taken with vastly greater efficiency. (Comment: Even then will it account for shift in information due to the requirement to cognize environment?).

These steps are drudgery: identifying the millions of people entering and leaving the USA, mapping the entrances to water plants or detecting E. coli in farm products.

"The particulars of Six Sigma are not exciting" when used in business or war, says Dan Burnham, CEO of Raytheon, a defense electronics company steeped in Six Sigma and which makes such anti-terrorism technologies as facial recognition. It's the results that are striking, he says.

Deploying Six Sigma against terrorism would be little different that when it was use to determine that most steps in a Japanese patent system's application process were wasteful. The cost of each filing was slashed to $1200 from $48000. Communication satellites are rented out by the second are not always used efficiently. General Electric used Six Sigma to make sure its satellites were being used 97% from 63%, adding $1.3 million a year in revenue. Former CEO Jack Welch, who drove Six Sigma deep into GE's culture before his retirement, counts himself among the cautious optimists that Six Sigma could work against terrorism.

Fighting terrorism isn't much different than marketing, Harry says. Marketing executives, like intelligence experts, must digest mountains of mostly useless data, analyze the fraction that is important and persuade decision makers to get to the right product on the shelf just as consumer tastes are changing. At it's best, marketing influences consumer tastes, which like terrorists, are a moving target.

Some abandon it

Even after hearing of the billions saved at companies like GE, others have abandoned the Six Sigma effort in frustration. Fewer than 15% of the Fortune 1000 are using it in a significant way.

Burnham says it won't work without an "obsessive, compulsive" CEO. Welch says he was a "raving lunatic" about it. (Comment: Reason can be that in the manner of Quality paradigm, once again the assumption in Six Sigma is to attribute the cause of system error to human error and circumvent the need to apply the system's approach to the task of error management). Some GE employees privately say that the most common-sense solutions can no longer be made easily but must pass a rigor of charts and statistics. (Comment: It is worthwhile to study if the statistics of a closed system, which is represented by an open loop, is at variance with the statistics of an open system, which is represented by a closed, (information processing) feedback loop that accounts for the dynamic (time – interdependent, evolving, conflicting) behavior of the system problem).

Companies that don't stick it out for at least five years soon revert and loose all progress. That doesn't bode well for the federal government, where attention spans often don't survive

election cycles. “The federal government makes GE look like an ant on an elephant’s back,” Harry says, and there will be a “a gantlet of pain” to get it implemented.

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There is no better chance than during a time of emergency, experts say.

At least one local government is using it. A Six Sigma project helped get 98% of the potholes in Fort Wayne, Ind., filled within 24 hours. It also will help the city figure out how to get twice as many contaminated people through the showers of a moving van converted for emergency use, Mayor Graham Richard says.

A Six Sigma onslaught against terrorism would produce many byproducts for the government, including cost savings, Keim says. She predicts that it will improve the fight against all crime. Statistics will lead to profiling, but it will profiling based on science, not prejudice, she says.

In his Oct. 17 testimony to the Senate Select Committee on Intelligence (the then – check?) CIA Director George Tenet used some Six Sigma vocabulary in calling the intelligence breakdown relating to Sept. 11 an “error” that exposed weakness in the process. He used the word “customer” for the recipients of intelligence. Six Sigma at corporations is built around customer needs.

“In the counter terrorism business, there is no such thing as 100%” Tenet said. (Comment: Given the reality of complex and changing environment, can there be zero error in any situation?).

Neither is perfection achievable in business. But in the quest for the near perfection of Six Sigma, companies say they have achieved improvements that did not seem possible.

Appendix II

TAKING THE SIX SIGMA APPROACH

(Reference: Del Jones, “TAKING THE SIX SIGMA APPROACH”, USA Today, Thursday, October 31, 2002, Page 5B)

A performance gap in the insurance industry is an example of a problem tailor-made for Six Sigma.

It’s common in insurance that the top agents sell far more policies than the worst. Insurance companies traditionally jump to conclusions when looking for ways to narrow that gap. For instance, they might offer a trip to Hawaii in a monthly contest to motivate less-productive agents to sell more policies. But that incentive tends to just increase the performance of the best agents and make the gap even wider.

Six Sigma uses an approach called DMAIC, which stands for define, measure, analyze, improve and control. A Six Sigma project would recognize the gap as a defect and go through several steps before attempting a solution.

“Having the loudest opinion doesn’t make it right,” says Elizabeth Keim, president of American Society for Quality and a Six Sigma consultant.

The project might first measure agents to learn that the top 25% sell nine times the policies as the bottom 35%. An analysis would consider such steps as mapping how top agents

spend their day, investigating specialists who have had success training the worst agents, or seeing how the hiring process could be changed to avoid hiring under-performers in the first place.

The next step would be test proposed solutions, such as training methods, or to see if psychological profiles truly identify poor performers among new hires. Only those steps that prove statistically fruitful would be introduced on a wide scale. Most companies try to make improvements before measuring what really works. The improvement step comes almost last in DMAIC.

Companies have discovered that Six Sigma is less about accuracy and more about reducing variation. (VVM's comment: To what extent then Six Sigma can satisfy mass-customization or individual decision situation needs, which are hall mark of changing market?). For example, passengers might like airlines to improve on-time performance, but it's more important to them for airlines to eliminate flights that are late 45 minutes or more. (Comment: In actuality, though, a passenger may be more happy if on arrival at the airport s/he has and gets a flight within a fixed time say 45 minutes).

Federal Express would not have a business if package-delivery time averaged 12 hours, but the "variation was all over the lot," says Jack Welch, former CEO of General Electric. Examples of success:

♦The National Science Foundation turned to Raytheon to cut the cost and danger of evacuating sick people from Antarctica. Using Six Sigma, Raytheon came up with ways of pre-screening scientists for possible psychological problems. They benchmarked companies including BP Amoco that station employees in remote places. Evacuations fell 22%.

♦Many hospitals used it to reduce prescription errors. One in Milwaukee used Six Sigma to map the process as prescriptions originated with a doctor's scribble, were filled by the pharmacy and then administered by nurses. Most mistakes came from errors in reading the doctors' handwriting. The hospital implemented a program requiring doctors to type the prescriptions into a computer, slashing errors.

Appendix III

Quality in Higher Education

(View of Academia)

(Reference: Quality in Higher Education, Volume 8, No. 1 April 2002, Carfax, UK Publishing, Taylor & Francis Group, ISSN 1353-8322, www.tandf.co.uk/online.html)
(Reference: Specific paper referred here from above journal: Jethro Newton, *Views from Below: academics coping with quality*", Quality in Higher Education, Volume 8, No. 1 April 2002, Carfax, UK Publishing, Taylor & Francis Group)

THE MEANING OF QUALITY

During the 1990s there was a proliferation in the use of notion of 'quality' in higher education. Quality migrated or was imported from its more familiar industrial and commercial setting of the 1980s into the domain of higher education and also other professional and public service settings. Over time, 'quality' viewed as keyword acquired a range of contingent meanings.

The original repertoire of formal meaning of the early 1990s , is typified by the following 'stakeholder-relative' conceptual framework:

- quality as exceptional or excellence
- quality as perfection or consistency
- quality as fitness of purpose
- quality as value for money
- quality as transformation of the learner

By the mid-1990s, academics felt themselves to be in an environment where, they were required to give regular and formal accounts of themselves, and the quality of work, whether to external or to internal bodies. Accordingly, 'quality' in higher education had, by the mid-1990s, become associated by most in the UK Academic community with 'bureaucracy', 'burden', and 'accountability'.

Following 10 themes thus emerge:

1. Quality as 'ritualism' and 'tokenism': Academics use procedures primarily to satisfy external requirements; quality enhancement becomes a residual feature of quality systems.
2. Quality as 'impression management': Preparations for external assessment are carefully scripted and stage- managed.
3. Quality as a 'burden': Quality is perceived as an 'add-on'; part of an inspectional compliance culture.
4. Quality as 'failure to close the loop': Key service areas are usually excluded from the formal system for managing academic quality. (Comment: This is a very useful view to build on).
5. Quality as 'suspicion of management motives': Quality monitoring, externally or internally driven, viewed as an essential management tool that threatens academic or professional autonomy.
6. Quality as 'discipline and technology': Academics perceive 'better systems' or 'improvements in quality assurance' as distinct from improvement in quality.
7. Quality as 'front-line Staff resistance': Implementation requires 'ownership' but staff responds in different ways with varying degrees of enthusiasm and support.
8. Quality as 'lack of mutual trust': Systems emphasize responsibilities of front-line academics; perceived lack of reciprocated accountability.
9. Quality as a culture of 'getting by': Academics constrained by lack of time; shift from 'resource-led' to 'improvement-led' (can one call this 'repair and service') culture associated by front-line staff with confusing demands.
10. Quality and 'constraints of teamwork': quality emphasizes 'teams'; staff reports situational pressures preventing this.

These themes are presented below in a tabular form. For the purpose of highlighting the contrast, they are set alongside some of the 'prevailing perceptions' and 'meanings' of quality of the early 1990s noted earlier:

Table: Illustrating contrasting meanings of quality

Dominant formal meanings of 'quality' in the early 1990s	Situated perceptions of 'quality' of front-line academics from mid-1990s
Quality as 'perfection' or 'consistency'	Quality as failure to close the loop
Quality as value for 'money'	Quality as 'burden'

Quality as 'total quality'	Quality as 'lack of mutual trust'
Quality as 'commitment'	Quality as 'suspicion of management motives'
Quality as 'culture change'	Quality as a culture of 'getting by'
Quality as 'peer review'	Quality as 'impression management' and 'game planning'.
Quality as 'transforming the learner'	Quality and 'constraints on teamwork'
Quality as 'fitness for purpose'	Quality as 'discipline' and technology
Quality as 'exceptional' or 'excellence'	Quality as 'ritualism' and 'tokenism'
Quality as 'customer satisfaction'	Quality as 'front-line resistance'

Demystifying Quality: lessons learnt from 1990s

1. Quality is an 'essentially contested' issue, and there are voices and discourses. Front-line academics and managers view 'quality' differently. So long as quality managers are wedded to forms of managerialism and accountability they remain hostage to fortune (chance or luck). They seek to influence the process and rituals of external audit and assessment, and to manipulate the values of the game, but in doing so they forfeit the prospect of engaging in innovative or quality-enhancement work.
2. Though many aspire towards the notion of a 'blue print', the lesson is that there is no blueprint model for a quality assurance system to be drawn on by higher education institutions (and other professional and public service settings).
   Note: To explain, when looking closely academics engaging closely with quality systems, it quickly becomes apparent that the constraints of circumstances and context may serve to undermine or subvert an idealistic, blueprint-driven approach to the opertionalisation of any given definition of 'quality' or the implementation of any designed or preferred quality assurance system (bringing in the need for I*I – VVM's comment).
3. What is achievable with 'quality' in higher education (and other services, which understandably emphasize information as product – VVM's comment) should not be seen as a 'blank (?) sheet'. For example, even though the notions of 'quality as consistency' or 'quality as transformation' may be laudable, the forces of context and circumstances impact on such aspirations.
4. Fourth, a particularly important lesson to be drawn centers on the 'implementation gap': the difference between planned outcomes of policy, or preferred definitions, and the outcomes that emerge through the implementation process (VVM's comment: This is the basis of I*I risk that the planner or the designer or the decision maker experiences). In the context of the NewColl research, the gap was between what was designed into and expected of the quality system (the desire to reconcile 'accountability' and 'improvement') and what at ground level, in a particular organizational context, prevented this from being achieved (VVM's comment: this describes a need to recognize all time present requirement for individual information decision as against the collective information decision). Ethnographic (ethnography: the scientific description of different races and cultures, ethnographic: adjective – for example, ethnographic research/studies) method and phenomenological (phenomenology: the branch of philosophy that deals with what you see, hear, feel, etc. in contrast to what may actually be real or true about the world) perspective on policy highlighted the importance of the views and perspectives of

'front– line' academic staff engaged in the implementation policy. They were revealed as 'makers' and 'shapers' in the policy implementation process, not mere passive recipients.

5. The notion of 'context' or 'situatedness', suggests that any given quality assurance definition or system will always be affected by 'situational factors' and by 'context' and that in the process of development and implementation, 'quality policy' becomes changed and subverted. This leads to the view that the success in application of a system or definition may be dependable less on the rigor of application or the neatness or the theoretical compactness of he 'dry', documented quality system per se, important though they may be, and more on its contingent actors, and on how the system is viewed and interpreted by them. (VVM's comment: Who are the actors? They could be those operating in the real world; operations being both physical and more importantly environmental, i.e., informational, which involve information origination, evaluation and processing within and between the functional worlds of the actors so as to reduce the consequences of the environmental uncertainties experienced by the actors. Thus they (actors) could be: objects (hardware), objects (concepts), people (external and internal to the system in which quality is being built), software, communication (includes medium and people), norms, procedure, rules and protocols, policy, financial mechanism, etc.).

   It is suggested that, when associated with (or led by) management objectives (as systems in higher education in the 1990's (and most of the professional services and applications at any time) most certainly appear to be), 'quality' appears as 'accountability' and 'managerialism' and that at the operational level 'quality' can only be properly understood relative to how actors, construe and construct 'quality' or 'the quality system'. This requires that close attention be paid to across 'subjectivites' and how this influences how they 'cope' with, 'shape', or even 'subvert' quality policy.

Appendix IV

Quality in Higher Education

(View of Academia)

Reference: Lee Harvey, "The End of Quality?" in Quality in Higher Education, Vol. 8, No. 1, 2002, Carfax publishing, Taylor and Francis Group, UK

1. Quality in Higher Education, Vol. 8, No. 1, 2002, is a special issue reporting the outcomes of discussions and some of the papers presented at "The End of Quality?" seminar held in Birmingham, UK, in May 2001. The issue is available at the NIPPA Library, New Delhi.
2. View of the delegates suggested following in regard too the theme "if external quality review has had its day".
   a. It has been suggested that external quality monitoring:
      i. Leads to bureaucratization and inflexibility;
      ii. It is incapable of asking the right questions and that 'visits' are amateurish and fail to observe what really goes on in higher education institutions;
      iii. It leads to 'game playing' and 'performance';
      iv. It has no real impact especially on student learning (i.e., lack of effectiveness);

v. It leads to short-term response, not permanent cultural changes;
vi. It has superficial impact on standards;
vii. It is obsessed with accountability but encourage internal quality improvement (VVM's comment-it could be called "integrity improvement") and external 'useful' information (VVVm's comment-This is the issue of Information Integrity (I*I) improvement).
    1. The above are scene-setting bullet points, which describe the delegates suggestions/views/conclusion/observations.

b. External Quality Monitoring (EQM)
EQM includes accreditation (of institutions and programs), institutional quality audit or assessment, program assessment or review, external evaluation and comparison of standards, research reviews and assessment undertaken by bodies external to the institution, including government ministries, specially created agencies and professional bodies.

c. Internal-External
For many people, working in higher education, external monitoring also includes 'internal-external' namely any assessment, review or evaluation of departmental or discipline activities by others from outside the department or discipline area, which might include such things as internal audit of procedures, monitoring of programs, pass rates, and teaching evaluation done externally or at faculty level.

d. Bureaucracy
It was felt that any form of external quality monitoring would involve some level of external quality monitoring would involve some level of 'bureaucracy'. Bureaucracy refers to both the organization of the external monitoring processes and the process by which such monitoring takes place. The key issue is not so much the existence of a bureaucracy or of bureaucratic processes but the nature of the bureaucracy and its processes. (VVM's comment – The problem arises as customer requirements are becoming local and instant. For emerging individual decision situations, this in fact calls for new bureaucracy and its processes in the form of integrity of information origination, evaluation and processing).

e. Quality Bureaucracy
The seminar suggested the Quality Monitoring Bureaucracies have three main roles: Integrity, Catalyst, Conduit. (VVM's comment: What in fact is needed are Integrity Monitoring Bureaucracies ensuring Integrity, i.e., Accuracy, Consistency, Reliability of Bureaucracies and of useful and usable individual information decision there from).

f. Move on Integrity
First, to ensure integrity in higher education, including integrity at international level, through something akin to an international procedure. In many senses, the context and stage of development of higher education within any system is a key variable. The presumption by governments and (their) agencies that integrity is maintained or assured by quality assessment or audit processes was not wholeheartedly endorsed. Many delegates were skeptical of controlling, accountability-oriented interventions by external agencies.

Appendix V

Towards designing I*I Technology -I
Planning Integrity for System Effectiveness and Economy

Cost due to lack of Planning Integrity	Benefit from ensuring Planning Integrity
Sunday Morning December 26, 2004 Indonesia	**Monday Night March 28, 2005 Indonesia**
(Ref.: "3-hour buffer, but ignorance took its toll, The TOI Pune, Monday December 27, 2004) **3-hour buffer,** **but ignorance took its toll** **New Delhi:** The tsunamis, which struck the northern tip of Sumatra island in Indonesia on Sunday morning, took about three hours to crash into the Indian coast. People could have been alerted and possibly evacuated in these crucial three hours. But it didn't happen. Why? The lack of knowledge (information) on tsunami is to be blamed, says the government. "This is the first time tsunami waves have hit the Indian coast. It is a new phenomenon for us," said Union home secretary Dhirendra Singh. Dr. R.S. Dattatrayam of Met added: "We had indications early enough. But we were not prepared to gauge it. We don't have warning facilities for tsunami." (TNN) (Comment: Why was information not originated?)	(Ref.: "Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly experiencing the uncertainty, origination of correct problem knowledge, correct problem information)", Editorial in Sakal, Marathi language vernacular news paper form Pune, Thursday, March 31, 2005) **Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly experiencing the uncertainty, origination of correct problem knowledge, correct problem information)** Last year on December 26, 2005, there was an unprecedented calamity in the world caused by the tsunami waves in the Indian Ocean. After that tsunami earthquake, mother earth has been undergoing lot many disturbances. Given the present state of the known information about the reactions, processes and disturbances in the body of the mother earth, experts forecast that time period between two high consequence earthquakes can be anywhere from 3 months to 20-50 years. Following the earthquake of December 26, 2004, in the night of Monday March 28, 2005, Indonesia experienced another tsunami earthquake.
(Ref.: "3-hour buffer, but ignorance took its toll, The TOI Pune, Monday December 27, 2004)	(Ref.: "Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly

Tsunami caught the govt. napping

New Delhi: Though the tsunami that hit Sumatra island took three hours to crash into the Indian coast, no measures to save life and property could be taken. The lack of knowledge (information) on tsunami is to be blamed, says the government.

"This is the first time tsunami waves have hit the Indian coast. It is a new phenomenon for us… You can't predict them," said Union home secretary Dhirendra Singh.

Dr. R. S. Dattatrayam, director (seismology) at India Meteorological Department, added: "We had indications pretty early in the morning, almost soon after it (the tsunami wave) originated (in Indonesia). But we were not prepared to gauge it. We don't have warning facilities for tsunami. We knew something would be hitting us, but couldn't tell the time, the location and the intensity."

The ISRO blamed the lack of wherewithal. It said its remote sensing satellites are not equipped to track killer waves.

As it happened, the Indian Remote Sensing Satellite was not imaging the coastline when the quake off Sumatra triggered the huge tidal waves. (TNN)

experiencing the uncertainty, origination of correct problem knowledge, correct problem information)", Editorial in Sakal, Marathi language vernacular news paper form Pune, Thursday, March 31, 2005)

Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly experiencing the uncertainty, origination of correct problem knowledge, correct problem information)

Earthquake in Indonesia in the night of Monday 28, 2005 caused the death of 1000 people. Heavy and un repairable loss it was, but the reality that the second tsunami earthquake was constrained with no further damage by it – this time India and other countries were saved from any consequences – was a soothing realization.

On Monday night Indonesia experienced the earthquake and neighboring countries in the Indian Ocean, namely, Thailand, Malaysia, Sri Lanka, India, etc. underwent fear psychosis. Just three months back these countries had come to know by first hand way as to how destructive in loss of human life and damage to the property and environment the tsunami earthquake can be. Few days before, there were small earthquake signals in the zone covering the Indian towns from Koyana (town of a major dam), Nasik to Jalgaon in the western state of Maharashtra in India. Monday March 28, 2005 earthquake in Indonesia was 8.7 Richter on scale. It was followed by the second earthquake in Sumatra, which was over 5 Richter on scale. The earthquake in December 2004 was 9 Richter on scale. Earthquake intensity in India, Sri Lanka etc. was less intense,

	but the consequence fear severity was higher and it had its origination in the previous experience.
(Ref.: Vijay Naik, "*Will we learn from the tsunami onslaught?*", Delhi Newsletter, Sakal – Marathi vernacular newspaper from Pune, January 3, 2005) **New Delhi, January 3, 2005**: Tsunami waves of December 26, 2004 created havoc in Indonesia, Thailand, Sri Lanka, Maldives, Bangladesh and India. Waves in the Indian Ocean forced Sumatra island to slide from its bottom 100 ft. in the South – West direction. Indian states of Tamilnadu, Pondichery, Andhra Pradesh and Kerala suffered very badly. Coasts of Orisa and West Bengal also experienced the earthquake shocks. Indian mainland lost contact with Andaman and Nicobar islands for 24 hours. As of the day of the news paper reporting, loss of human life ran in lakhs; the final figure over the weeks and the month to come being 2.75 lakhs (Ref. For the figure number 2.75 lakhs: Editorial, Sakal News Paper, Pune, Thursday, March 31, 2005). In winter countries from South East Asia and Southern Asia experience tourists rush. To escape from the extreme winter, lakhs of tourists from the Western nations tour Maldives, India, Thailand, Singapore, Malaysia, Bali islands in Indonesia, etc. Thousands of these tourists and the people from these countries and their properties have been lost into the sea due to the tsunami waves. In India the property loss is estimated to be 200 crores USD. In South Asia, Sri Lanka has had maximum human deaths (over 12,000) and many countries find themselves under the direct danger of	(Ref.: "Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly experiencing the uncertainty, origination of correct problem knowledge, correct problem information)", Editorial in Sakal, Marathi language vernacular news paper form Pune, Thursday, March 31, 2005) **Calamity averted due to Alertness (correctly recognizing the environmental anomaly, correctly experiencing the uncertainty, origination of correct problem knowledge, correct problem information)** 18 nations, who had suffered from the unprecedented consequences of the tsunami waves of December 2004, had by now learnt their lessons. ♦As soon as Indonesia experienced earthquake shocks in the night of Monday March 28, 2005, India gave "highest alert" warning signal to its coastal states. ♦From 4-5 villages, properly identified, entire population was relocated at safe places and this was achieved on war footings. ♦All the three arms of the Armed Forces were put on highest alert. ♦Fishermen were stopped form going into the seas. ♦At all relevant places precautionary and safety measures and procedures were implanted. ♦At the governmental level, the Center and the States established excellent co-ordination. ♦People were removed from locations, which in December 2004 had become

the fertility of their lands getting adversely affected by the spread of salty tsunami waters, spread of diseases, devastation of towns and villages, and requirement of hundreds of croers of dollars for reconstruction of damaged houses, schools, roads, railways, bridges, etc.

On December 26, 2004, Sumatra experienced the earthquake at 06:00 Hrs. in the morning. It is learned that Tsunami International Consortium gave the news of earthquake at 06:15 Hrs. However, after that the Indian Weather Bureau took total 90 minutes to give the information to the govt. The message sent to the govt. at 07:45 Hrs. had "no urgency" noting. By that time at 07:00 Hrs. in the morning of Sunday December 26, 2004 the earthquake signals and tsunami waves had reached Nicobar islands. Tsunami International Consortium has 26 counties as its members. If there is a possibility of earthquake or tsunami waves in the pacific Ocean, this Consortium originates this information and informs its member countries. On December 26, 2004, within 15 minutes of the earthquake, these 26 nations got the information. But as per the news item on Tuesday, which attributes the news to Dr. Satish Shete, Director, Indian Institute of Oceanography, Punjim, Goa, the above information about the impending danger from the earthquake and the tsunami waves had not reached the Institute till 10:00 Hrs in the morning. Islands of Chile, Japan and Hawaii experience tsunami effect frequently and therefore they are constant practice of how to face them keeping the damage at the minimum. No such measures are undertaken in the coastal states of India and no need is experienced. In spite of the scenes of death.

- Information also came from the American Pacific Tsunami Warning Center that the center of the earthquake was 203 km. from Sibolga on Sumatra island.
- It was also advised that all the people in 1000 km. radius be moved to safe places.
- In pursuit of a total protection from a possible repeat of an unprecedented destruction of life, environment, and property different nations maintained a well-balanced coordination, which proved very effective and beneficial.

First Time in India: Countries such as America, Japan are well developed. The type of ultramodern information and connectivity infrastructure they have is not there with the developing, underdeveloped and poor countries. By the way of tsunami earthquake consequences in Indian Ocean, the world has witnessed the colossal losses caused by the absence of information. This time, however, the coordinated effort that was made to save the destruction of humans, environment and property was greatly successful and beneficial to the concerned nations. Nation like India, which has an enormous coastline, was saved from the second possible calamity. Nation like Sri Lanka, which is spread into the sea, was also saved. Indonesia had irreparable loss of life but it could be said that the overall human loss was much less in comparison to what happened in December 2004. It is not a small thing that only Niyas and Simulu provinces in Indonesia had property losses. What is very significant is that these second time tsunami earthquake shocks in Indonesia occurred at nighttime. Even then the concerned nations could successfully

unprecedented tsunami calamity, Dr. Dattatrayam, Director, Indian Meteorological Dept., says that this is a subject of science. Till it (functional danger from tsunami in Indian Ocean) has not been scientifically (read observably) proved, no fear (about the impending losses) can be created among the general public. He further goes on to say, "On June 26, 1941, Andaman experienced earthquake on 8.1 Richter scale. But there were no tsunami waves". On the contrary, Expert Ted Murthy, Manitoba University, Winnipeg, USA, opines that that in keeping with rising coastal area population in India tsunami warning system should have been installed long back. Cities like Mumbai, Delhi are known to fall under earthquake prone zone. However there are no signs of installation of earthquake warning systems or of citizens' safety procedures or of training. Los Angeles, USA also comes under earthquake prone zone. As a result a lot of building retrofitting projects are implemented in America as in Japan. But there are no such projects in India. "Lack of money" is the reason, which is frequently forwarded.	carry out the preventive life, environment and property saving steps. (In the today's world where often it is the calamity, which makes the news, it is not surprising that the second tsunami went almost unnoticed from the general public attention. This first time success in such a major situation is very satisfying for countries like India). As mentioned earlier, the current scientific information only allows to predict that the second tsunami earthquake can occur anytime within 3 months to 20-50 years from the time of occurrence of the first one. Methods for more accurate prediction of the time of earthquake occurrence are yet to be developed. Mankind, which is successful in tracking stars millions of light years away from the earth, is still groping in dark as to what all goes on below the ocean bottoms and below the soil on which the mountains stand and the humans walk. (In a way it is a limit – boundary - to the information based on which the mankind has to make a decision about the nature of the impending danger. (The immediate, direct consequence is the Information Integrity Risk that the scientists and technologists, planners and the general public at large experience.) (To reduce (manage) the I*I risk, solution is to originate, evaluate and process additional information with integrity so as to improve integrity of the information on which the decision is to be based. This calls for study of hitherto un-researched information integrity processes. That the alertness avoided the impending consequences of the currently encountered danger (by the way of the second tsunami of March 28, 2005) is indeed a welcome event. But the development of I*I Technologies will help anticipate and

	manage consequences of the environmental anomalies in the form of complex errors that may come tomorrow. The end result of I*I Technology will be the recommendations and the best practices that will avert the complex errors and their consequences).

Appendix VI

Towards designing I*I Technology-II
Benefit from ensuring integrity environmental topology
for
Planning integrity for System Effectiveness and Economy

(Reference: Deshpande, A.G., "Earthquake alertness is must", Editorial article, Sakal vernacular Marathi newspaper, Pune, Tuesday, April 19, 2005)

Integrity environmental topology illustrated

(**Note:** Real world systems are loosely connected. Loosely connected systems are open systems. Whatever else it (an open system) does, it necessarily imports and exports information with the environment. Environment is conducive to information errors. Said differently, it is by managing information errors that the open system (which is an information system) copes with the environment, which is complex and ever changing. This information flow occurs when the *IS* view of the open system cognizes the environment. Specifically, cognition is related to the situation in the real world. This relationship necessitates the consideration of situational factors impacting cognition. This is how information and environment co-evolve. *It is generally recognized that it is these situational factors that reduce acuity of cognition, i.e., integrity of information flow in that environment*.

There is another aspect of situation-oriented approach to environment. It is referred to as *situation awareness*, that is, being aware of all that is occurring in the situation and what might be causing it. *Situation awareness is found by those operating at the sharp end of operations (e.g., air craft pilots) to reduce the likelihood of errors in sharp end task at hand*.

Finally, knowing that the environment can be conducive to information error, the proposition is that by developing a list of critical events in information origination, evaluation and processing, a systematized situational event management can be carried out to reduce the likelihood of error. *At this stage of research, a view can be that this event management is in fact the situational information acquisition and utilization and events are the multistage dynamic decisions under the open system's IS view*.

Within this framework, given the design context and domain, the perception of situation awareness can be a precursor to the design of environmental or requirements or information topology. It can When operated upon by the consequences of situational factors, this topology can lead to IBMS for the information origination and acquisition cycle for individual decision

situation. Further, it may be mentioned that the descriptors of the environmental factors *here* (i.e., in the illustration covered under this Appendix) in situations include the standards and/or guide words. While developing this thought further a researcher may appropriately strengthen and/or modify this perception of the environmental topology.)

Integrity environmental topology illustrated with particular reference to Earthquake consequences:

(a) Scientific view of the environmental topology for earthquake and its consequences,

(b) Technological view of the environmental topology for earthquake and its consequences,

(c) Safety, education and instructional view of the environmental topology for earthquake and its consequences: At the time of the earthquake, due to the lack of information people get confused. They become helpless and start mindless, ad hoc actions, which in the end invite unnecessary dangers. Misunderstandings and rumors create confusion. It is important to increase the society's knowledge by creating awareness about earthquakes and their consequences and by giving people relevant information and instructions about best safety practices. That will remove fear of earthquake and improve I*I (behaviorally – confidence and courage) to face earthquake. If people opt for earthquake resistant structures and be alert all the time, then even in earthquake prone zone they will live life without fear (I*I Risk will be minimum. In case of a calamity, there will be a feasible chance for recovery at an affordable cost).

For spreading awareness about earthquake, imaginative use should be made of instruments such as: computer, IT, newspapers, radio, TV, etc. Documented information and equipments should be made available to the people at large in simple, attractive and usable formats. Further, in normal condition, during earthquake and after earthquake, all should take following care.

a. ***In normal condition***: Regular inspection, care and maintenance of the building, its structure; Not to hang or store a heavy load at a height; Regular maintenance of electrical short circuits and gas leakages; Easy availability and accessibility of the ready-for-use-first-aid-kit;
b. ***When earthquake is in progress***: Without any confusion and noise, wear helmet and quickly come out of the house or go under the table or cot in the house; Do not stand in the door frame; Do not stand near a wall; Do not light a matchstick or lamp or gas; If outside the house, stand in an open space away from the electric wires and transmission lines; If in a vehicle, stop it immediately;
c. ***After the earthquake***: Do not start gas, electricity, water immediately after the earthquake is over; Do not enter the building, structure, house without first completing proper inspection, If proper inspection not done, do not stay in it; Do not fear earthquake shocks that may follow;
d. ***Instructional aspects***: Topics covering earthquake related science, technology, security, tsunami, volcano, etc. should be made part of the school and college curricula; Those in construction sector should be trained in safe construction methods for protection from earthquakes;
e. ***Educational and research aspects***: ISO should demand that structural design and building construction must be earthquake resistant; Computers have made earthquake analysis of structures feasible, Accordingly about it (i.e., the earthquake analysis of structures) there should be research, education and dissemination of knowledge; It is

feared that dated (i.e., earlier or old) buildings may not be earthquake resistant, All such structures should be inspected and made earthquake resistant, There should be studies and actions for the purpose;

Summary: If there is information with integrity that the existing and yet to come structures, constructions, projects are earthquake resistant, then I*I risk will be minimized and there will be far less fear of earthquake.

Appendix VII

(Reference: R.S. Chalapathi, "Developing Six Sigma competencies – Delivering World-class products and services", Excel Books, New Delhi, 2003)

1. **Six Sigma definition**:
    a. Six Sigma concept began as a statistical measurement indicating ≤ 3.4 defects per million opportunities (DPMO) (Mid 1980s).
    b. Hill (1999) of Allied Signal, defines six sigma as follows: "It is a customer focused, continuous improvement strategy and discipline that minimizes defects per million opportunities in our product design, production and administrative processes."
    c. Harry (2000) gives following six sigma definition: "Six sigma is a long-term forward thinking initiative designed to fundamentally change the way corporations do business, it is first and foremost designed to generate immediate improvements in profit margins."
    d. Harry (2000b) suggests that, all defects or errors represent risk but not all forms of risk can be characterized in terms of defects. He further says that six sigma is about the abatement of risk inn everything a business does or delivers. Thus Harry is suggesting that elimination of defects or errors is not the ultimate aim of six sigma, proactively reducing the business risk is the real goal of six sigma.
    e. Further, achieving the six sigma performance (3.4 DPMO) once is NOT going to last for ever, as changes in the customer requirements will change the sigma level back to three sigma overnight. Today, customer requirements, competition, technology are changing dynamically and even we may not have sufficient time to achieve six sigma performance lels.
    f. Another, important aspect of six sigma is, one may not try to achieve six sigma performance in each and every process, it may not be require or may not be economical. In the so-called six sigma companies also, six sigma performance is achieved in a couple of processes.
2. **Six Sigma History in brief**:
    a. Motorola, Inc., USA is one of the world's leading manufacturer of electronic equipment, systems and components for both the domestic and international markets. Motorola initiated six sigma in 1981 by establishing as one of its 10 top corporate goals *the improvement of quality by ten times by 1986*.
    b. In the process of working towards this goal Motorola found new ways to run the business at significantly improved quality levels. Specifically, it was recognized that to become best in the class, one must reduce variation in everything including administrative activities, such as typing, filing, etc. The key is to focus on the root

causes for the variation, identify, isolate, control and ultimately eliminate variation in the process.

(Comment: However, with the rise of data driven technologies keyed to the flow of information across the enterprise wide supply chain and the Net, the issue is that of "shift" in decisions due to the impact of internal and external environmental factors, which are interdependent, evolving and conflicting. Due to the shift, for competitive advantage, business decisions have a need to cognize the environment. Needless to say, these decisions are the outcomes of dynamic decision-making processes and are characterized by complex error mechanisms that occur, the cause and form of error not withstanding. Critically analyze if six sigma accounts for the consequences of this "shift" phenomenon?)

c. As Motorola is a highly decentralized company with many different businesses, this created the most-difficult problem-How to track the five-year program of ten times improvement in diversified units?

   To take care of this difficulty, during the second half of 1985, the communications sector established a single metric quality-total defects per unit (DPU). This dramatically changed the ease with which management could measure and compare the quality improvement rates of all divisions. For the first time, it was easy for the general manager of one division to gauge his performance relative to the other divisions. They all spoke the same language. (Comment: The common language was in the form of information I_1, which described DPU).

d. Definitions:
   i. Defect: In Motorola parlance a defect was anything, which caused customer dissatisfaction, whether specified or implied. A unit may be a product, process, a page in a manual, a transaction, a line of a software, an hour of equipment operation, etc.

      Motorola Inc. developed a scheme to convert the defects per unit (DPU) to the 'sigma' scale.

      Note: In statistics, sigma = $\sigma = \sqrt{}$ of (Sum of $[x\text{-mean}]^2/ N$)

   ii. In Motorola terminology, 'sigma' is a measure of process capability.
   iii. Motorola developed the sigma quality concept. The lower the DPU, the higher is the sigma value and vice versa.
   iv. Based on the sigma quality metric, Motorola studied the quality levels of several companies and the benchmarking data resulted in the following conclusions:
      1. Best in class companies exhibited 6 sigma quality performance.
      2. Average companies exhibited 3-4 sigma quality performance.
      3. Motorola was operating at about 3.5 sigma quality performance.

   This helped Motorola to set its corporate quality goal.

e. Six Sigma at GE:

i. Even though six sigma originated at Motorola, General Electric (GE) has mastered the six sigma deployment with great success and is today considered a benchmark for the six sigma implementation.
ii. GE launched a corporate wide quality improvement strategy in 1995. Jack Welch, Chairman and CEO stated that each GE operation, from credit card service to aircraft engine plant to NBC-TV, would work towards achieving six sigma by the year 2000. GE averaged about 3.5-sigma level at the time of launch of the six sigma initiative.

3. **Quality and Customer Satisfaction**:
   a. Traditional definition of Quality: Inn most companies 'quality' means how well a product or service meets its specifications. In other words quality is defined as *conformance to standards*.
      i. Product quality attributes: Conformance, Performance, Features, Reliability, Durability, Serviceability, Aesthetics, Perception, etc.
      ii. Service quality attributes: Tangibles, Reliability, Responsiveness, Competence, Courtesy, Credibility, Security, Access, Communication, Understanding the customer, etc.

   Traditionally quality programs have focused on above quality attributes to various degrees. However, improving product or service quality on all the above attributes does not lead to improvement in key financial performance measures at the business level. This limitation of the traditional definition of quality is why the following new definition of quality.

   b. Quality redefined: Quality is a state in which value entitlement is realized for the customer and provider in every aspect of the business relationship (Mikel Harry (Jan'200a).

   The key word here is 'value entitlement'. True entitlement is realized when the customer gets the highest possible product or service utility at the lowest price on time, and the provider brings forth these products and services in a manner that minimizes cost and cycle times and maximizes profit. Only when this happens does the term 'quality' catty meaning in business relationship.

   Said in general terms, eliminating defects in products or services will eliminate customer dissatisfaction. However, you have to provide more features to gain customer satisfaction.

   Comment: "Six sigma has been developed for manufacturing sector; mainly for standard product in high volume seeking business models." Discuss. Further, critically analyze if it has an analytical approach to answer the question of optimum quality value for ensuring 'value entitlement'. In other words, how much quality is optimum (sufficient)?

4. **Six sigma performance**:
   a. Study following concepts under six sigma terminology:
      i. Critical to quality characteristics (CTQ's) of product/service,

ii. Critical to process characteristics (CTP's) in the process that control critical to quality characteristics,

Note: In real world CTP's exhibit variation due to day-to-day changes in the process - materials, methods, machines, men, measurement and environment. This variation is reflected in CTQ's and subsequently in critical to satisfaction characteristics (CTS's). Study critically if these variations account for implications of "shifts".

iii. Critical to satisfaction (CTS's), which are the key characteristics of customer satisfaction,

iv. Process capability,

v. Process drifting (Note: Under the six sigma concept, the process is considered to be dynamic, implying that over the time the process will move both higher and lower because of many changes in material, operators, environmental factors, etc.)

Comment: Critically study if this concept takes care of the implications of the "shift" phenomenon due to interdependent, evolving and conflicting environmental factors..

5. Quality management philosophies:

a. Deming's philosophy: quality improvement through involvement
b. Six sigma program is a management process.

Comment: Develop the point that I*I control is a technological process.

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