Implications of Convergence Technology for Information System Design- Requirement to go Beyond Quality paradigm

Vijay V. Mandke
Research Leader,
Center for Information Integrity Research,
Delhi Center: B-64, Gulmohar Park, New Delhi – 110 049,
Pune Center: Flat A-2, Nikash Skies, Someshwar Wadi, Pashan, Pune-4110 08
Visit us at: centerforinformationintegrityresearch.org

Information Integrity/Integrity Information System/Management Information System
Course Lecture # 14
2006-2007

INFORMATION SYSTEM DESIGN FOR INTERNETWORKED BUSINESS

Example 1 of The Digitally Supported Movement of Things"-Federal Express (FedEx) as The Logistics Link between Customers and Merchants

- Ref.: Don Tapscott, The Digital economy, New Paradigm Learning Corporation, McGraw-Hill, Inc., USA.
- If organized chaos has a home, it is at the Federal express SuperHub in Memphis, Tennessee. There, in a frantic four-hour period that begins just before midnight, more than 100 airplanes wing in bearing 1.2 million packages for approximately 7000 employees to sort on 200 miles of conveyor belts.
  - On the night in 1973 that FedEx was launched , the firm carried 19 items. Today (year 2000), its more than 108,000 employees and 35,000 trucks mean that FedEx has captured half of the overnight delivery market.
- "Federal Express is a series of networks, and it takes about 17 hours for a package to move from shipper to receiver" says Dennis Jones, CIO, FedEx. "During that seventeen hours we must do everything possible to keep this shipment from going astray as it moves from shipper to station, to airport, to one of the sorting hubs, and on to the destination customer. We must have a flawless set of events happen for seventeen hours and we must track and measure every critical point along the way."
  - This is the statement of integrity information system as required by the indicated business process.

- To understand the role of technology and the engineering of an enterprise around quality goals, it's worthwhile to review what happens to a parcel you send with FedEx.
  - Every time that parcel changes status, information is recorded through sensors and entered into the COSMOS (customer, operations, management, and services) database. The database contains all the basic customer information-name, account number, address, package pickup location data- and it communicates with a number of other systems and devices to maintain a complete record of each shipment that FedEx handles, from the beginning to the end of the process.
  - When a customer calls in to have a package picked up, that call is taken by a customer service agent at one of the forty-two (42) call-centers worldwide.
  - The package pickup request is transmitted to the COSMOS system, and
  - relayed to the dispatch center in the city closest to the shipper.
  - Seconds later this pickup request is transmitted to a small computer (called DADS, or digitally assisted dispatch system) located aboard a FedEx van.
  - The courier then drives to the customer's location and picks up the package.

- It is at this point that service quality measurement begins.
- The courier uses the Supertracker – a small, portable, battery-operated, menu-driven computer having bar code scanner-to scan the smart bar code on the package.
- As well, the courier keys in certain information such as the destination ZIP code.
- The Supertracker device is very smart. It knows its own ZIP code, which route it is on, who the courier is, and the time and date.
- When the courier leaves the customer and returns to the van, the courier places the Supertracker into a port located on the DADS computer.
- The package information is automatically transmitted back to the dispatch center and to the COSMOS database, making the data available to all customer-service personnel worldwide.
- At that point, less than five minutes after the package is picked up, FedEx has all the information required for the shipper and consignee about when the package was picked up, who picked it up, the location, the type of service, where the package is going, and the intended routing.

- As the package moves through the system and is scanned, this information is continually updated. Before the night is over FedEx will have scanned 2.4 million shipments, up to nine times each, as they move through the network.
- All during this period FedEx is running comparison reports in all systems to determine if any shipments has gone astray.
  - The idea is to be proactive-to spot and correct a problem before there is a failure from the customer's perspective.
- After the package arrives at the destination city, it is scanned and sorted. When it is placed on a courier's van for delivery that morning, another scan is carried out so that the system knows which truck and driver has the package.
- Finally, when the van arrives at the customer's destination a scan for proof of delivery is conducted by keying in the name of the person who signed for the package.
- The courier then returns to the van and places Supertracker in the DADS computer, and the final proof of delivery information is transmitted back to the main database in less than four minutes.

- The result is that FedEx has complete package of information. “What is more important, is if that package was delivered five minutes late, if there was an exception, if it had been damaged or misrouted, we have been able to capture all that information on real time basis,” says CIO Dennis Jones.
- By the middle of the afternoon , FedEx will know how many packages in the cycle have been misdelivered, delivered late, damaged, or lost.
- The next morning the individual courier receives a quality feedback report giving details of all transactions that were not 100% correct. Other teams work to understand exactly why an error was made and follow up if if there is a dissatisfied customer.

- The FedEx approach combines continuous learning and action. Information technology is no different from marketing. It is continuous and needs always to be taken into account. “It requires more expertise by people at lower level to understand information technology. They need to know where the information is and where it is coming from. When technology is so integral, one has got to know more than just what’s coming across your desk” says Cynthia Spangler, vice president of corporate headquarters systems.

- What this technology integration at FedEx has achieved is business process transformation though three levels leading to integrated enterprise. These three levels are:
  - Level 1: The Effective Individual
    - An individual does more in less time,
  - Level 2: The High-Performance Team
    - Change in focus from the individual who was accountable to the manager, to teams that function as service units of servers and clients,
  - Level 3: The Integrated Enterprise
    - An enterprise infostructure that enables the enterprise to function as a cohesive organization by providing corporate-wide information for decision-making and new competitive enterprise applicationsn that trascend autonomos business units or teams.

  (Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA
- Focused employee training has been going on at FedEx for more than 10 years, but in 1995 FedEx launched a new interactive training system using multimedia workstations made by Silicon Graphics, Inc. These screens combine TV- quality video with text, graphics, and voice to teach basic interaction skills such as customer-contact methods and features of service categories for its 35,000 couriers and customer-service agents. Objective is to further transform the business to make it into the extended enterprise by taking the company's information systems and put the power into the hands of its clients.

- For, example, the FedEx PowerShip network consists of shipping systems for shippers with with up to 50,000 packages a day or as few as one package per year. It automates shipping by printing the mailing labels, does the cost calculations to the the client's customers, and provides tracking and shipping. "The strategy is to bring internal and external customers more useful information to make timely decisions," says Spangler.
- PowerShip is the FedEx's trademark for the family of networked products that it supplies to customers so that a client's PC is integrated with FedEx's client/server application. Three avenues are possible:
  - 1. FedEx supplies a PC and software,
  - 2. FedEx integrates the customer's system with the FedEx system,
  - 3. FedEx supplies desktop software that can run on any PC equipped with a modem and laser printer.

- "We have adopted open systems [because they] give us the greatest flexibility. We, not our customers, know what our future needs will be," Spangler says. (Note: What has been done here is to extend the system boundary and it is leading to improvement in integrity of the information system design).

- The result is revolutionary: FedEx's customers are becoming part of the extended enterprise. And IT is the focal point. "We are no longer the critical path," Spangler says, "*we are now the path*."
- For customers, what it means is that they have a self-service customer service agent at their own site. Or, put it another way, this is the consumer as producer, a theme that will be occurring more and more in the new economy as the gap between the two continues to blur.
  - Customers can request a pickup over the network, generate their own shipping label, arrange their billing through the same system using no invoice, track or trace shipments by directly linking with FedEx, and create a manifest of shipments at the end of the day. Many customers even have a "hot key" that allows them to track packages that may have been ordered by *their customers* through FedEx.
- This, then, is the 4th level business transformation into the extended enterprise.

- The next step beyond the extended enterprise business model would be for FedEx customers with PowerShip system to have the C&C catalog electronically embedded in their PowerShip software application, C&C catalog being the document of customers of Calyx & Corolla (Company Calyx & Corolla, the San Francisco firm sells fresh-cut flowers. It works with a dozen flower growers and sells their fresh-cut products directly to the end-users (the customer) using FedEx as shipper. As a result, the flowers stay fresher longer in the hands of the customer who buys them). In that way, their PCs would become more and more of an information appliance, and FedEx would increasingly be a creator in the digital economy beyond the extended enterprise. What it will thus undergo is a business transformation at the 5th level into an internetworked enterprise.
- Thus, with technology integration business process transformation is achievable at five levels leading to an internetworked enterprise These five levels are:
  - Level 1: The Effective Individual,
  - Level 2: The High-Performance Team,
  - Level 3: The Integrated Enterprise,
  - Level 4: The Extended Enterprise,
    - There is a shift from “value-added” enterprise to an enterprise that is a “value network”.
  - Level 5: The Internetworked Enterprise is this:
    - Effective individuals, working on high-performance team structures; becoming integrated organizational networks of clients and server; which reach out to customers, suppliers, affinity groups, and even competitors; which move onto the public Net, changing the way products and services are created, marketed, and distributed. In economic terms it means new models of wealth creation. In social terms, it means new systems for sustaining social development and improving quality of life.

(Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA)

ENABLING TECHNOLOGY	THE PROMISE	THE CHANGE
The Net	The Internetworked Business	Wealth Creation, Social Development
Interenterprise Computing: Shift from linear value chain (information flow physical) emphasizing "value addition" to value network (information flow digital) emphasizing value generated	The Extended Enterprise	Recasting External Relationships
Enterprise Infostructure: New architecture is based on the principles defined by business people, not technologists. Information available instantly electronically - eliminating layers of management. It enables the enterprise to function as a cohesive organization by providing corporate-wide information for decision-making and new competitive enterprise applications that transcend autonomous business units or teams. At the same time, such architectures provide a platform for entrepreneurial innovation in the use of computers by business teams while maintaining an enterprise capability. Business units can become viewed as networked clients and servers, working in a modular, flexible organizational structure - a very different concept from the stovepipes of then old hierarchy.	The Integrated Enterprise	Organizational Transformation
Workgroup Computing: Lotus Notes, Platform approach.	The High Performance Team	Business Process and Job Design
Personal Multimedia: Multimedia computing,	The Effective Individual	Task, Learning Efficiency

(Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA)

Fig.: Business Transformation Through Convergence Technology

Example 2 of The Digitally Supported Health Care as The Convergence Technology Implications for Information System Design

- Lecture #14 has discussed the real world healthcare case that was handled by the National Information Infrastructure Testbed (NIIT) in 1994 to demonstrate – on the basis of a real case – how internetworking could transform healthcare. Based on this test case description, In this section we briefly outline the implication of convergence technology for healthcare information system design so implemented.
- Level 1: Personal multimedia (diagnostic and 3D visualization tools) create effective individuals. Vast array of new medical and general-purpose workstations can improve the personal effectiveness of medical and administrative personnel. Workstations should also include multimedia learning tools, communication tools such as electronic mail, document creation, and management tools for administrative functions.
- Level 2: Workgroup collaborative computing environments that create high-performance healthcare teams. These are generally referred to as clinical information systems. Patient-focused care, customer service, and community-based care models will require team approaches to delivering health care, linking specialists, family practitioners, and others.

- Level 3: Integrated healthcare delivery systems, which extend across an organization such as Johns Hopkins University Medical Center or a health care maintenance organization (HMO). The islands of patient records that currently paint the health care landscape in hospitals, clinics, private labs, provider offices, and pharmacies need to be integrated into a computer-based patient record (CPR). This record would include demographic information, discharge summaries, operating room reports, pathology and lab results, medication profiles, radiology information, and hot links to information in systems outside the organization, such as access to medical reference databases drug formularies, and anagrams.
- Level 4: Community and regional networks linking the High Desert Hospital to USC/LSC. It is estimated that CHINS (community health care information networks) could save $20 billion in administrative costs alone, by making claims and payments electronic, thus avoiding duplication and making the system paperless.
  - *A big challenge here is to get various parties, some of them in competition, to share information. This is a pointer to need for information integrity technology*.

- Level 5: Links across the country on the national information infrastructure (through the Net). As a patient moves through the system from office visits, to inpatient care, to ancillary services such as home health, practitioners have the tools and information to create high-performance health care.

Example 3 of Digitally Supported Creation of Ideas as the Convergence

Technology implication for Information System Design

- George Poirier, hired on contract and then named full-time MIS director, created the system Leopard needed by using Lotus notes. Lotus Notes (**Level Two-The High Performance Team**) allows different employees to comment on the same situation. There were no meetings. There wasn't even time wasted tying to set up a meeting, yet everyone added expertise to the project as time permitted. In the end, there was consensus and a solution was launched with the precision of a probe into space. Leopard Communications was creating an integrated organization.
- The new system caused an immediate impact. "We used to all manage files on our own desks. Now we have got a central file cabinet," says Leopard. Into that cabinet they poured details about specific product uses that they heard about from clients, trade magazines, e-mail chatter, and grapevines of every hue. A vast array of information on a variety of product is important for a client like IBM.

- Such access to information is essential when a potential client calls for a request for proposal (RFP). Clients usually want examples of other companies that are successfully using, say, the same client/server system they are considering. The capacity to find endorsements, an exercise that used to take several days, now requires seconds because the marketing rep has in the laptop examples that have been downloaded that morning from Leopard's digital document library. As well, there are videos of the of the product or service – all available for demonstration from this electronic library on the rep's laptop as part of the RFP (**Level Four-The Extended Enterprise**).
- At the moment, there are 268 references in the database-focused on IBM desktop, LAN, and networking systems-and number is doubling annually. Because the information is equally available to 15,000 IBM reps in the United States and an unknown number around the world through IBM servers in Cary, North Carolina and Austin, Texas, "It's empowering people," says Leopard. "Who's the keeper? Everyone and no one.

- Because the system is open and user-friendly, the newest employee at leopard Communications can attain goals s/he didn't even now were possible.
- Leopard's firm now offers clients a three-part service. First, there are the traditional, static PR agency items like direct mail. Second are multimedia presentations beamed by satellite to trade shows, like the corporate ad to Comdex. Third is the on-line communications data-base, or what Leopard calls "the future of the business."
- The next step was to move everything onto the Internet, putting Leopard at **the fifth level: digital economy**. "With our own Web server, we deliver to our clients via the Internet," says Kathy Simon, the firm's technology director, who is a former IBMer who joined Leopard Communications in 1984 and has seen how marketing has changed. "We have changed our whole approach to clients because the big missing piece was content," says Leopard.

  - The fifth level of digital economy and accounting for “content” meant that employees across the organization and most importantly irrespective of hierarchies are as successful as the superior. Organization relies on every employee to bring in business, but her bandwidth is only so wide. At fifth level of digital economy every employee has access to client information, Leopard can monitor what’s happening, and the whole team knows what’s going on. “The trouble with empowering people is that they can all go and get business,”says Poirier, it’s better than not getting any business at all.

- The database has become the core of Leopard’s strength. This way, everybody can use the same database and anyone can configure the highest decision. No employee can do it alone. As an entrepreneur, s/he has to believe in people’s ability to get work done without her or him. Such organization can form teams, then break them up and form new ones.
- What IT has done, whether at giants like FedEX or small firms like Leopard Communications, is place decisions in the hands of people all the way down in the organization and create capacity for firms to operate on all five levels of the internetworked enterprise-from individual effectiveness to the digital economy.

  (Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA)

Example 4 of Digital Design of Things as the Convergence Technology implication for Information System Design

- In the 90s in designing the new Boeing 777 in response to the challenges of the new economy, what Boeing Co., of Everett, Washington, accomplished was equal parts transformation of its corporate culture and altering of the basic way in which an airplane had been built since World War II.
  - *The Old Economy Way*: Build an airplane and deliver it. Make paper drawings and full-scale mockups. Test fly to discover blunders. Separate all work functions. Write maintenance manuals last.
  - *The New Economy Way*: Customer participates in design. Paperless, no mockups. Computer simulation removes bugs. Design-team builds. Mechanics involved throughout.
- The transformation process cost $4 billion, took five years, and resulted in an airplane that weighs about 550,000 pounds and, at 209 feet long with a wingspan of 200 feet, is only one foot narrower than a 747, can fly as far as 8000 miles, carries up to 375 passengers, and cost about $125 million. When the first aircraft was delivered to United Airlines in May, 1995, there were 144 orders and 99 options from fifteen airlines on four continents.
  - “Engineers who had been with the company ten, twenty, thirty years simply didn’t think it would work,” says Larry Olson, director of information systems at the Everett site of Boeing Commercial Airplane Group. “We are in real competition with Airbus and we want to maintain as large a market as possible. Our products have been around a long time and Airbus was delivering some of the fewer products, so we wanted to improve our processes so that we could give better value and higher reliability to the airlines.”

- To create a team approach to designing the new aircraft, Boeing used the CATIA (computer-aided three-dimensional interactive application) and ELFINI (finite element analysis system), both developed by Dassault Systems of France and licensed in the United States through IBM. Designers also used EPIC (electronic pre-assembly integration) on CATIA. The workstations reduced or eliminated hand drawings, drafting tables, full-size metal mockups, and master models. Because every step was concurrent, engineers working together had simultaneous access to design; they didn't have to wait while drawings ambled their way from place to place. CATIA's digital accuracy and three-dimensional checks at the pre-assembly stage allowed designers to see whether parts would fit or how adding new systems altered stress in the structure. That's because Boeing was able to create, in effect, an electronic mockup of the aircraft and focus on any of its 130,000 parts. So workable were the "drawings" that CATIA even had a computer-simulated mechanic who could demonstrate whether a human could get inside a particular area to carry out repairs.
- "It has changed the whole way of building airplanes at Boeing," says Olson. "All of the digital data…created by the engineer goes to make the tools that assemble the airplane. It means much higher accuracy in assembling. That means less drag and less fuel. Parts 'snap together,' as the mechanics say. If we had to go do this airplane on paper, it would take at least 30 to 40 percent longer."

- As a result of concurrent engineering and CATIA, changes were possible late in the procedure. For instance, aerodynamics was only one of the considerations in the wing-tip design. In the past, the process would have called for aerodynamic considerations first, followed by the later addition of such required items as visibility lights. The 777's design-build teams allowed everything to e built in the same time.
- The heart of the system included 1700 individual compute workstations in the Puget Sound area, linked to four connected IBM mainframes that provided the capacity to carry out complete checks prior to assembly. This meant that misalignments could be spotted, tolerances confirmed, and weights analyzed. Access to the system went beyond Boeing itself to include many of the more than 500 suppliers in a dozen countries. A new computer-based control system made data available about production as well as offering updates on the status of the aircraft. Fully 27% of the 777 was produced in Japan, and key Japanese subcontractors working on on the fuselage were connected via dedicate cable under the Pacific Ocean.
- About 230 cross-functional teams, with up to forty members, were organized around parts of the aircraft rather than according to function, as they had been in the past. The teams brought together engineering, procurement, manufacturing, operations, customer services, and marketing. "The biggest driving force for success was the 'working together' agreement not only with the airlines but all the employees. They could openly and honestly discuss all their problems," says Olson.

- The result was as follows:
  - Sharing of information and identification of problems before anything is manufactured.
  - Reduction of engineering changes at the early stages of production.
  - 60% to 90% less scrap and rework than when using previous methods.
- In many ways, what Boeing did was return to its 1920 roots when the company was small enough that design engineers, the manufacturing group, and administrators could sit around the same conference table and solve problems. As the time passed, Boeing grew, departments became huge, and stages became separated. As each department finished its part of the project, it would throw plans “over the fence,” in the jargon of Boeing, to the next department.
- The new workgroups included not only Boeing staffers from every corner of the company but also key representatives from customers and vendors. The process meant joint problem solving, error reduction, and improved creativity. Coordination of the teams themselves resulted in fewer surprises. In the past, one function area might complete its work then pass the results on without further communication. Now, manufacturing could immediately let the design team know the problems that had to be taken into account.

- The teams did more than create the 777; they transformed Boeing by replacing bureaucracy and departmentalization with synergy and stimulation. The engineers also returned to the strength of the team process because they were able to collaborate over the long distances on the same three-dimensional design just as if they were all brainstorming in the same room.

  (Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA)

Example 5 of Digitally Supported Creation of Ideas as the Convergence

Technology implication for Information System Design

- George Poirier, hired on contract and then named full-time MIS director, created the system Leopard needed by using Lotus notes. Lotus Notes (**Level Two-The High Performance Team**) allows different employees to comment on the same situation. There were no meetings. There wasn't even time wasted tying to set up a meeting, yet everyone added expertise to the project as time permitted. In the end, there was consensus and a solution was launched with the precision of a probe into space. Leopard Communications was creating an integrated organization.
- The new system caused an immediate impact. "We used to all manage files on our own desks. Now we have got a central file cabinet," says Leopard. Into that cabinet they poured details about specific product uses that they heard about from clients, trade magazines, e-mail chatter, and grapevines of every hue. A vast array of information on a variety of product is important for a client like IBM.

- Such access to information is essential when a potential client calls for a request for proposal (RFP). Clients usually want examples of other companies that are successfully using, say, the same client/server system they are considering. The capacity to find endorsements, an exercise that used to take several days, now requires seconds because the marketing rep has in the laptop examples that have been downloaded that morning from Leopard's digital document library. As well, there are videos of the of the product or service – all available for demonstration from this electronic library on the rep's laptop as part of the RFP (**Level Four-The Extended Enterprise**).
- At the moment, there are 268 references in the database-focused on IBM desktop, LAN, and networking systems-and number is doubling annually. Because the information is equally available to 15,000 IBM reps in the United States and an unknown number around the world through IBM servers in Cary, North Carolina and Austin, Texas, "It's empowering people," says Leopard. "Who's the keeper? Everyone and no one.

- Because the system is open and user-friendly, the newest employee at leopard Communications can attain goals s/he didn't even now were possible.
- Leopard's firm now offers clients a three-part service. First, there are the traditional, static PR agency items like direct mail. Second are multimedia presentations beamed by satellite to trade shows, like the corporate ad to Comdex. Third is the on-line communications data-base, or what Leopard calls "the future of the business."
- The next step was to move everything onto the Internet, putting Leopard at **the fifth level: digital economy**. "With our own Web server, we deliver to our clients via the Internet," says Kathy Simon, the firm's technology director, who is a former IBMer who joined Leopard Communications in 1984 and has seen how marketing has changed. "We have changed our whole approach to clients because the big missing piece was content," says Leopard.

  - The fifth level of digital economy and accounting for “content” meant that employees across the organization and most importantly irrespective of hierarchies are as successful as the superior. Organization relies on every employee to bring in business, but her bandwidth is only so wide. At fifth level of digital economy every employee has access to client information, Leopard can monitor what’s happening, and the whole team knows what’s going on. “The trouble with empowering people is that they can all go and get business,”says Poirier, it’s better than not getting any business at all.

- The database has become the core of Leopard’s strength. This way, everybody can use the same database and anyone can configure the highest decision. No employee can do it alone. As an entrepreneur, s/he has to believe in people’s ability to get work done without her or him. Such organization can form teams, then break them up and form new ones.
- What IT has done, whether at giants like FedEX or small firms like Leopard Communications, is place decisions in the hands of people all the way down in the organization and create capacity for firms to operate on all five levels of the internetworked enterprise-from individual effectiveness to the digital economy.

  (Ref.: Don Tapscott, *The Digital Economy*, McGraw-Hill, Inc., USA)

Example 6 of Supply-Chain Information Systems

(Ref.: “As distinction between ownership and control becomes blurred, supply chains are getting more twisted”, A Survey of Logistics, The Economist June 17, 2006 pp. 7 after page 56)

- It could happen anywhere in the world, on any production line, but if one of its products or components fails a test, Cisco Systems knows about it. This is because the world’s largest maker of the networking equipment that powers the internet has linked up all the test machinery in the factories that make its products, and results are immediately relayed to Cisco’s headquarters in San Joes, California. If the company’s engineers do not like what they see, they can remotely shut down a production line or distribution center until the problem is fixed.
- This degree of transparency in global manufacturing operation is remarkable- even more so when one considers that Cisco, which may achieve sales of some $28 billion this year (year 2006), does not own the vast majority of factories that make its products. The company believes that outsourcing has allowed it to grow far more rapidly than if it operated its own assembly plants.
  - But it has had a few problems along the way.
    - In 2000, some customers were ordering technology products on a hunch that shortages were on the way (distorted demand information for Cisco). But the bubble suddenly burst, and despite its clever manufacturing system Cisco was left heavily over-committed as some of its customers slashed their spending reducing product demand. In 2001, Cisco reported its first quarterly loss since it went public in 1990 and wrote off $ 2.2 billion-worth of unsold networking equipment.
      - This emphasized need to improve supply chain for business effectiveness.
- This need is becoming more complex as Cisco expands into new areas.
  - Big routers and networking-switching equipments make Cisco’s core business. These products are custom built.

- But for competitive advantage in the face of rise of convergence technology, in 2003 the company bought Linksys, which provides wireless networking equipment, much of it for home use.
- And in 2005 Cisco splashed out $ 6.9 billion on Scientific-Atlanta, which makes television set-top boxes for video, cable and satellite.
- Further, as technologies merge, Cisco may make the equipment to broadcast television programs taken from the internet around people's homes (See the shift in product spectrum).

- Consequence of the change in product spectrum are noticeable and significant.
  - Building big internet routers involves some forecasting of future demand, pre-manufacturing certain common parts and rapidly customizing the equipment when an order comes in.
  - By contrast, making consumer electronics involves manufacturing lots of standard products that will be sold mostly through retailers.
  - To keep on top of demand, Cisco has has to do the sort of things that P&G does in supplying supermarkets, avoiding shortages on one hand and too much stock on the other.
  - This means that on the consumer side of its business Cisco is in daily contact with retailers. "What happens in Ohio at Best Buy is going to be quite different at Dixons in Manchester," says Angel Mendez, head of Cisco's worldwide manufacturing.
  - Plenty of consumer-electronics companies outsource their production, but Cisco is now having to re-examine whether that is really the best option for its consumer division, because Scientific-Atlanta has done rather well building its own products in its own factories. Mr. Mendez is convinced that outsourcing, albeit with strong centralized controls has given Cisco a huge competitive advantage in its core business, but he is open-minded about what will work best on the consumer side. "The one-size-fits-all solution may or may not be right,: he says. "What does matter is having an agile, adaptable and speedy supply chain." For Cisco, that means it will have to find a system that can cope with a spectrum of products ranging from $ 99 consumer items to $ 1m-plus purpose-built router systems. Then answer may be to set up completely different supply chains with some common features, such as combined component-purchasing.

- Rise of supply-chain information systems
  - Integration of supply-chain information systems is increasingly becoming crucial to achieve business competitive advantage. There is no single solution to information system design and to information decision therefrom. As explained earlier, different outsourcing strategies could be found among successful companies in the same industry. Apple, for instance, designs its hugely popular iPod but out-sources the supply of the components and the assembly to other companies, many of them in Taiwan and China. By contrast, South Korea's Samsung Electronics is highly integrated, even making its own chips and liquid-crystal displays.
  - One of the problems companies face is that different products may need to move along their supply chains at different speeds. A supermarket, for instance, needs regular supplies of perishable products such as bread, eggs, and milk, although customers coming in to buy them will also occasionally buy slower-moving items such as shoe polish or light bulbs. A supplier cannot afford to ignore either. If people cannot find what they are looking for, they may go elsewhere. "Being in stock is one of the most important measures supermarkets look at," says Sam Israelit, an expert in retail logistics for Bain & Company, a firm of management consultants.
    - The companies need to offer different service levels for different products. The idea is never to be out of stock of high-velocity items, which tend to be most profitable. On lower-velocity items, there is slightly more room for error. But demand will also vary by location and season. One supermarket may sell lots of ethnic food because of local demographics, whereas another may get runs on things like barbecue sauce and charcoal when the sun comes out. According to Mr. Israelit, "it adds enormous complexity to the planning process." Few firms will have the clout to build an organization capable of handling all of these things, so they will outsource their logistics to specialists.
  - P&G, which is one of the world's largest consumer- goods companies, outsources parts of its supply chain, such as trucking operations.

- The company talks about two “moments of truths” in retailing.
  - First, is your product on the shelf?
  - Second, when you have persuaded a customer (or rather when the customer has taken the decision and acted upon it) to purchase your product, does it deliver what it promised, i.e., is the post-decision outcome for the customer as good as (if not more) what the customer had estimated it to be at the pre-decision stage?
    - Please note that, in abstraction, the customer, here, need not only be a “human” but can also be a machine or a software.
    - Further, this is a pointer to the definition of Information Integrity Risk.
- The first requirement can be met through a collaborative (information sharing) effort between supplier and retailer; the second will depend on a combination of things such as product innovation, marketing, packaging, presentation and pricing.

- Business significance of supply chain collaboration
  - Collaboration in the supply chain improves visibility, says Chris Poole, P&G’s director of outbound logistics in western Europe. He calls it “joint value creation”. At a practical level it means that by sharing more sales information, a supermarket planning a special promotion, for instance, can be reasonably sure, i.e., will experience acceptable (or rather for competitive advantage minimum Information Integrity (I*I) risk) that a supplier will be able to deliver the necessary goods.
  - Further, at the same time the supplier will be better placed to increase production.
  - With better (integrity) information, both the retailer and the supplier can afford to carry less stock. “Supply chains are becoming leaner, bur paradoxically they can also become more agile,” adds Mr. Poole.
- All this is pointer to:
  - *The concept of “Information Value Network” or “Networked value Creation” as against the Value Chain of traditional business models, and to*
  - *The concept of “error tolerant information systems”*.

- For developing lean and agile supply chains - the researcher The Economist June 17th 2006 points out - there are various ways.
  - One way of reducing costly handling is to put items into “shelf-ready packaging” so they do not need to be unpacked from a box and placed on the shelf individually. In Europe, P&G uses a three-tier logistics system to schedule deliveries of fast- and slow- selling goods, bulky and small items in the most efficient way. The idea is that every shop gets what it wants when it needs it and lorries travel as full as possible. When the load is too small to justify a truck, it is sometimes sent by courier. And thanks to satellite-tracking gear on vehicles, supermarkets can be altered when a truck is about to arrive so they can prepare for unloading.
  - Individually these are small things, but taken together they can make a huge difference. In Europe, P&G uses some 2,000 trucks a day just for outbound deliveries. Excluding small items like cosmetics and fragrances, those trucks carry more than 1,800 different products. Ensuring that the supply chain runs like clockwork – and to do it every day, seven days a week – takes an enormous amount of effort.

Example 7 from Cargo industry

- Ref.: “Cargo cults”, A Survey of Logistics, The Economist June 17, 2006 pp. 8 after page 56.

ISSUES

There is a huge gap between what consumer's want and what vendors would like to sell them

- Ref.: "Spare me the details", A survey of IT - Make it simple, The Economist October 30th 2004, after page 54 page 12.

Being too lean and mean is a dangerous thing

- Ref.: “When the chain breaks”, A Survey of Logistics, The Economist June 17, 2006, pp. 14 after page 56.

Financial software can work magic, but only with the right data

- Ref.: “Chain reaction”, A survey of the real-time economy, The Economist February 2nd 2002.

Need to go beyond IS quality…

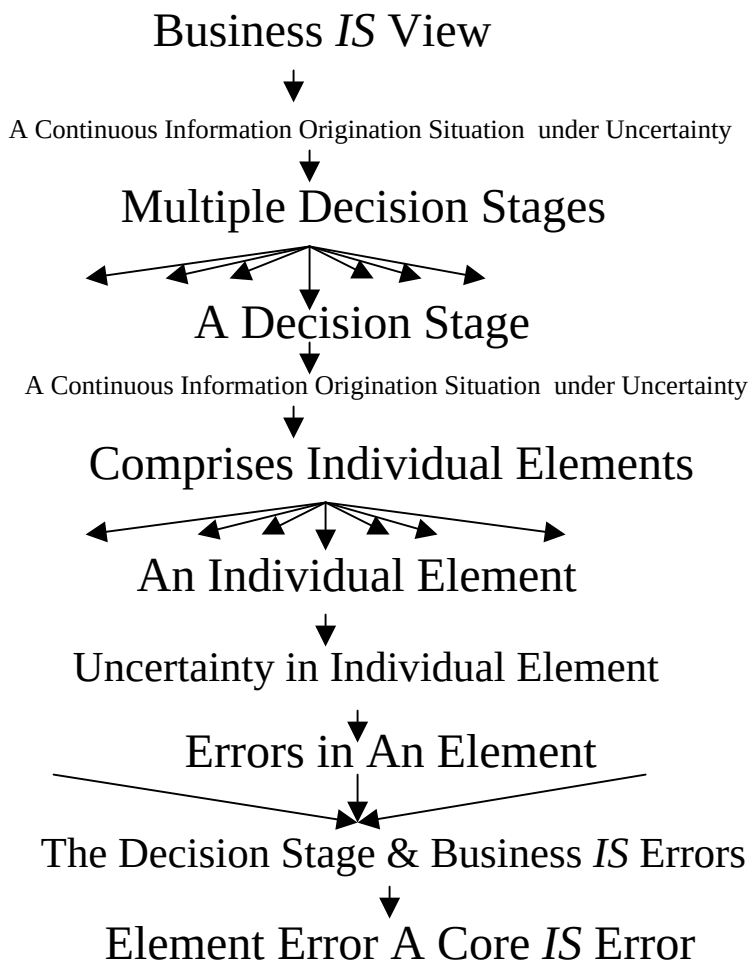
Elaboration….

Open System View of Business Process

- Business organizations getting ***recognized*** to be “open systems” (*OS*).
  - Offering a modeling tool to account for:
    - differing organizational environments, and
    - for organization’s dependency on its internal and external environments.
- This formalizes environment as a major factor in business decisions.

IS ERRORS

- Each decision stage an information origination situation, comprising individual elements:
  - Observation and Verification,
  - Problem recognition,
  - Prediction,
  - Selection of flexible information decision and control implementation,
  - Reevaluation
  - Information Origination Resource Management.



ERROR MODEL

- Inexact Information:
  - Exactness: Concern is noise in minimal information
  - Reliability – Attribute of Exactness aspect
    - Is system functioning well for specified periods of time?
- Incorrect Information:
  - Correctness: Concern is “distortion” and “noise” in maximal information.
    - Is there incorrect production of information?
  - Accuracy, Consistency, Reliability – Attributes of Correctness aspect
- Emerging Error Model
  - Non-observable, i.e., Informational Error
    - Model: Error is a failure to ensure intended value, which is correct given the situation, the cause and form of error not withstanding.
  - Information errors are decision errors.
  - They far exceed observational errors.

Applicability of Quality *IS*

- Managing Business Process (*BP)* Task Of Managing *IS*.
- As with *BP*, functional areas describe *IS*.
- Quality paradigm improves functional global performance in a global organization.
- Therefore, ‘quality’ an obvious candidate for application to information systems.
- In the form of “quality *IS*”, this is the basis for application of TQM framework to business process *IS.*

Traditional *vs*. Quality *IS*

Approach: **Good-Enough Reliability**: Focus on observed failure.	**Zero Error**: (i) Error prevention, (ii) Error detection while the system is in operation, (iii) Failure – Wait till system fails.
Approach: **Direct Cost**: **Reliability** of system additional cost, requiring time and money.	**Cost of Ownership**: Includes future maintenance and **loss due to lack of reliability**.
Design- a Process Factor: Sequential: (a) Design just one phase in *SDLC* model, (b) Iterative trial & error approach to defects.	**Concurrent:** (a) Design teams are cross-functional, (b) Design phase includes: **reliability & robustness aspects.**
Manufacturing- a Process Factor: Trial & Error until a **good-enough reliable** system is produced.	Goal is "Right the First Time": (a) Extensive and careful design phase, (b) **Extensive reliability testing** at the manufacturing phase.
Manufacturing - a Process Factor: Hardware **reliability** & supplier's **insurance** for defect-free & continuously improving service.	Demand for getting involved with the internal quality efforts of the supplier.
Maintenance factor: **Fire Fighting**	**Recovery Plan**: (a) Error prevention by designing **reliability** into the system, and (b) Detection of errors through constant field data collection and monitoring via control charts.

INADEQUACY OF QUALITY *IS*

- **What does a Quality *IS* aim to Do then?**
  - Designed for the reliability attribute.
  - For zero defect goal, emphasizes “exactness”.
  - Pursues business objectives of
    - operational optimization, and
    - cost efficiency,
    - which are based on assumptions of:
      - complete knowledge of initial conditions,
      - linearity of process, and
      - availability of adequate information processing resources.

What is Required of the *IS* though?

- Flexible information decision for control implementation.
- Bringing in “correctness” aspect of information requirement, which requires:
  - Processing maximal information requirements, and
  - Including accuracy, consistency and reliability attributes of information in
    - the design and implementation of the *IS* view (Information Integrity System).

What are the Implications?

- In traditional *IS* little attention to the type of *IS* needed for managing information integrity.
- Quality *IS* designed to ensure only the reliability attribute.
- This has following implications:
  - Quality Paradigm Necessary but Not Sufficient
  - Information Origination and Decision-Making Considered as Costless Activities
  - No Analytical Basis to Compare and Select a Better Quality Mechanism

THANK YOU