Paradigm Shift

THE NEW PROMISE OF INFORMATION TECHNOLOGY

By: Don Tapscott and Art Caston

Most strategists agree that the corporation of old - the multi-level, inward-focused, command and control hierarchy — simply doesn't work anymore. Fifty books at your local bookstore explain how business transformation is required to succeed in the new environment. The new enterprise is dynamic and can respond quickly to changing market conditions. It has a different structure - flatter and team oriented - eliminating bureaucratic hierarchy. It is based on commitment rather than control. Business processes are streamlined for productivity and quality. It is open — focused outward — and networked.

Conventional wisdom holds that information and information technology (IT) are at the heart of corporate reinvention and rebirth. However a multi-million dollar investigation of 4,500 organizations uncovered a hole in conventional thinking. Many business executives expressed the view that IT, rather than enabling business transformation was an important obstacle. As one said:

"Like the old organization, around here we have hierarchical islands of computing which are multi-level, inwardly focused, bureaucratic, limited in function, unresponsive, expensive, and hard to change. Furthermore they correspond to the old organizational chart. Rather than enabling us to break free and create, the new enterprise systems are locking us onto old models."

This problem is creating a "demand-pull" for a new view, model or paradigm in IT.

Simultaneously there is a "technology push" from some important changes in the technology itself. There is a fundamental change taking place in the nature and application of technology in business. To date, no one has fully articulated this change. As a result, developments in technology often appear as a barrage of random, unrelated events. Further, most enterprises are having severe difficulties embracing the new, remaining constrained by traditional approaches to exploiting technology and by legacy technology investments and cultures.

The research came to a number of striking conclusions which all center around one theme. Information technology is going through its first *paradigm shift* – driven by the demands of the new, competitive business environment on the one hand and profound changes in the nature of computers on the other. *The information age is evolving into a second era.*

The paradigm shift is fundamental change in just about everything regarding the technology itself and its application to business. The old paradigm began in the 1950s. The late 1980s and the 1990s are a period of transition to the new paradigm. Organizations which do not make this transition will fail. They will become irrelevant or cease to exist.

A paradigm shift is a fundamentally new way of looking at something. It is often necessitated by new developments in science, technology, art or other areas of endeavor. Such shifts are necessary because important changes in reality demand a shift in conceptualization. For example, in the early 20th century the march of science began to raise issues which were not easily explained by Newtonian physics. A new paradigm, in this case Einstein's Special Theory of Relativity, emerged as a new and more comprehensive theory and framework to explain the new realities.

The concept of a paradigm shift was first introduced by philosopher and science historian Thomas Kuhn in his 1962 book, *The Structure of Scientific Revolutions.*[1] The notion of a paradigm has grown beyond the dictionary definition to be a broad model, framework, a way of thinking, or a scheme for understanding reality. Today the term is widely used. The idea that the information age is going through its first paradigm shift was first elaborated by DMR Group in 1987.[2,3]

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He has given executive briefings and consulted to leading enterprises around the world. Mr. Tapscott has also consulted to governments in Canada, the United States, Europe and Australia on information technology policy and strategy. He recently chaired the Advisory Committee on a Telecommunications Strategy for Ontario.

In the 1970's Mr. Tapscott managed pioneering work at Bell Northern Research on "the Office of the future." In 1986 DMR Group acquired the consulting practice of Trigon Systems Group, which he co-founded in 1981. DMR is an international information technology services company. Mr. Tapscott was DMR's Vice President, Technology and, among other things, led a multi-million dollar research program which led to the publication of Paradigm Shift.

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Paradigm Shift is the culmination of twenty-five years of experience in working with innovative applications of technology in business. The past sixteen years were spent at DMR Group Inc., where he was Vice President responsible for their Architecture Consulting Practice.

He has worked closely with co-author

Don Tapscott, DMR's Vice President, Technology, over the past seven years building upon complementary backgrounds in systems and research studies which identified the paradigm shift in the application of information technology which is now underway.

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The new technology paradigm parallels the new enterprise. Like the new enterprise it is open and networked. It is modular and dynamic – based in interchangeable parts. It *technologically* empowers – distributing intelligence and decision making to users. Yet, through standards, it is integrated – moving enterprises beyond the system islands (and their organizational equivalents) of the first era. It works like people do, ignoring boundaries among data, text, voice and image and providing a backbone for team-oriented business structures. It blurs walls between enterprises, enabling the recasting of external relationships. Most important, it has matured to the point where it is achievable, and affordable. In fact, the longer your organization waits to begin a transition the more you have to spend, even in the short term.

The research concluded that it is only through open, network, integrated, client/server computing that the open, networked, integrated, client/service enterprise can be achieved. Understanding the technology paradigm shift is therefore becoming a precondition for business success in the information age.

This has far reaching implication for strategy. So called "strategic plans" for information technology of the past are being bypassed, as IT becomes part of business strategy itself. Every strategy will have an IT component just as it might have a component dealing with marketing, financial or human resources.

The New Promise of Information Technology

For its first few decades (1950s, '60s, and '70s) data processing was pursued primarily to reduce clerical costs. As one insurance company executive told us, "we were after clerical heads." Today however, technology has moved to the front line in most organizations. It has become "strategic" in the sense that it is a necessary component in the execution of a business strategy. Countless books and articles discuss the innovative use of computers to achieve temporary competitive advantage or parity. For example, many banks felt the sting of losing customers to better information services such as Merrill Lynch's Cash Management Account. These banks and others in similar circumstances have scrambled to expand computing beyond back room data processing to the front line delivery of business services and products to customers.

A change has also occurred in terms of who uses computers. In the first era the focus was on technical specialists, professionals, and managers who designed, implemented, managed, controlled, and usually owned the computing infrastructure of the enterprise. With the transition to the new era, business users of technology have moved to the fore. They number in the tens of millions, are more sophisticated and more demanding. They are also no longer content to depend on Management Information Systems departments to achieve the benefits that technology can bring. Users want to shape or control the technology which is implemented in their organizations. They want to control its use and determine the effect it will have on their own work. They are rapidly understanding that their effective use of technology coupled with a change in how they do business will determine their personal and organizational success. They have become the vanguard of an information technology revolution that is quickly altering the old ways of organizational computing.

Three Critical Shifts in the Application of Information Technology

This sets the stage for three fundamental shifts in the application of computers in business. Information technology enables enterprises to have a *high-performance team structure*; to function as *integrated businesses* despite high business unit autonomy; and to reach out and develop *new relationships with external organizations* – to become an "extended enterprise." This is depicted in the Figure on the next page.

The Enabling Effect of Information Technology

Shift 1: From personal to workgroup computing. Personal computers (PCs) have percolated throughout organizations to touch every job. However, their impact can rarely be described as "strategic." The main limiting factor is that the standalone PC does not work the way that people do – in communications with others, especially within a workgroup. The new thrust appreciates the importance of the business team as the cornerstone organizational unit and the huge opportunities to support teams within the execution of business functions.

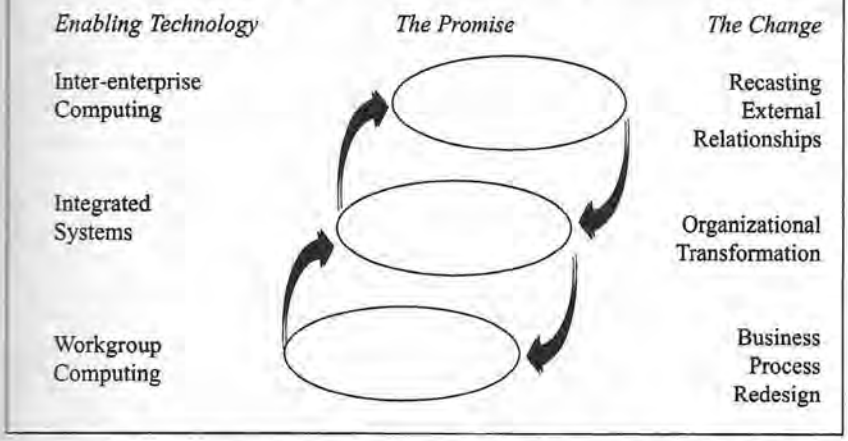
Workgroup computing provides personal and workgroup tools, information, and capabilities to directly support all categories of people in the information sector of the economy. If well conceived and implemented, workgroup systems can be a focal point for the redesign of business processes and jobs. This can result in spectacular improvements in productivity and responsiveness. Rather than improving the efficiency of a task such as writing a report or preparing a budget, the goal is to improve the effectiveness and performance of the group.

Workgroup systems can enable the streamlining of a work process and changes to the nature of jobs in a business unit. The results are typically a reduction in the turnaround time for creating work products. Staff are also able to save time which can be reinvested in doing more important activities. For example, an electric utility's process to complete a customer order had a seven week cycle time. An investigation revealed this was completely unrelated to the actual work time required to execute the process. An IT-enabled re-engineering program reduced the cycle time to two hours.

Marketing personnel in one Citibank division were able to save hours a day, freeing them to spend more time in direct customer contact. This was achieved through redesign of work processes, the implementation of workgroup computing and the building of high performance work teams. The result was a dramatic increase in revenue and profit, and interestingly, improved quality of work life for employees.

Shift 2: From system islands to integrated systems. Traditionally, information technology has been used to help manage and control costs of three resources: physical assets, financial resources, and people. As a result, separate systems islands sprung

The Enabling Effect of Information Technology



up through the organization in those three areas.

Management and Control of Physical Assets and Facilities included a broad range of sensor-based or realtime control systems associated with production and process control; systems involved with more efficient storage and movement of raw materials and intermediate or finished goods; and systems dealing with improved management, operation and protection of operating facilities and equipment that included plant sites, sales and distribution points, vehicles, and offices.

Financial Management and Control Systems formed the origins of the data processing department and dealt with the automation of the bookkeeping end of business transactions. They were oriented towards reducing clerical overhead and increasing the efficiency of processing business transactions. Data processing systems grew beyond financial applications to address broader information such as customers and insurance policies.

Technologies to manage the Human Resource were intended to support management and other employees in fulfilling their various job functions. They included administrative technologies such as photocopiers, office automation systems such as word processing, records management and library systems, and office communications including telephone, telex, electronic mail and facsimile, and human resource applications such as benefits administration and skills inventories.

In the first era of information technology, organizations were forced to keep these areas separate and independent, because of the immaturity of the technology and our ability to exploit it. This strategy resulted in the creation of isolated islands of technology. At the same time, separate areas of the organization emerged with (engineering departments, the Information Systems function) responsibility for these three different types of systems applications. Unfortunately, the result was often systems which were not integrated, highly fragmented, overlapping in function and content, and costly to maintain – typically consuming a majority of all operational costs.

Because of the maturity of technology standards, it is now possible to plan an entire enterprise architecture rather than continuing to add another room on the farmhouse as required.

Enterprise architectures provide the backbone for the new open networked enterprise – in fact, they are a key prerequisite. They enable moving beyond the hierarchy as layers of management are not required when information is instantly available electronically. Such architectures can enable the enterprise to function better as a cohesive organization – providing corporate-wide information for decision making and new competitive enterprise applications which transcend autonomous business units.

A good example is Federal Express (FEDEX), which has built an integrated, and very competitive company on an enterprise architecture. Integrated systems at FEDEX enable tracking of a parcel in "realtime" and provide detailed information regarding the minute-by-minute parcel movements for the management of quality. The architecture integrates systems capabilities to manage the three resources – physical, financial and human.

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.

As a transitional step, many companies are building links between various systems to enable an enterprise capability. For example, Philips Petroleum, Frito-Lay, and Northern Telecom have implemented Management Support Systems to provide information from a variety of disparate systems for executive decision making.

Shift 3: From internal to inter-enterprise computing. In the first era, systems were viewed as being internal to the organization – reflecting the walls which existed between enterprises. Computer systems are now extending outward to link enterprises with their suppliers, distribution channels and consumers. Insurance companies and airlines link with agents. Governments provide information kiosks for the public. Banks provide online access to customers. Manufacturers tie in to terminals in the trucks of a distributor. The research found that such systems can strengthen customer loyalty, lock out competitors, speed up the distribution of goods and customer service, and save money (to name a few).

Technology is becoming a vehicle for forging links between business partners – both suppliers and consumers of products and services. Early systems such as the American Airlines SABRE reservation system and the American Hospital Supply customer order system have become legends in how to use technology to link with customers to defeat the competition. However, they were really the tip of the iceberg.

The new technology of *extended reach* enables the recasting of relationships with external organizations. Computer systems between enterprises are beginning to talk to each other. The manual "value chain" from suppliers to consumers is becoming an *electronic value network* which also links to affinity groups (such as business partners) and even competitors. Computing is becoming inter-enterprise computing, enabling the rise of "The Inter-enterprise."

The emerging technologies include inter-enterprise databases, voice response systems, electronic messaging and new point-of-sale technologies. Standards such as Electronic Data Interchange (EDI), (the computer-to-computer interchange of business documents between companies), is

transforming the ways companies work together.

When large auto manufacturers demand that their suppliers communicate with them using EDI, one of the objectives is to make suppliers more productive, profitable and therefore stable. Auto manufacturers acquire an interest in the profitability of their suppliers and can contribute through EDI. New extended enterprises are being born.

Eight Critical Technology Shifts

What is the new technology paradigm required to deliver on this promise? Among the shifts occuring are:

Shift 1: From traditional semiconductors to microprocessor-based systems.

The microprocessor – computer on a chip – is at the center of the new paradigm. Traditional semiconductor technology which fills the massive cabinets of the mainframe and minicomputers in your corporate data centers, is going the way of the dinosaur. Microprocessors are beginning to dominate leading edge computers of every size. Since 1988 desktop machines costing under $20,000 have outperformed the multi-million dollar mainframes of several years ago. Similarly, when comparing the speed of computers today, a unit of performance costs hundreds of dollars on a microprocessor-based system compared to tens of thousands of dollars on mainframe systems. Systems which combine many microprocessors into a single large computer can dramatically outperform mainframes in sheer power.

The microprocessor is the precondition for a new approach to computing, which (like organizational empowerment) moves intelligence out into the enterprise where the action is (for example, at the point of sale, customer service, R&D lab, or marketing department). It enables organizations to have "empowered architectures" which exploit the superior price/performance of microprocessor technology.

Shift 2: From host-based to network-based systems. Era I systems were based on large "host" mainframe or minicomputers each supporting a "network" of local or remote terminals attached to it. These hosts were optimized for efficiency given the high cost of traditional semiconductor technology. The terminals were typically "dumb" with a cryptic user interface.

Now, because of the spectacular power of the microprocessor and the maturity of networking technology and standards, a fundamentally different style of computing is emerging. It goes by different names such as network computing, cooperative processing, and client/server architecture. Regardless of the name, the new approach provides the potential for users to access a wide range of data, applications, and computing resources without worrying about where they are or how they are connected.

Most important, software is processed not only on a host but wherever it makes most sense. It does not even have to be limited to one machine, but can be processed "cooperatively" on various computers on the network. The computer becomes the network and the network becomes the computer. To use a human analogy, thoughts are processed on the minds of many people in an office – not just on the mind of the person with the biggest brain. And, it is communicated as required to meet requirements of the collective process.

The advantages of this approach are huge. It exploits the inherent power of the microprocessor. It will more efficiently use computing power as unused devices on the network can be brought to bear on a problem as required. It enables information and applications to be processed where they should be – close to the user such as in the case of a workgroup application.

Shift 3: From vendor-proprietary software to open software standards. In the early days, computers used software created specifically for that computer – *one computer, one vendor.* When the customer needed a larger computer they had to recreate the software at huge cost. In the 1960s vendors introduced the concept of "scalability" – software would work on different sized computers – *one vendor, multiple computers.* However, each vendor had a unique product architecture. Software, whether purchased from that vendor or developed in-house, worked only on the hardware of that vendor. Consequently, the organization was "locked in" to that vendor, as it was too costly to move their software to another vendor's equipment.

Now the computer industry (like the construction industry of 17th century Boston, the railroad industry of the 19th century, or the electric bulb and automobile industries of the 20th century) has matured to the point where it is consolidating around standards. Open systems, based on industry standards which are not controlled by any one vendor, are transforming the computer industry and presenting a monumental challenge to commercial organizations alike. Standards are arising in all areas of computing including communications, databases, user interfaces, computer operating systems and software development tools. By 1992, every major computer vendor had adopted open systems as its main approach to technology.

Open systems result in information and software being "portable" – that is, run on hardware regardless of size or brand. Such standards also enable systems of different sizes and brands to "interoperate" – that is, communicate with each other.

DMR's research showed that open systems have far reaching advantages over the traditional approach. They are significantly less expensive due to their exploitation of microprocessors, lower vendor margins due to customer freedom, and use of shrinkwrapped, as opposed to home-grown software – to name a few. More important, the leading organizations had concluded that industry standards were necessary to enable them to adopt the new computing paradigm. Standards in general, and open systems in particular, do not simply provide "benefits." They are becoming imperative in order to create the kind of modular, flexible, powerful, networked computing architecture required by the new business environment.

Shift 4: From separate to data, text, voice and image to multi-media. In the first era, the immaturity of technology and the absence of open standards meant that these four forms of information were separate, each with separate technologies to manage them. Data processing systems handled data. Word processing systems and telex handled text. Telephone and dictation systems handled voice. Photocopiers and microform systems handled image. As the information contained in these systems becomes digitized, and as standards grow, the opportunity is unfolding to integrate them. Today for example, two professionals in different parts of the globe can exchange (at the speed of light) computerized or "digital documents" which contain all four forms of information. A document on a workstation screen may have text surrounding a digitized photograph and a "live" spreadsheet with another's voice (requesting clarification from the recipient) attached to certain parts of the document. This "compound document" can be filed electronically, retrieved, altered, and communicated as appropriate without ever being transformed into paper. Again, the re-

search showed that the benefits can be striking.

Shift 5: Software development – from craft to factory. Like the pre-industrial creation of rifles, software development in the first era was a craft. The quality and cost of software was a function of the skills and creativity of the professionals developing it. Typically, programs from within the same organization – even running on the same computer and developed by individuals within a team – were as different in style, utility, and cost as the weapons of early America. When a gun broke a craftsman had to fix it, as there were no interchangeable parts.

As significant as the move to the industrial design and production of rifles, software is going through a fundamental transformation. It is becoming an engineered profession using factory-of-the-future production techniques. This is an important issue given the huge investment in software made by any medium or large organization.

Because computers are now the basic delivery systems for products and services companies need new computer applications in days or weeks, rather than months or years. For example, some financial products in the banking industry have a competitive life span of a few weeks. Leading enterprises have concluded that the traditional model of custom software development on traditional computing platforms was too expensive and too slow.

Developers use and reuse modules or parts which are standardized and which work together. Computer Aided Software Engineering (CASE) tools (after much ballyhoo and delay) are finally showing their potential to radically improve the way software is created – not unlike the automated industrial production line.

The New Challenges

The fundamental changes in today's business environment coupled with the rise of the new technology paradigm are beginning to present a major challenge to organizations. We refer to this as the "Three R's." Organizations need to **Reengineer** themselves — exploiting the enabling effect of the new paradigm. A second challenge is **Retooling** the information technology environment in each organization. A legacy of Era I systems is a huge impediment to moving forward. A third is to **Realign** the IS organization with the Business organization. The computer department arose to meet the needs of the First Era and is becoming inappropriate to address the needs of the second.

Overall the challenge is one of leading change. Back in 1976, Marilyn Ferguson, was one of the first to popularize the notion of a paradigm shift in *Aquarian Conspiracy – Personal and Social Transformation in our Time.* She wrote that a paradigm shift involves dislocation, conflict, confusion, uncertainty. New paradigms are nearly always received with coolness, even mockery or hostility. Those with vested interests fight the change. The shift demands such a different view of things that established leaders are often the last to be won over, if at all.[4]

The research undertaken by DMR produced another very striking finding. Today's enterprise is typically faced with a crisis of leadership. Many traditional Information Systems (IS) professionals and managers are so buried in fighting the bush fires of the old IS platform that they are unable to lead in the creation of the new. Leadership is often not forthcoming from the technology vendors either, many of whom are in disarray due to the transformation of customer requirements, marketplaces and the first restructuring of the IT industry. Leadership is not forthcoming from third parties such as consultants, value-added resellers and the like. Old approaches, knowledge, methods and attitudes die hard, even (and perhaps especially) among the leaders of the old view. And leadership is a challenge for the CEO, business unit executives, and the user community who traditionally have been cynical about the claims, arcane language and perceived territorial motives of IS professionals. Many business managers have, until relatively recently, left technology to the technologists and feel that they lack the confidence and knowledge to engineer a change of this magnitude.

On the other hand for those organizations who had succeeded in initiating the transition to Era II leadership came from every conceivable place in every conceivable type of organization. From secretaries to the Chairman of the Board, across every industry sector, from line business units to the central IS function, from both IT vendors and commercial enterprises, leaders are beginning to appear.

This creates an historic and opportunity and in many ways responsibility for the business strategist.

Passive observation of tumultuous change breeds paralysis and cynicism. The world of the strategist is in transformation and s/he has an opportunity to be an active participant in this change – to lead. Not, necessarily to give great oratory or call troops to arms, but to lead – in the spirit of the learning organization - to help the organization overcome its Era I learning disabilities and effectively Re-engineer, Retool and Realign. ❐

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