New Technologies, Old Problems

Historical Amnesia and Enterprise Computing

Structure of the Talk

- General Introduction
  - My Research
  - Information Systems in the 1990s
- 1: Business Process Reengineering
- 2: Enterprise Resources Planning
- 3: The Data Warehouse
- Conclusions

Broader Research

- Dissertation: “Technology, Information & Power: Administrative Technicians in the American Corporation, 1917-2000”
- Multiple publications, presentations
- First presentation of final chapter
  - Major trends in 1990s
  - Stresses continuity

Managerial Technicians

Claim technical authority over some managerial activities.

- Construction of new kinds of expertise
- Seek group mobility
- Identities tied to construction, elevation of corporate departments
- Conflation of managerial and professional ambitions


No business too large or too small—
Rand visible control shows
the facts at a glance.
John Wanamaker, Philadelphia, is one of the high-class organizations using considerable RAND equipment.
RAND
A
B
C
D
"Just a Second! There!—there are the facts.
Now you can decide."
—all the facts concisely in the least possible time; glance down the panel holding RAND cards till you reach the name you want, swing up the card just ahead—and there are all the recorded facts. With RAND Visible-Card Systems one clerk does the work of four.

Big Project

- First full-length, professional history of corporate IT usage
- Three Strands
  - Organizational & Institutional
  - Identity & Professionalism
  - Technology & Practice
- Goes back before the computer
  - “Systems” work
  - Office management
  - Punched card machines

Methodology

- Narrative
  - Charts, tables, figures for support
- Mixture of sources
  - Journals, magazines, conference proceedings
  - Archival holdings (producers, users, associations)
  - Contemporary surveys
  - Memoirs, Interviews

Enterprise Computing in the 1990s

Enterprise Computing

- Large scale, corporate systems. Mainframes plus
  - Network backbones
  - Inter-departmental applications
  - Technical standards
  - Centralized databases
  - Intranet
- Used to be the only kind (almost)
- Striking continuity over decades in issues
  - Practical
  - Technological
  - Professional

The 1990s – New Technology

- Large-scale relational databases
- Incorporation of PC into enterprise systems
  - Graphical User Interface
  - Client-server technologies
  - RAD (Rapid Application Development)
- N-Tier model
  - Object Orientation (C++, Java)
  - Distributed Objects, Brokers
- The Internet, “e-business”

The Productivity Paradox

- "You see the computer everywhere but in the productivity figures"
  - Robert Solow – MIT Economist
- By mid-1990s business spends on computers
  - 3% of GNP
  - 50%+ of capital investment

Rise in GNP Does Not Correlate

Period	Computer Spending (% of GNP)	GNP Growth (annual)
1960s	0.003	4.5%
1970s	0.05	2.95%
1980s	0.3	2.75%
1990s	3.1	2.2%

White Collar Productivity

- How much economic output you get per unit of input
  - Gives sustainable, non-inflationary growth
- Computer is supposed to make clerical and processional workers more efficient
- Overall labor productivity grew 1.1% p/a 1973 to 1997
  - Most of GNP rise is from working harder
  - Real median wages fell from mid-70s to mid-90s

At The Firm Level

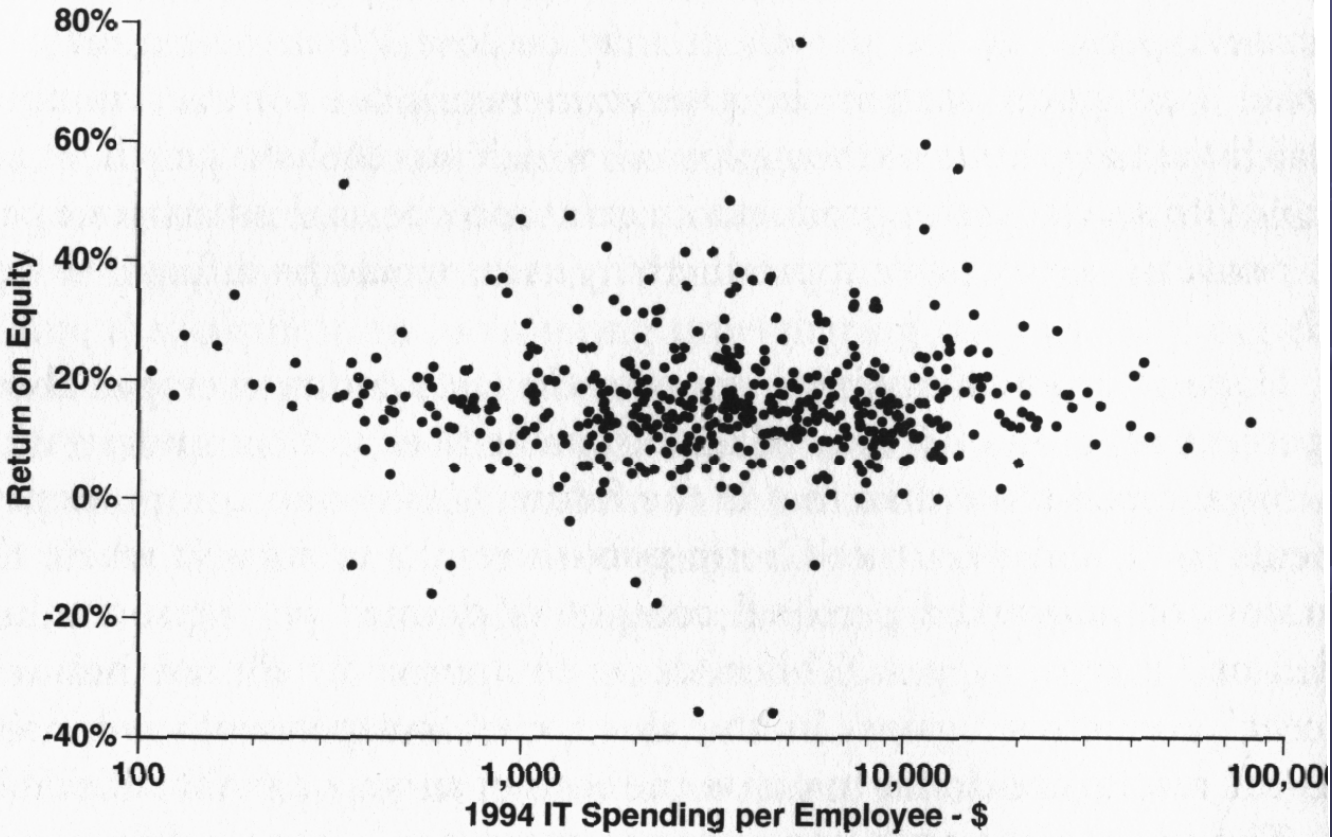
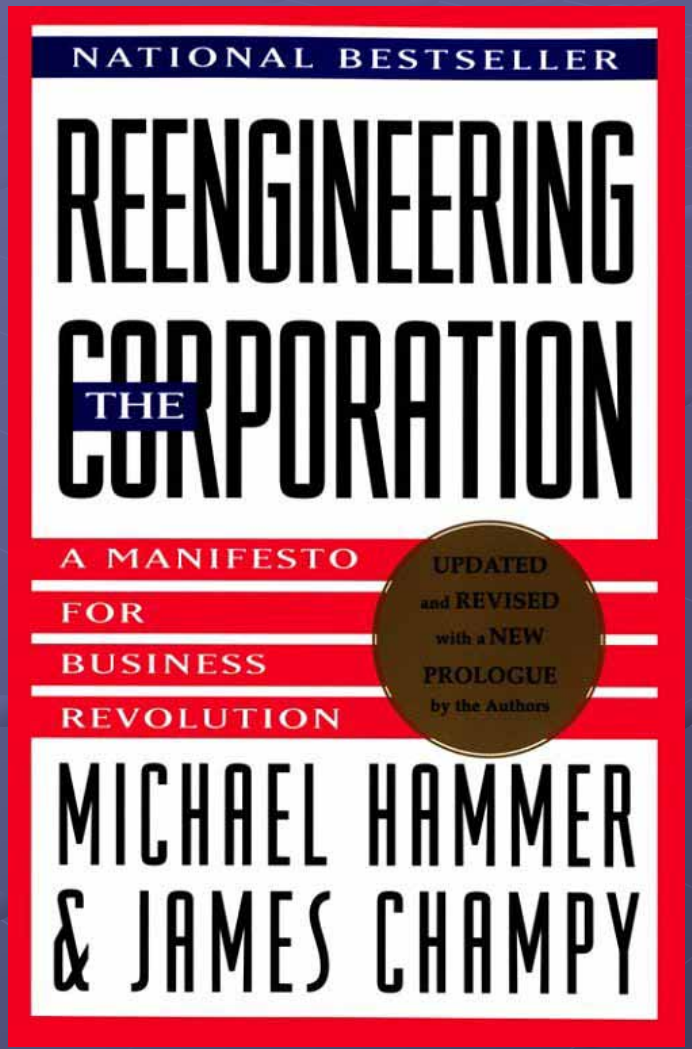


Figure 8 No correlation in spending on computers and profitability

New Approach 1: Business Process Reengineering

A Business Revolution



- Former CS professor
- Rhetoric of revolution
  - "Take a machine gun and an axe to the organization chart"
  - "Shoot the dissenters"
- Insists new idea
  - Old ways were good before
  - New technology means new approach

BPR – Fate

- Ushers in great consulting boom
  - Also attractive to internal IT leaders
- Term applied quite indiscriminately
  - Often used to justify any layoffs
  - “Chainsaw” Al Dunlap, etc.
- Backlash grows from mid-1990s

How New Was It?

- Some obvious antecedents
  - Industrial Engineering (Davenport)
  - Taylorism/Scientific Management
- Closest antecedents
  - Systems and Procedures Movement

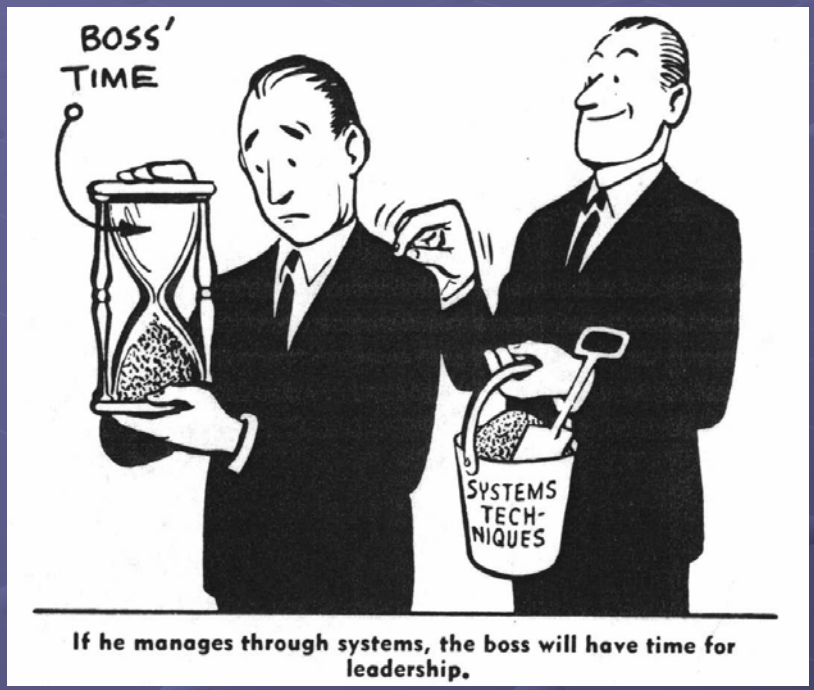
The “Systems Men”

- Systems and Procedures Association
  - Chartered 1947 (informally 1944)
  - Spread very rapidly in early 1950s
- Managerial Technicians
  - Corporate
  - Staff role – advisory, not supervisory
  - Aspire to true managerial power

Who Were The Systems Men?

- World War II was genesis of movement
  - Administrative innovation for wartime production
  - Seek to apply rational, scientific, systems approach
- Thrive with shift to multidivisional organization
- Self-consciously modern group
  - Mostly originating in accounting departments
  - Parallel with, but separate from, industrial engineering
  - Even lay claim to being “information engineers”

Great dreams…

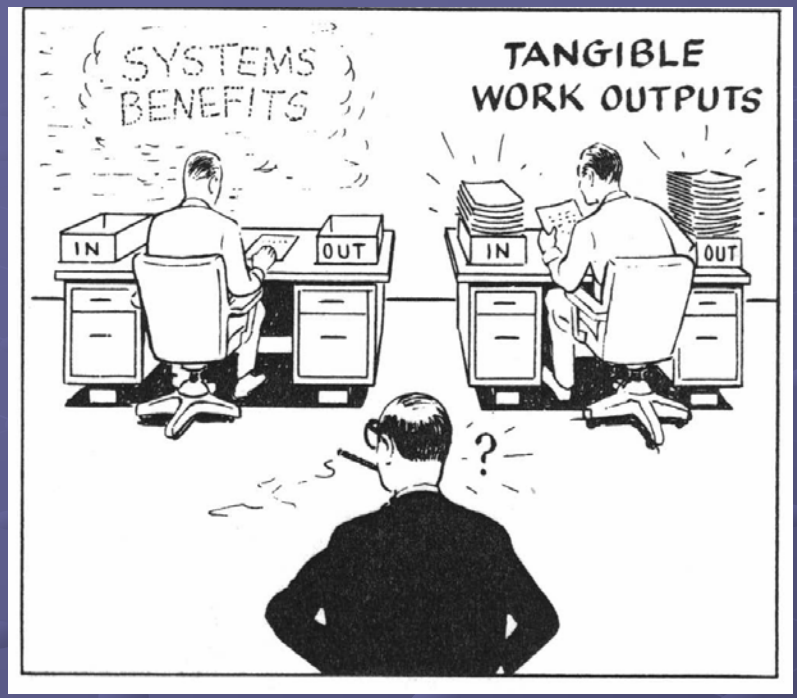


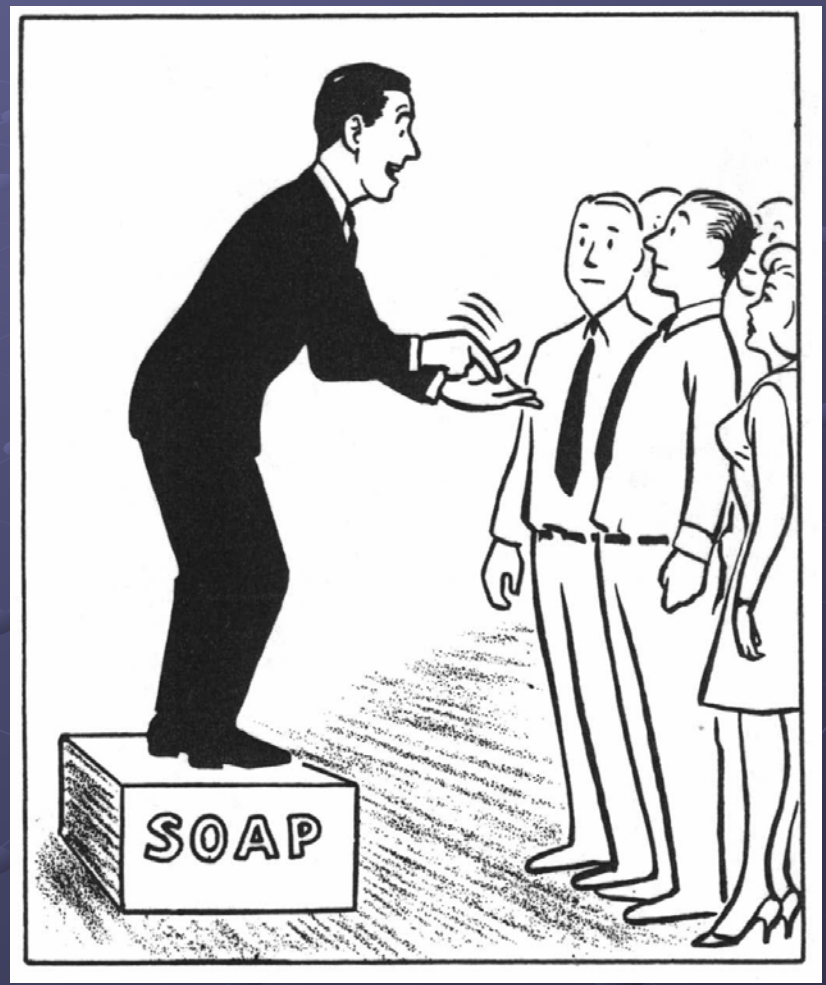
If he manages through systems, the boss will have time for leadership.

- Management Generalist
  - Technocratic mandate from top executive
  - Audit departmental effectiveness
  - Reorganize departmental structure to unlock efficiency, "re-engineering and replanning the entire system"

(1958 presidential address)

… but limited respect





- Write manuals
- Improve clerical procedures
- Design forms

“Generalist” Experts

- Try to build a profession around toolkit
  - Form Design; Report Design
  - Procedures Manual; Workflow study
  - Punched card methods, etc.
- Generalist case hard to make
  - Claim management methods as technical expertise
  - Executives respect technologies, specialists more than managerial generalists
- Increasingly tied to computer

Systems vs. BRP

- Technocratic Mandate
  - Who is the “engineer”
  - What are they an expert it?
- Role of Consulting Firms
  - How to square with authority of managers?
- Appeal to Computing Departments

New Approach II: Enterprise Resources Planning

ERP

- Enterprise Resources Planning
  - Not very meaningful term
- Packaged enterprise suite
  - SAP/R3 is best known
- Modules for different functions
  - Finance
  - Logistics
  - Personnel
  - Order processing

ERP – Benefits

- Operational efficiencies
  - Software is pre-integrated
- Less work on ad-hoc fixes
- Better information flow
- Improved managerial control
- Reduced support burden
  - Spread maintenance costs
  - Skills more available
- Proven methodologies, technologies

ERP in Practice

- Forces difficult standardization
  - Between divisions
  - To fit constraints of package
- Slow, expensive process
  - Average of two years
  - Cira $50,000 per seat!
  - Huge boom for consultants

How New is ERP?

- Main ideas:
  - Total integration of administrative processes is possible on operational basis
  - Packaged software is the best basis for this system
  - Business processes, jobs, must be altered to exploit technology

The Computer Enters Business

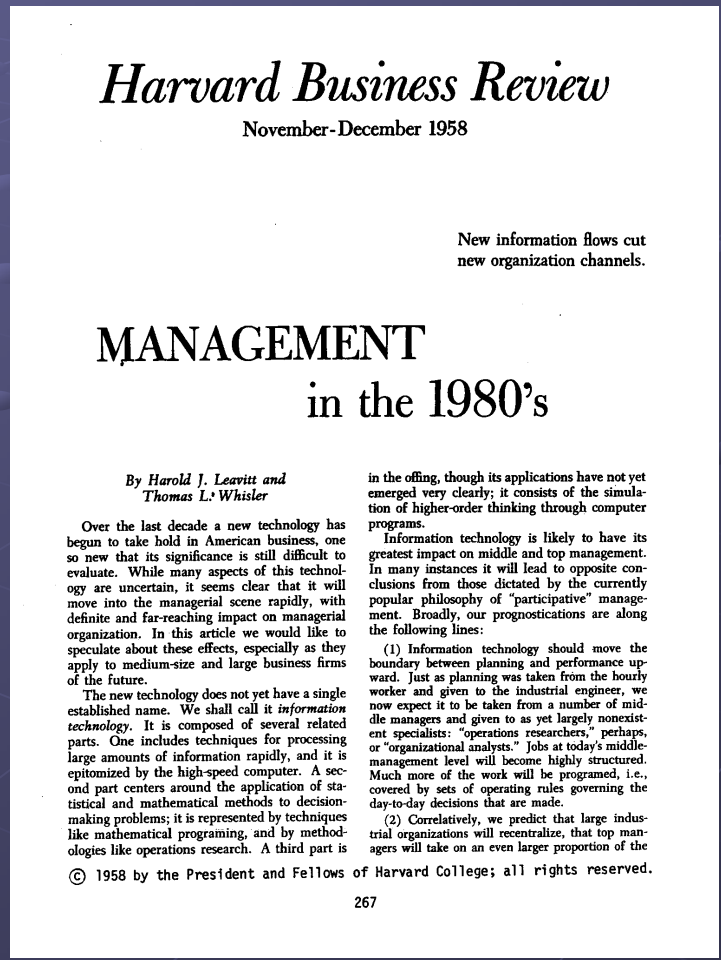
Claims for Computer, 1953

"We can set our course towards push-button administration, and God willing we can get there…The ominous rumble you sense is the future coming at us.
…the potential effect of electronics is of the order of that wrought by moveable type. The changes ahead appear to be similar in character but far beyond those effected by printing."

Worthington, W. B. "Application of Electronics to Administrative Systems." *Systems and Procedures Quarterly* 4, no. 1 (1953): 8-14.

Information Technology

- 1958 – Harvard Business Review – “Management in the 1980s”.
  - First use of phrase “Information Technology” for computers.
  - Extremely influential
- Business school professors and computers as new managerial elite



Harvard Business Review

November-December 1958

New information flows cut new organization channels.

MANAGEMENT in the 1980's

By Harold J. Leavitt and Thomas L. Whisler

Over the last decade a new technology has begun to take hold in American business, one so new that its significance is still difficult to evaluate. While many aspects of this technology are uncertain, it seems clear that it will move into the managerial scene rapidly, with definite and far-reaching impact on managerial organization. In this article we would like to speculate about these effects, especially as they apply to medium-size and large business firms of the future.

The new technology does not yet have a single established name. We shall call it *information technology*. It is composed of several related parts. One includes techniques for processing large amounts of information rapidly, and it is epitomized by the high-speed computer. A second part centers around the application of statistical and mathematical methods to decision-making problems; it is represented by techniques like mathematical programing, and by methodologies like operations research. A third part is in the offing, though its applications have not yet emerged very clearly; it consists of the simulation of higher-order thinking through computer programs.

Information technology is likely to have its greatest impact on middle and top management. In many instances it will lead to opposite conclusions from those dictated by the currently popular philosophy of "participative" management. Broadly, our prognostications are along the following lines:

(1) Information technology should move the boundary between planning and performance upward. Just as planning was taken from the hourly worker and given to the industrial engineer, we now expect it to be taken from a number of middle managers and given to as yet largely nonexistent specialists: "operations researchers," perhaps, or "organizational analysts." Jobs at today's middle-management level will become highly structured. Much more of the work will be programed, i.e., covered by sets of operating rules governing the day-to-day decisions that are made.

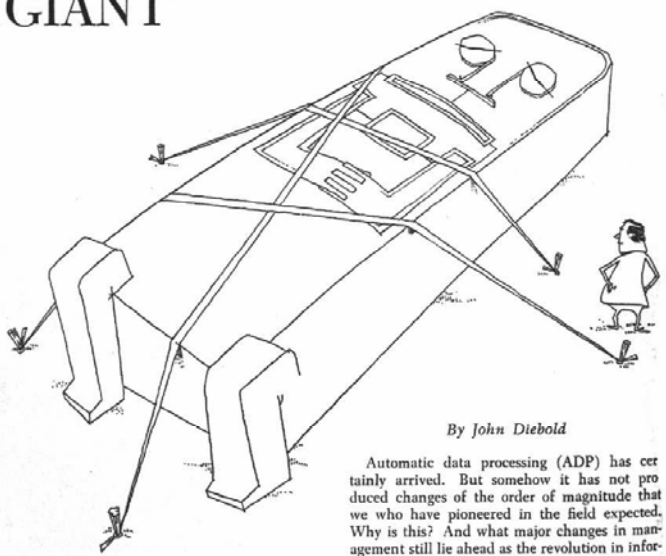
(2) Correlatively, we predict that large industrial organizations will recentralize, that top managers will take on an even larger proportion of the

Total Systems

- “Totally Integrated Management Information System”
- From 1962 to 1970 – dominant idea for correct role of the computer in management
  - All information, instantly, all managers, whole firm
  - System include models, forecasts, projections
  - Used directly by top executives
  - Real-Time, On-Line

This Will Realize Potential of computer…

ADP – THE STILL-SLEEPING GIANT



By John Diebold

Automatic data processing (ADP) has certainly arrived. But somehow it has not produced changes of the order of magnitude that we who have pioneered in the field expected. Why is this? And what major changes in management still lie ahead as the revolution in information technology gathers momentum?

Speedy and Spotty

Let's take a quick look at the record since ENIAC and Mark I made their appearance 19 years ago. In that brief period five distinct phases may be discerned:

60

(1) First, there was the coldness of potential users in the early 1950's. Typical of this period is the controller who quoted me Pope's "Be not the first by whom the new is tried, nor yet the last to lay the old aside." Everyone was from Missouri and had to be shown.

(2) Next came the status "kick" of 1956–1957 when corporate presidents decided they had to keep up with the Joneses. Four-color photos of walnut paneled, deep-carpeted, "showcase" installations graced corporate annual reports, and yet-to-be-realized savings by computers were what the presidents bragged about to one another out on the golf course.

(3) Then, with the onset of the 1957 recession, came disillusion as the initial installations failed to live up to expectations. Naive early projections of big payoffs changed in a matter of months to an attitude reminiscent of Damon Runyon's character, Harry the Horse, on his way to the track: "I hope I break even today — I need the money."

(4) The fourth era was ushered in during the early 1960's. It was characterized by a growing sophistication on the part of business regarding at least the obvious data-processing applications (as more programmers and other trained personnel became available). Of especial importance, there was a growing appreciation by computer manufacturers of business data-processing problems, which affected computer design.

(5) Finally, today, we have routine acceptance of the electronic computer as an everyday tool of business. Almost 15,000 computer systems are now installed in this country alone. And, of even greater significance, more computers are now on order than have been built in the past 15 years.

"BE NOT THE FIRST BY WHOM THE NEW IS TRIED, NOR YET THE LAST TO LAY THE OLD ASIDE!"

"OF COURSE OUR INSTALLATION IS A SUCCESS – FOUR-COLOR PICTURE SPREAD IN LAST MONTH'S OFFICE INTERIORS – NEXT MONTH, HOUSE BEAUTIFUL!"

"I HOPE WE BREAK EVEN TODAY – WE NEED THE MONEY!"

Unrealized Potential

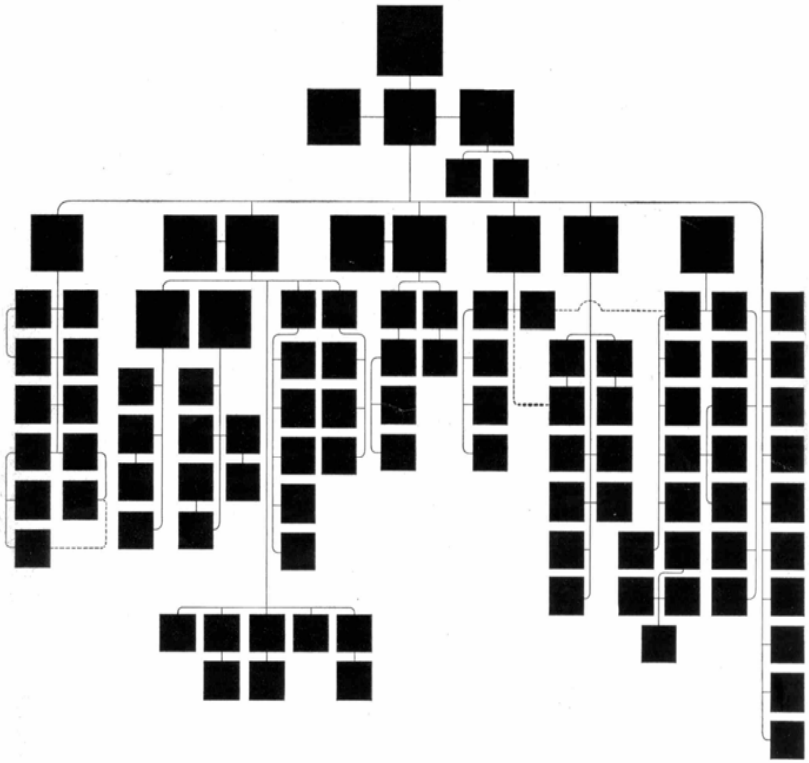
Of course, many of the 15,000 ADP systems in use are more than paying their way, and some are performing tasks that were not possible before. But even in the best applications we have not come close to realizing the computer's true potential. Let me hazard some reasons why.

Deterring factors differ from installation to installation. Sometimes — but rarely now — the equipment is at fault. In most cases the problem can be laid right on management's doorstep:

- Inadequate planning, mostly parochial rather than corporate-wide in scope.
- Not enough fresh thinking, and too much reliance on canned approaches.
- Selection of the wrong people to plan the installation — i.e., technical specialists who fail to acknowledge or even appreciate their limited understanding of business practice.
- Overemphasis on hardware and underemphasis on the design of comprehensive systems.

These are serious faults. But the basic problem lies deeper. It is far more subtle, yet in a

Harvard Business Review - 1964



Your business.

16

Your business with a Univac Total Management Information System.

Management is no longer the remote apex of a pyramid but the hub of a wheel. Lines of communication are direct. Every area of activity is monitored on an absolutely current basis. And centralized control of decentralized operations becomes a reality. Painlessly.

There are three distinct Total Management Information Systems graded for businesses of varying size and complexity and known collectively as The Univac Modular 490 Real-Time Systems.

For information about them, get in touch with the **Univac Division of Sperry Rand Corporation.**

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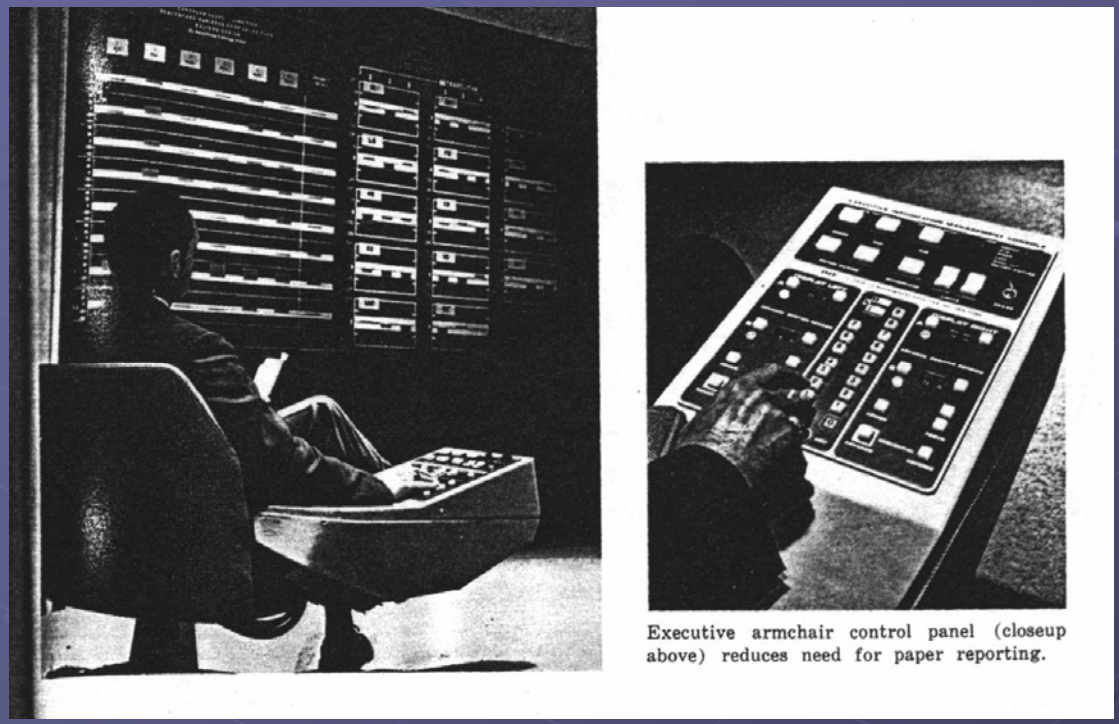
Univac Advertisement, Business Week 1965

An Information Utopia (1968)



Executive armchair control panel (closeup above) reduces need for paper reporting.

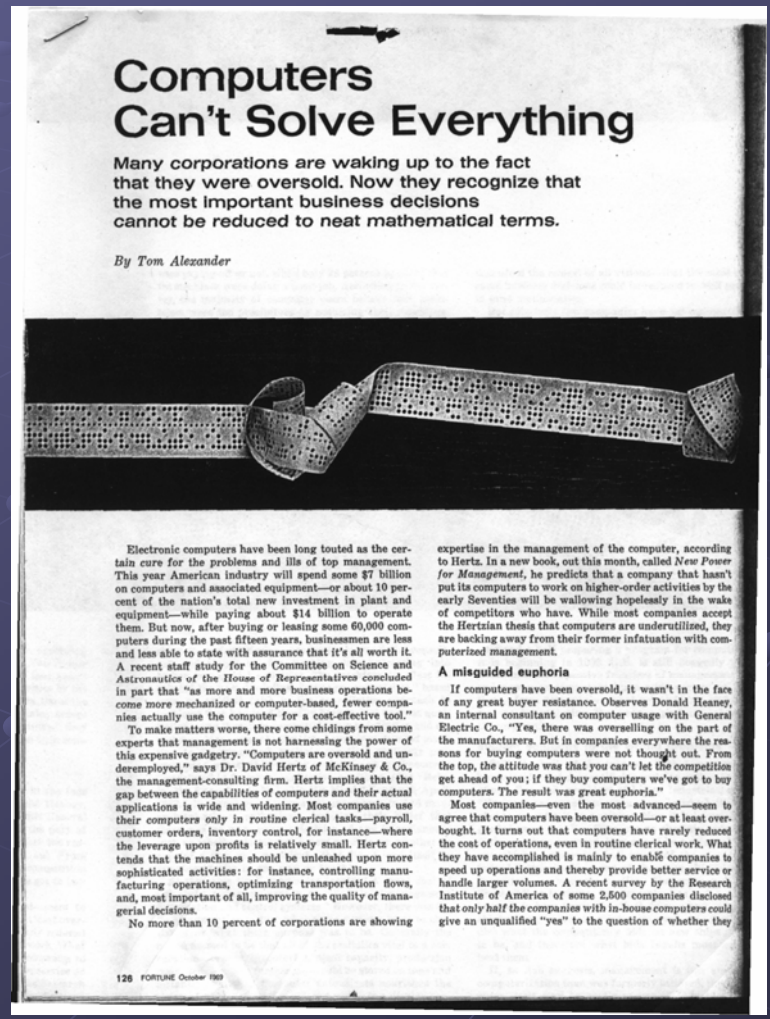
a more relaxed, leisurely management environment. The uneasiness will be replaced by a feeling of confidence in the completeness and timeliness of information and in the decisions based on that information....

Problems of Total Systems

- Impossible to build at the time
- Rigidity imposed by computerized system
- Managers can’t define “information needs”
  - Most executive information is not a by-product of routine transactions
- Expense of real-time operation hard to justify
- No rush to reorganize corporation
  - If responsibilities remain within functional bounds, so can information

The Fate of MIS/Total Systems

- MIS redefined by 1970s
  - “total” part downplayed
- Backlash grows in elite management press
  - MIS remains term for computer study in business schools
  - New name for computer department



Computers Can't Solve Everything

Many corporations are waking up to the fact that they were oversold. Now they recognize that the most important business decisions cannot be reduced to neat mathematical terms.

By Tom Alexander

Electronic computers have been long touted as the certain cure for the problems and ills of top management. This year American industry will spend some $7 billion on computers and associated equipment—or about 10 percent of the nation's total new investment in plant and equipment—while paying about $14 billion to operate them. But now, after buying or leasing some 60,000 computers during the past fifteen years, businessmen are less and less able to state with assurance that it's all worth it. A recent staff study for the Committee on Science and Astronautics of the House of Representatives concluded in part that "as more and more business operations become more mechanized or computer-based, fewer companies actually use the computer for a cost-effective tool."

To make matters worse, there come chidings from some experts that management is not harnessing the power of this expensive gadgetry. "Computers are oversold and underemployed," says Dr. David Hertz of McKinsey & Co., the management-consulting firm. Hertz implies that the gap between the capabilities of computers and their actual applications is wide and widening. Most companies use their computers only in routine clerical tasks—payroll, customer orders, inventory control, for instance—where the leverage upon profits is relatively small. Hertz contends that the machines should be unleashed upon more sophisticated activities: for instance, controlling manufacturing operations, optimizing transportation flows, and, most important of all, improving the quality of managerial decisions.

No more than 10 percent of corporations are showing expertise in the management of the computer, according to Hertz. In a new book, out this month, called *New Power for Management*, he predicts that a company that hasn't put its computers to work on higher-order activities by the early Seventies will be wallowing hopelessly in the wake of competitors who have. While most companies accept the Hertzian thesis that computers are underutilized, they are backing away from their former infatuation with computerized management.

A misguided euphoria

If computers have been oversold, it wasn't in the face of any great buyer resistance. Observes Donald Heaney, an internal consultant on computer usage with General Electric Co., "Yes, there was overselling on the part of the manufacturers. But in companies everywhere the reasons for buying computers were not thought out. From the top, the attitude was that you can't let the competition get ahead of you; if they buy computers we've got to buy computers. The result was great euphoria."

Most companies—even the most advanced—seem to agree that computers have been oversold—or at least overbought. It turns out that computers have rarely reduced the cost of operations, even in routine clerical work. What they have accomplished is mainly to enable companies to speed up operations and thereby provide better service or handle larger volumes. A recent survey by the Research Institute of America of some 2,500 companies disclosed that only half the companies with in-house computers could give an unqualified "yes" to the question of whether they

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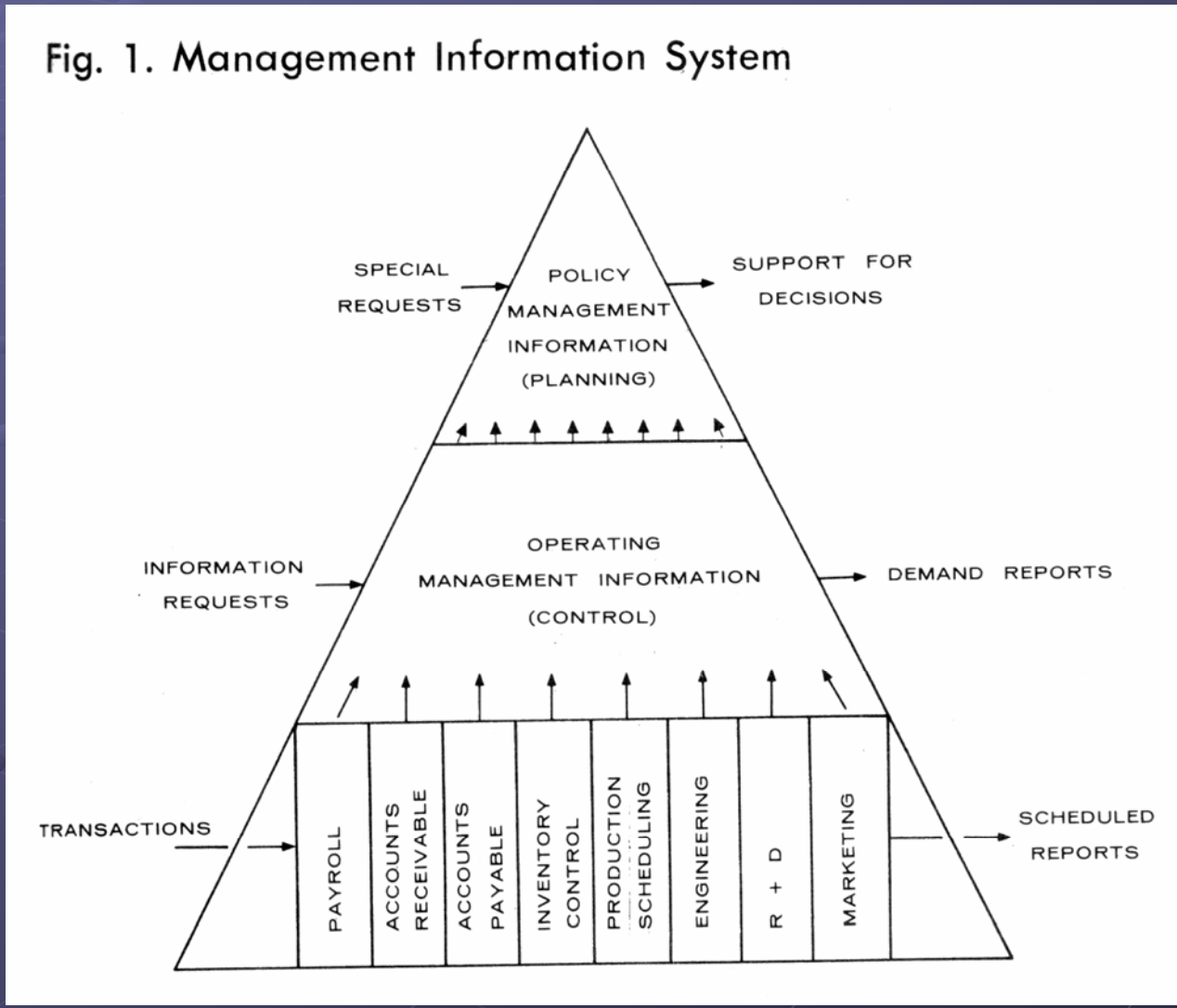
Parallels with ERP

- Alike
  - Integration of operational, administrative systems
  - Vendors, consultants sell to top management
  - Firms rush into whether need or not
  - Expected benefits hard to realize
- Different
  - ERP is technologically possible
  - ERP relies on packaged software

New Idea 3: The Data Warehouse

The Information Pyramid (1967)

- "Information" ties together all levels of management & operations
- Bottom level of the pyramid is the **"data base"**



Hopes for MIS reborn with DB

- “Writings on MIS have waned recently and have largely been replaced by writings on the Data Base” (1973)
- The “Data Base Administrator”
  - Originally expected to take responsibility for “data as a resource… much broader than machine readable data” (1974)
  - “something of a superstar” (1975)
- DBMS technology expected to build integrated, company wide DB

Data Base Management System

- New concept in early 1970s
- DBMS as software layer between data, users
  - Different interfaces, languages for
    - Programs & programmers
    - Ad-hoc managerial reporting
    - Data definition
    - maintenance and administration
- Hopes for managerial use
  - Respond instantly to arbitrary query

DBMS usages in the 1970s

- Advantages mostly for programmers
  - easier reporting,
  - Program/data independence
  - faster application development,
  - easier maintenance
  - better integration of different applications
- Integration proves harder than expected
- Help with conversion to disk and multitasking operating system

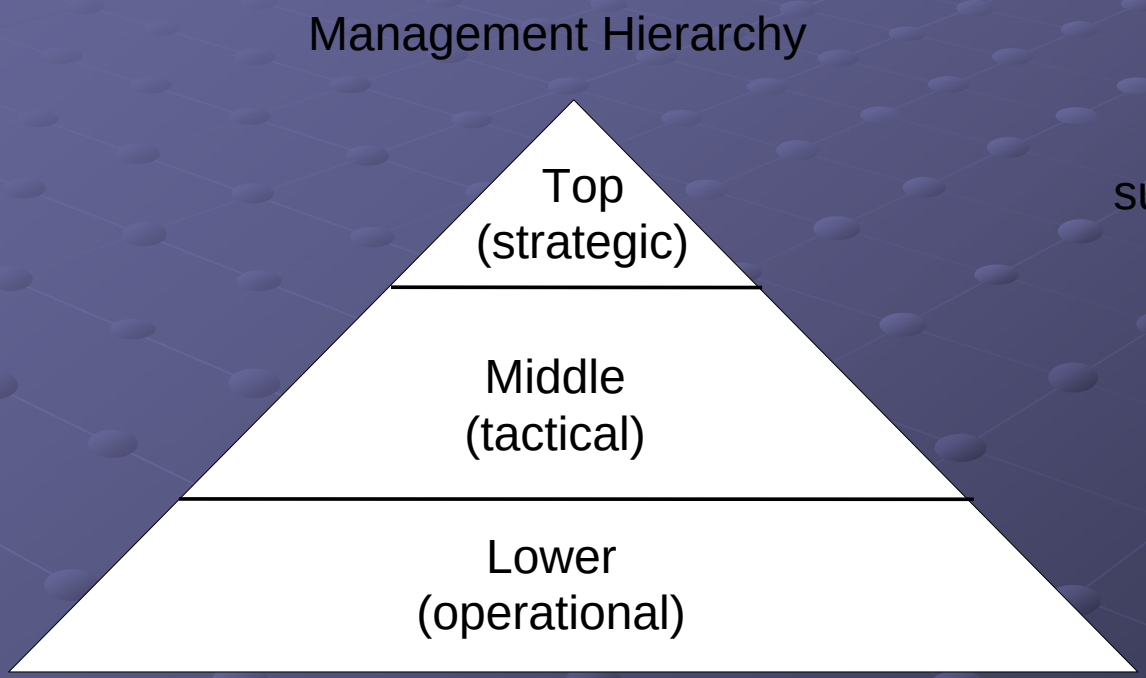
Not One Big Database

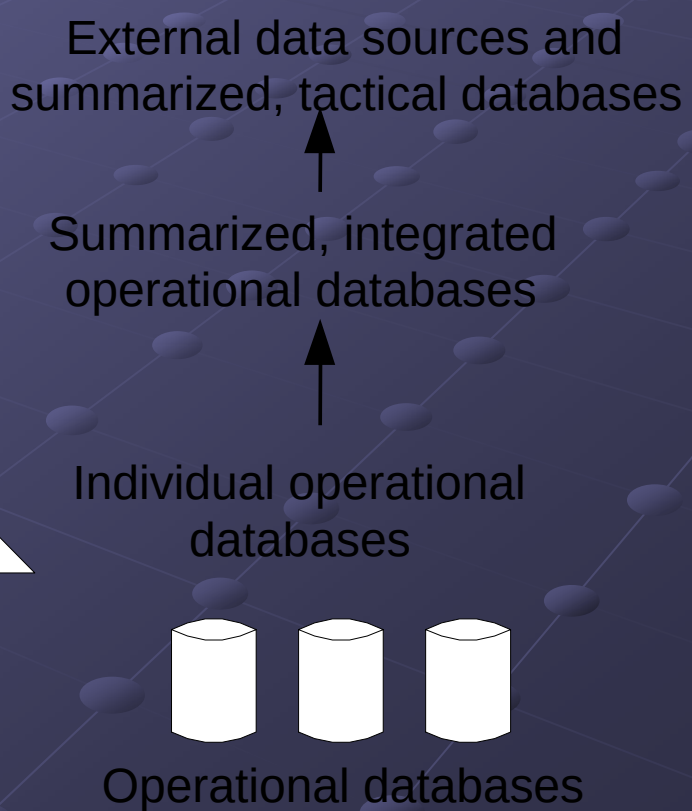
- Big central database doesn't work
- Finish up with dozens/hundreds of little data bases
  - Physically separate
  - All incomplete
  - Different data formats
  - Different concepts of data
- Dominant model is "relational" (eg Oracle)
  - Good for updating
  - Flexible
  - Can be slow & complex to extract data for reports

Data Warehouse Concept

- Emerges early 1990s
- One big DB for everything has failed, so
  - Leave “transactional” systems spread out (physically, organizationally), BUT
  - Make a second, read-only copy of everything in a centralized “data warehouse”. Update regularly.
- Lots of work for consultants
  - Copying, “cleaning”, reformatting data
  - Restructuring data around business areas and for easy querying
  - Providing query tools for managerial users

From Recent DB Textbook





Data Warehouse -- Practice

- Many systems limited in scope
- Enormous on-going costs
  - Import routines must be maintained
- Managers often fail to use

4: Other New Ideas

CRM

- Customer Relationship Management
  - Aim: “help companies keep track of their customers and boost revenues by increasing customer loyalty”
  - Customer database integration
  - Sales/service force automation
  - Data mining tools
- Vendors promote packaged systems
  - Siebel Systems pioneered

Backlash Came Quickly

“most Fortune 500 companies are involved in some sort of CRM project, experts say, and many multimillion dollar initiatives have quietly stalled or failed as executives search for business benefits and salespeople shy away from technology they say won't help them.”

Patton, Susannah. "The Truth About CRM." *CIO Magazine*, May 1 2001.

Knowledge Management

- Movement launched in mid-1990s
  - “Knowledge” as more general, free-form than “information”
  - Shift focus from technology to people
  - Ties to information science
- Term gets applied to a lot of software
  - Early attempts center on “knowledge repository”

Knowledge Management

"KM has fallen victim to a mixture of bad implementation practices and software vendors eager to turn a complex process into a pure technology play. The result: Like many a business concept, KM has evolved from a hot buzzword to a phrase that now evokes more skepticism than enthusiasm."

Berkan, Erick. "When Bad Things Happen To Good Ideas." *Darwin Magazine*, April 2001.

Real Time Enterprise

"In the real time corporation… information becomes more current… because you are eliminating steps of inefficiency. Because information comes in real time, senior people get to make more decisions."

Vinod Kholsa, venture capitalist and Sun Microsystems co-founder, 2002.

Conclusions

Lessons

- Role of fads cannot be ignored
  - Premium on apparent novelty
  - Disillusion with one idea lays ground of next
- History matters
- Technology cannot solve organizational problems
  - Yet technology is so much easier to sell
  - Technical expertise so much easier to define
  - Standard solution may not be good fit

Difficulty in Combining Technical and Managerial Expertise

- Rapid pace of technological change
  - Always expected to slow down.
  - Can’t wait for it to go away.
  - Can’t “educate” managers
- “Alignment” is much harder said than done
- How to manage technology without understanding it?

Integration – An End in Itself?

- 2001 survey (Cutter Consortium)
  - Integration of legacy systems & e-business as #1 issue
  - “much of our industry suffers from the delusion that total integration is achievable.”
  - “the vision is a chimera, a false goal that encourages, at best, frustration over dashed hopes and, at worst, misallocation of IT resources.”

Pickering, Chris. *E-Comment: The Integration Chimera* internet.com, July 18 2001

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- Papers (4 published, one forthcoming, one draft), including “Inventing Information Systems”
- Information on research project
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