Look Before You Leap:
The Concealed Costs of Downsizing

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Background

All of us in IS are victims of paradigms. What are paradigms? Paradigms are patterns or models of behavior. They are rules and regulations. They set how to solve a problem with the rules, and filter incoming experience - while trying to ignore the rest of unfamiliar input.

This is called the *Paradigm Effect*. For example, in one of my post-graduate classes we enacted a playing card flip exercise. Using video technology, we were able to flip cards at 1/30 of a second. At this speed, we could recognize six out of eight cards; but we failed to recognize two cards. We eventually slowed the card flip speed to about 1/8 of a second. At that point, we realized why we could not recognize the two cards - they were in a wrong color suit. The eight of hearts was black and the six of spades was red. Our minds had grown so accustomed to associating a color with a particular card suit. This was but one example of how all of us are unconsciously accustomed to patterns of behavior.

There is one particular pattern of behavior of which people in IS should be aware. That behavior, specifically, is the propensity to search for a technological solution to productivity problems, rather than concentrating on business solutions.

I am not suggesting that we quit trying new ideas and technologies. On the contrary, I advocate change. As Charles Kettering has articulated, "The world hates change, yet it is the only thing that has brought progress." Change is *necessitated* for a business entity's survival.

It is where your energies are being channeled searching for productivity gains that I would like you to reconsider.

Historically, IS professionals have looked to newer technologies to facilitate our productivity gains. But this habit of relying on technical advances needs to change, as necessitated for a business organization's survival. As imparted by Robert H. Deming, from Harvard's Graduate School of Business, in his doctoral dissertation investigating American businesses,

> "One great weakness of business in general, is to look to the past, since it has been successful, as providing the answer for the future. Guidelines based on history may be useful to top management as check points, but when they start to become absolute and binding, they endanger adequate long-range planning."

Plainly, change is necessary if an organization is to survive into the next century. For the past 20 years, technology has enhanced the capabilities of countless organizations. However, the 'capability curve' has flattened. There is an over-reliance on technology to accomplish the IS department's goals. As articulated by the computer scientist Cherian Thackenkary,

> "What is overlooked in these analyses is the fact that the United States has invested more heavily in information technology equipment in the last decade than perhaps any other industrialized country

> in the world. Yet, we cannot overlook the fact that a trillion dollars worth of IT investment in just the last decade has failed to produce any great impact on the rate of growth in our productivity."

Emotions can run high at the mention of this productivity paradox. Stating that computers have not delivered their long-promised productivity payback sends shock waves through high-tech North America. And with good reason! Such a statement challenges the heart of the supposed miracles of information technology.

The critics will say that it is a measurement problem. Surely, technology has great value - value that has escaped economic measurement systems. Fix the metrics, and the productivity paradox will vanish.

The National Academy of Sciences recently published a volume titled *Information Technology and the Service Society: A Twenty-First Century Lever*. In its simplest form, the paradox went like this: America's vast service sector - industries such as banks, airlines, telecommunications, and retail that collectively own about 85% of the nation's installed base of information technology - was stuck in a quagmire of disappointing productivity growth. In the 1980's this segment of the economy spent $860 billion on hardware alone. At the same time however, service sector productivity failed to respond, continuing to increase at an anemic 0.7% average annual rate. The widely presumed benefits of the information age are starting to ring hollow.

We've talked about productivity, but what about profitability? Paul Strassman, the former Chief Information Officer at Xerox, published an article in Computerworld last February 19, 1996. In this article, Mr. Strassman charted the financial results and operating statistics from 500 U.S., European, and Canadian firms. He concluded that '...computer expenditures and corporate profits show no correlation whatsoever, and it is unlikely that any such relationship can ever be demonstrated.'

As the Nobel Laureate economist Robert Solow has expressed: "We see computers everywhere except in the productivity statistics."

The In Thing: Downsizing

With few exceptions, mainframe sites are either considering, or are in the midst of, downsizing from their mainframes. It is rare nowadays to find a reference to mainframes in the press that does not state that they are obsolete, expensive, and doomed to extinction in the near future. Because of this negative notion, there is much talk about downsizing from mainframes to smaller systems.

We are bombarded with questions such as: When is your site transitioning to open systems? What front-end to Sybase did you choose? When are you getting rid of your mainframe and save some money? Proponents of downsizing rarely cite *financial* justification for the argument of downsizing; it is *assumed* that mainframes are more expensive.

It is incorrect to *assume* that the current state of client/server is ready for large-scale production and mission-critical systems. Bad habits can be carried over to newer technologies. Faulty systems can be developed in any language. Scientists have not developed a programming language so good that people can't use it to write bad programs. No design methodology currently exists that is so good that a bad coder cannot totally destroy the integrity of the final product. 'Open Systems' is an oxymoron; UNIX, for example, comes in an agitating variety of flavors. And your users will not become better users merely by being arrayed with new technologies --- there are strong inward expectations from the user community. Have you noticed that your users' needs are always beyond what you and your systems can deliver?

Undoubtedly, there is a strong increase in the number of new applications being developed in client/server technologies. There are many situations when an IS department might develop a new application on a client/server platform.

In a 1993 survey conducted by the big-six accounting firm *Deloitte & Touche* and published in *Computerworld*, a poll of more than 400 CIOs showed that 27% of their applications were on a client/server platform, up from 5% in 1992. And, a 1994 survey conducted by the same firm on the same CIOs indicated that 43% of their applications were on a client/server platform, up significantly from 27% in 1993. The survey did not take into account the size of these applications --- but just the number of applications.

This survey, though, also showed a distressing conclusion. The 1993 average IS budget only rose by 0.04%. However, companies making use of client/server technologies in 1993 saw jumps of 9%. And in 1994, companies with more than 25% of applications on client/server saw jumps of 16%. What this means, according to the person who headed the study, is that "....client/server is not cheaper. When you are making a commitment to client/server, you are making a dollar commitment."

This was no surprise to many people. For example, Rose Taylor, the general manager of planning and architecture at *Chevron*, said that "Many outside consultants and companies are selling client/server as the latest and greatest thing to solve all your problems." Charles Popper, the CIO

for *Merck & Co.*, indicated that "...the dissatisfaction we've seen relates to the cost of client/server." Steve Pliskin, a principal at *Deloitte & Touche*, articulated that "They [the industry] sold an awful lot of technology before its time."

The True Cost of Mainframes

The numbers in this section are mostly based on the technical paper 'The Dinosaur Myth' published in the IBM DB2 Users Journal. There is no need to regurgitate the numbers in the 'Dinosaur Myth' paper here. I strongly recommend that you read the paper, and even distribute it to your peers. However, I have summarized most areas of note. This paper was first published in the computing journal Xephon and re-published in the IBM DB2 Users Journal.

MIPS

A large mainframe, with hardware and software, can cost between £10 to £20 million pounds. The most expensive IBM-compatible Pentium-based PC can be purchased for less than £10000 pounds. It would be naive to say that PCs are 1000 or 2000 times more productive than mainframes. What is needed is a more common yardstick of computer effectiveness by which systems of all sizes can be compared.

Processing speed, or the rate at which a computer can process instructions, is one possible measure. Dividing the cost of the computer by its MIPS rating would seem a convenient measure of effectiveness. A large mainframe running at 220 MIPS costing £8 million pounds will have a cost-per-MIPS of £36,000. A PC on the other hand, might have a cost-per-MIPS rating of £100. Clearly, in this measure the mainframe would have a disadvantage.

However, MIPS for years has stood for Meaningless Indicator of Processing Speed in our computing industry. Computers of different designs do not have the same criteria regarding which instructions should be counted in calculating MIPS ratings. And some designs have rich instruction sets, whereas RISC-based processors have a small set of simple instructions. MIPS is not a sensible measure of processing speed, even when comparing systems of similar design.

Data Handling

For most organizations, the work is data-intensive rather than processor-intensive, where relatively simple operations are applied to very large amounts of data. The calculations for producing an invoice or airline seat reservation are trivial, but a lot of data has to be retrieved, updated, and stored. Mainframes are specifically designed for data-intensive work, with very sophisticated data-handling routines - nowadays performed by multiple dedicated processors in the central processing box and the peripheral devices attached to it.

In practice, most mainframe shops are data rich, and MIPS poor --- that is, they control very large amounts of data with a relatively modest amount of processing power. In a survey by IBM of 807 installations, it was found that the mainframe typically had 3 gigabytes of data per MIPS, UNIX minis a fifth of a gigabyte, and a tenth of a gigabyte for PCs.

It is easy to make a case that the amount of data managed by the computer is of greater practical significance than speed at which the computer can perform a million additions or subtractions. Most organizations have massive files that need to be accessible. And by that measure, mainframes have as clear an advantage over minicomputers as minicomputers ostensibly have over mainframes in terms of MIPS.

User Effectiveness

Data handling speed is not an entirely satisfactory measure of a computer's effectiveness for an organization. What really matters is the number of users, performing whatever functions are necessary to the organization, that a computer can support with a reasonable level of service. If this criterion is accepted, then the key measure of a computer's effectiveness is the total cost per user over a reasonable span of time - say, five years.

The costs of computing can be divided into three categories:

- hardware, including printers, operating software, terminals. This has to include the cost of maintaining hardware over that period.
- applications software, including off-the-shelf packages and customized programs to allow the computer to do useful work.
- personnel costs associated with operating the hardware and software. This includes time wasted waiting for the computer system.

In the hardware category, we will look at numbers comparing an IBM ES/9021 and IBM ES/9021-520 (equivalent of an IBM 3090-600J) versus an HP 8XXS, running UNIX, capable of supporting 200 users. Here are the calculations for the basic hardware, software, and maintenance costs over five years for these two systems. These numbers exclude finance charges and inflation. The estimate for per user cost:

IBM - £1545 to £2236; HP - £1680 to £2240

These are based on a workload of commercial applications and office systems, and assume that 60% of users are active at any time, and that each active user interacts with the computer every 45 seconds.

These figures make no allowance for batch processing. Most sites use the overnight shift to reorganize files to improve on-line performance during the day. Mainframes are the undisputed masters of batch processing, while on-line networks are only active during office hours. However, due to the difficulties in quantifying batch processing in terms of effectiveness, it was decided to leave out the benefits of batch processing altogether. Besides, the concept of 'batch' is foreign to most client/server platforms.

Applications Software

For the IBM mainframe, the study used a ratio of one programmer for every ninety users. For an installation of 6690 users, that equates to a 75-member development staff, which at £25,000 a year, works out to £280 per user, or £1440 over five years.

The study concluded that it was likely that the cost for downsized platforms using packaged software would be less --- say £200 per year, or £1000 over a five-year period. Many packages are available for the mainframe also, but most large organizations, particularly those that use computers to gain a competitive advantage, regularly pay a premium for tailored software. The Japanese, in particular, are very averse to off-the-shelf software; and clearly, they have not suffered competitively as a consequence.

So in terms of application software, downsized platforms have an advantage over mainframes. However, the study based its numbers on the HP specifications that called for a user response time of 2-4 seconds, which is a common criterion for downsized platforms. Mainframes, on the other hand, are generally configured for sub-second response times. It was estimated that downsized configurations capable of supporting 50-60 users would cost at least £2500 more per user over a five-year period. Today, even the largest client/server platform cannot support 200 concurrent on-line users with sub-second response time. IBM's marketing literature for client/server platforms classifies configurations supporting more than 25 users as 'large systems.' An under-figured system, although cheaper, will carry a cost penalty.

Personnel

Let's look at personnel costs. All computers require some human supervision, except Commander Data of the starship Enterprise. The costs of running mainframes are very visible; operators and systems programmers who do nothing but administer the mainframe. Current mainframe configurations require one technician for every two mainframe MIPS, which, at an average employment cost of £30,000, suggests a total of £1.875 million in salaries for a 125-MIPS IBM mainframe to support 6690 users. That would amount to £1401 per user over a five-year period.

For downsized platforms, fewer technical staff are required because these systems do not normally operate 24 hours a day, like mainframes are expected to do. The study estimated a cost for operators of £75 per user per year, or £375 for a five-year period. However, it is estimated that one full-time specialist is required to support every 80 users in a typical client/server environment. If the specialist costs £24,000 a year to employ, this computes to a five-year cost of £1500 per user. The total cost for a downsized platform, is £1875 for the 5-year period.

For PC LANs, the numbers are even worse. It is estimated that the average PC user spends two hours a week, or 25 minutes a day, either tending to the system or waiting for a response from it. *KPMG Peat Marwick* estimated a cost for PC support as £6212 per user for each year for support.

Do you really know the cost of PC support? A survey published in *PC Magazine* compared the actual component costs of PCs with the costs perceived by their users. The results are as follows:

	Perceived %	***Actual %***
Hardware	60	20
Software	20	10
Supplies	5	5
Maintenance	5	5
Outside Help	5	15
Support	5	45

In other words, outside help and internal support cost sixteen times *more* than the users suspect, relative to the hardware and software.

White-collar productivity in the United States, which has the world's highest per capita penetration of PCs, increased by just 0.2% in the last decade. Japan, which has the lowest penetration of PCs of any developed country, recorded a far higher productivity growth.

A study published in *Information Week* found:

> "...[there is] a negative relationship between the proportion of users who have PCs and IS effectiveness. Highly effective IS organizations have fewer PCs per worker than ineffective ones."

Dinosaur Study Totals

In addition to what I have summarized above, the 'Dinosaur' paper presented a variety of cost factors. The final totals are indicated in the table below:

	Cost Range
IBM Mainframes	£5285 to £5973
Proprietary Minis	£7306 to £7786
UNIX Minis	£7180 to £7740
PCs on LANs	£9400 to £15,500

As you can see, the final numbers are even more skewed towards giving mainframes the advantage over downsized platforms.

In a separate study, published in the *IBEX Bulletin*, MIS managers were canvassed for the total cost and number of users for the different types of systems they use. This study came up with the following numbers:

Type	*Cost*
AS/400	$6795
Proprietary Minis	$6667
UNIX Minis	$5000
Mainframes	$4800
PC LANs	$3571

The Hidden Costs of Downsizing

Here are additional concerns of downsizing.

Data Integrity

Mainframes have a very high level of data integrity. When a mainframe database crashes, data is restored to pre-abend state. Over 95% of mainframe crashes result in no significant data loss. Contrast this with the typical minicomputer or PC environment, where it's often left to the user to back-up before going home.

Decentralization

Can your organization live with decentralized control? Downsizing is typically accompanied by de-centralizing of data. With the mainframe, there is no question about who is responsible for systems administration, data security, backup, recovery, and other data center functions. But client/server environments often have no central point of control. Client/server involves a whole new world of maintenance. Even simple tasks such as software upgrades can become nightmares without sufficient support.

Partitioning

With the mainframe, applications are always placed on the server. But with client/server technologies, knowing how to partition application logic among client and server nodes can be very confusing. Typically, database-intensive logic is placed on the server, while activities requiring user interaction, such as queries and report writing, are on the client. Once your partitioning is coded in this fashion, it can be very difficult to change short of a complete application rewrite.

Client/server is saddled with the mainframe. Why? The principal problem is distributed database software. It has evolved too slowly during the past decade. Distributed backup, security, and systems management compound the problem. Like it or not, corporate-wide data will remain centralized for the rest of the decade.

Staff Morale

Little consideration is generally given to the IS professional's emotional well-being, as staff can undergo trauma while transitioning to new platforms. With mainframes, you might tweak your database to suit certain situations. But that is nothing compared to the range of things you can do in the UNIX world. Every company knows the expense and frustration of hiring a competent UNIX administrator. You need someone both technically competent and able to work with little

supervision, two fairly difficult traits to assess in the fresh-from-college applicants who are the only ones likely to be interested in what you're willing to pay. Those field-proven UNIX administrators seem to have lucrative consulting careers and are able to name their price. Will management be patient during the learning process? Will there be any mentors?

The new software technologies are utterly different. For instance, in procedural languages you break down work-flow and code it. With the newer object-oriented languages, you break down events and assign attributes to objects without really considering work-flow. To take a programmer from the mainframe world and into the client/server world, takes a certain amount of training, mentoring, and experience to pull off the transition. Of course, if you have solid skills, the transition should not be that difficult. But when you take that step into a new environment, you go back to the starting point. You have to understand that you will be frustrated for a while and just accept it.

New Skills and Training

It is generally easy to re-train people who show that they really want to do it, but what about the others? Do you force-fit them into a new role? For many, it is either a matter of learning new client/server skills, or finding an employer who appreciates the old skills. PowerBuilder contrives an image that developing systems is just a matter of drawing screens and creating icons. Uh-uh - you still have to consider user feedback, the initial needs of a GUI style-guide, understanding object-oriented concepts such as classification and inheritance, and learning C.

Transition costs training. Here are some numbers published by *Forrester Research, Inc*., a Cambridge, Massachusetts consultancy. These costs include training and lost productivity:

- cost to train a central IS person to learn a new infrastructure: $35,000 to $50,000
- cost to train a developer to work on new platforms: $25,000 - $40,000

- weeks of class time for each central IS person: 10
- weeks of class time for each developer: 5
- months of reduced productivity for each central IS person: 4+
- months of reduced productivity for each developer: 2

Bookman Consulting, the software developer that supplies most of the industry's technical exams, published some interesting numbers in the February 20, 1995 issue of *Computerworld*. They indicated that the CICS exam still outsells the PowerBuilder and Visual Basic tests combined. Overall, the CICS exam only ranks as the third-most requested exam; COBOL still ranks as number one by far. Additionally, the DB2 test is requested 50% more times than the Oracle exam; and the Oracle exam, in turn, is requested 2 1/2 times more than the Sybase test.

And Wait! There are many other items to consider.

The Orange County Appraiser's Office, in Orlando, Florida, came up with a list of essential questions after conducting a two-year downsizing effort. These are some of the essential questions they considered:

- Money — What can be spent for hardware, software, and project costs? What is the anticipated return of investment, and over what time period?
- File Sizes — What is the size of the current databases? Will it shrink during migration?
- Databases — What impact will your prior database have on your new selection?
- Batch — What are the batch processing time windows? Will the completely migrated system fit into these windows?
- OLTP — Do on-line transaction rates meet minimum standard of performance for screen transactions, such as a half to full second response time?
- Printing — Can mainframe benchmarks be met or exceeded?
- Maintenance — Will costs drop from the associated mainframe platform, and by how many percent? Aim for a minimum decline of 30% as a first-year target.
- Network — Can the network handle both the downsized and legacy systems as well?
- Hardware — Can workstations be upgraded to the optimal 486s with eight meg of Ram? PC upgrades are perhaps not an issue to private companies, but for state governments with ever-shrinking budgets, this is a definite issue.

The County of San Diego, with an IBM 3090-600J and a 1,400-node telecommunications network, is pondering its future in client/server. They would add these questions to the Orange County Appraiser's list:

- How do we manage the change from enterprise-wide legacy systems to distributed client/server applications?
- What is the real cost of moving to client/server?
- How much of your current software logic can be successfully converted?
- Can your existing staff make the shift? Will you lose your top performers?
- Which UNIX system should you invest in? Should you move to Windows NT? What is the sacrifice of selecting one over the other?
- What controls can you establish for your firm's protection?
- How do you ensure proper disaster recovery?
- Who chooses which client/server products to buy? The IS staff, the user, or a combination?
- How is IS going to maintain the technical knowledge of all the various product combinations possible under client/server?

But Where Do We Go?

Rather than moving systems from the mainframe to a downsized platform, the IS department will commit to uncovering *other* ways by which to leverage technology for competitive gain.

The mainframe is not dead - we've been shoveling dirt on it for the last ten years. This reminds me of the old predictions that programmers would be obsolete in the nineties. How many of us still spend most of our time either coding or creating specifications for code? Well, according to most predictions of the industry clairvoyants, we shouldn't even exist anymore!

In *Forum/204*, the newsletter for the International Model 204 Users Group, the *Mercer Management Consulting* study commissioned by *Praxis* indicated that:

- fully 70% see the mainframe playing a role for years to come.
- 22% stated that the mainframe will continue as the central host.
- 48% indicated that the mainframe will evolve into a central enterprise server.

The decline in departures from the mainframe is supported by other surveys. The following numbers are obtained from a survey done by the *International Data Corp*., who asked,

Is your site downsizing to client/server?

response base: 8,000	**IS Managers**		**LAN Managers**	
	1993	**1994**	**1993**	**1994**
Actively Pursuing	34%	29%	53%	47%
Considering	6%	6%	11%	9%
Not Pursuing	59%	61%	35%	43%
Don't Know	1%	4%	1%	1%

The downsized client/server solution is not usually a cheaper alternative to mainframe-based systems. Nor is it a mandate that all computing centers migrate to this type of platform. It is not that simple for sites that have invested millions of dollars in mainframe systems to convert to another technology. It is incorrect to assume that the current state of client/server/open systems is ready for large-scale production and mission-critical systems.

The *Computerworld* article 'Client/Server Pandemonium', published November 14, 1994, has numerous real-life examples of the hazards in downsizing to client/server platforms.

Conclusion

To this date, my organization knows of no case where a sizable modern mainframe has been *wholly replaced* by client/server minicomputers running the *same* workload. Many downsizing stories in the press, upon closer inspection, are nothing of the kind. For example, one story was about a Data-General mainframe downsizing to seven UNIX-based HPs. Never mind that Data-General has never made a mainframe.

In another story, a System/36 was replaced by a PC LAN. For those that are old enough, you know that a System/36 can be outperformed by a 486. And realize that no one is keen to publicize downsizing blunders.

Downsizing in the commonly understood term just **does not happen**. What does happen, is a sort of incremental downsizing, but rarely with the same functionality.

Of course, mainframe users must take advantage of other technologies. Other platforms have specific strengths - and can be used to complement the mainframe; but not to replace it altogether. An environment of client/server architectures with PCs providing the user interface, the mainframe handling data and systems management, and the processing divided optimally between them - can give the best of both worlds. Even major players in the market such as *Microsoft*, *Intel*, and *Sun* are using mainframes to run their businesses. If the mainframe truly belongs on the junk pile, then why are these vendors not first in line to do so?

It is impossible to fully consider a change in technology without understanding how it applies to the multiple dimensions of an organization's environment. Chief information officers who are naive enough to believe that one right strategy fits every IS organization are probably among the 19% of CIOs that had to clean out their desks last year.

A likely scenario is that organizations will abandon the mainframe, encounter insurmountable problems with the solutions they chose, and revert back to the mainframe. These costs and disruptions, and the serious impairment of computer services during the interim, are enormous. And for many IS professionals, such a mistake could be their last.

Management wants a *business* solution. Rather than jumping on the latest technological bandwagon or downsizing, organizations need to look at *other* means to gain a competitive edge.

Last year, 70% of the Fortune 1000 companies underwent a corporate-wide downsizing effort. Of these, less than half showed increased profitability. Into which half would your organization fall?

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