THE IT PRODUCTIVITY PARADOX REVISITED: TECHNOLOGICAL DETERMINISM MASKED BY MANAGEMENT METHOD

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INTRODUCTION

The information technology (IT) productivity paradox is the perceived discrepancy between IT investment and IT performance, between input and output. The particular perception which launched public discussion of the issue can be dated, with some precision, to a book review by Robert Solow published in the *New York Times* in July 1987 which included the line, "we see the computer age everywhere except in the productivity statistics" (Solow, 1987). From mighty aphorisms little aphorisms grow and other sages readily declared on the issue, Lester Thorow, for example, announcing that "The American factory works, the American office doesn't" and Paul Strassman that "There is no relation between spending for computers, profits and productivity." The topic suited the requirements of the business press perfectly, allowing managers to share concern about a common experience. And fuelling the interest of the business press were the management consultants. Predating Solow by some months is the work of Stephen Roach, a consultant working for Morgan Stanley, who was also to figure prominently in the later discussion.

MEANING AND CONTEXT

The meaning of productivity and of IT would seem obvious enough, but the more the terms were used in the context of the productivity paradox, the less clear they became. Productivity in its crudest, and most common, form is labour productivity - the level of output divided by labour input. More sophisticated is multifactor productivity (ambitiously called 'total factor' productivity), which is the level of output for a given level of several inputs, typically labour, capital and materials (Brynjolfsson, 1993). This

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* In 1999, the Department of Trade and Industry in London commissioned a literature review of, and commentary on, the productivity paradox in information technology (Macdonald, Anderson and Kimbel, 1999). Parts of this paper are derived from that report and a subsequent publication (Macdonald, Anderson and Kimbel, 2000). The author is grateful to John Rigby for collecting the data on which the Figures in this paper are based, and to Patricia Anderson for preparing them.

provides a better guide to efficiency because it adjusts to shifts among inputs, but the data are difficult to acquire. Thus, at the most basic level, discussion about the productivity paradox was torn between a measure of productivity that was preferable but hard to obtain, and a measure that was less satisfactory, but much easier to obtain.

The water was further muddied by the baggage IT had accumulated before Solow's declaration. Throughout the late 1970s and early 1980s, fear was widespread that IT would replace workers - so many secretaries out for every word processor in - (e.g., Windschuttle, 1979), an alarm which seemed to make labour productivity from IT a more apposite measure than total factor productivity. Consequently, interest in labour productivity was directed more towards measuring the impact of reductions in labour input than towards the problems of measuring output with any accuracy. Only when the focus turned to measuring output did it begin to become clear how difficult measurement would be, and indeed how awkward were concepts of productivity designed for the manufacturing sector when transferred to the service sector.

The result was that inordinate effort was put into issues of definition and measurement in addressing the productivity paradox. Economists busied themselves with ever more detailed calculations, and sophisticated justifications of calculations, of IT productivity. The gulf between this esoteric enthusiasm and the approach of the business press yawned. More important, it sucked in and suffocated those who might have applied other perspectives to the paradox. Sometimes the discussion became surreal with definitions of IT abandoning common sense altogether in the determination to follow statistical practice. For example, according to the US Bureau of Economic Analysis, IT was only 'Office, Computing and Accounting Machinery'. This definition discouraged many researchers from including even the categories of communications equipment, instruments, photocopiers and related equipment and software and related services in their calculations of IT productivity.

> "And how long must users of government statistics put up with the total lack of any PPI [producer price index] for the single most important component of PDE [producers' durable equipment], communications equipment, when the PPI contains literally hundreds of detailed commodity indexes for nuts, bolts, pipes, flanges, valves, cans, barrels, pails, tanks, hinges, cleats, knives, and other crude products of lesser economic importance?" (Baily and Gordon, 1988, p.420)

It is important to consider the context in which discussion of the productivity paradox was set in the second half of the 1980s, a consideration which perhaps requires a hindsight that contemporary authors were unable to supply. The productivity paradox

was set firmly in the context of a productivity slowdown which had afflicted the developed economies since the early 1970s:

> "..... the average growth in total factor productivity (labour productivity) for 18 OECD countries fell from 3.25% (4.41%) per year over the years 1961-1973 to 1.09% (1.81%) per year over the years 1974-1992. Why has the productivity slowdown persisted for so long in spite of large absolute increases in research and development, scientific knowledge and technological innovations? This seems to be the essence of the productivity paradox." (Diewert and Fox, 1997, p.3)

The situation was no different in the United States (Brynjolfsson and Hitt, 1998), but the expectation that it should be otherwise was very much greater than elsewhere. IT, or more precisely, its manufacturers, promised rapid recovery from slowdown. Thus, when the general productivity slowdown of the early 1970s coincided with a very rapid increase in the use of IT, there was understandable expectation that the latter would eradicate the former. These expectations were further fuelled by hype, much of it from the IT industry, about the brave new world of the Information Age. Governments, too, contributed to the enthusiasm with policies based on high technology, designed to convert just about anywhere into a bustling Silicon Valley. The Luddism of the 1970s had become outmoded by the early 1980s: new technology would provide new and high-quality employment, new competitiveness and new prosperity. And at the heart of all this new technology was IT.

There seemed to be only one obstacle to IT overcoming the productivity slowdown, and this was simple lack of information capital. An issue prominent in the early 1980s was the discrepancy between capital per information worker and capital per production worker. Information workers, it was argued, were deprived of the level of capital which assisted manufacturing workers and would become more productive with more capital to support them, though not necessarily IT (Strassman, 1985). With growth in the numbers of information workers came a steady increase in their production capital until it eventually equalled that of blue collar workers.

> "Investment in computers at current prices increased at twenty-seven percent per year from 1958 to 1989, while current price GDP expanded at only 7.9 percent and investment at 8.1 percent. During this period average annual inflation rates for GDP and investment have been 4.4 and 3.7 percent, respectively, *while computer prices have declined at an annual rate of 19.8 percent!*" [italics in original] (Jorgenson and Stiroh, 1993. See also Gordon, 1987, p.1)

But no matter how many more information workers, no matter how much more was spent on IT, and no matter how cheap and how powerful computers became, nothing seemed to have any influence on a productivity paradox that, by the late 1980s, simply

could not be ignored. Indeed, particularly galling was the observation that, in as much as there was any recovery in productivity growth in the 1980s, it was in the manufacturing sector rather than the service sector with its much greater investment in IT (Baily and Gordon, 1988). How appropriate, then, that Solow's quip should have appeared in his review of Cohen and Zysman, *Manufacturing Matters: The Myth of the Post-Industrial Economy*.

THE PARADOX UNFOLDS

It is not the case that the productivity paradox started in 1987 because Solow declared it started, and ended in the early 1990s because Brynjolfsson and Hitt, the most prominent and prolific of the academics writing on the subject, declared it ended. There is nothing particularly special about the adoption and use of IT during these years; this is merely the period in which public discussion of the paradox was most intense. The development of the discussion was gradual, it progressed in stages, and it is not over yet.

Stage 1 - In the beginning, because IT was imagined to displace labour, there was great interest in labour productivity and IT, leading to an almost automatic assumption that labour productivity was the appropriate measure of IT impact. There were many studies of clerical employee displacement, and a huge gulf opened between advocates of IT and detractors, with little research to span the chasm (Mandeville and Macdonald, 1980).

> "IBM, for example, instructed its sales employees to ask potential customers what productivity increases they sought, and trained its sales workers to prepare specific projections of the productivity gains to be anticipated. These figures were completely speculative, as old IBM-ers freely admit. No one really knew what productivity effects would occur, and no one, least of all the computer manufacturers, was funding researchers to carefully measure the outcomes of computerization on clerical productivity levels within individual firms." (Attewell, 1993, p.2)

Stage II - By the late 1970s, occasional hints were appearing in a diverse literature that IT performance was less than expected. Even so, computer budgets were huge and growing.

> "... companies were on a treadmill. As their competitors provided services that could only be offered using IT, firms found they had to invest more and more in IT just to stay in the game, whether or not there was a clear ROI [return on investment] for those investments." (Attewell, 1993, p.3)

Indeed, return on investment was just about the most sophisticated tool firms employed for evaluation of IT investment, when they used any at all. So essential was IT reckoned to be that many firms never bothered with evaluation (Farbey, Land and Targett, 1992).

Stage III- In the early 1980s, it seemed a mistake to think of IT in terms of productivity. IT was to be used for a grander purpose altogether, for strategy (Cash and Konsynsk, 1985). Great emphasis was given to case studies where strategic use of IT had produced massive competitive advantage (Wiseman and Macmillan, 1984-5), those of American Airlines (Monteiro and Macdonald), American Hospital Supplies, and Citibank becoming classics in their time. It was important to think of IT in radically new terms. After all, as the business press of the period never tired of reminding the world, if the automobile industry had done what the computer industry had done, a Rolls-Royce would cost $2.50 and get 2,000,000 miles to the gallon. A variant was that if progress in the rest of the economy had matched progress in the computer sector, a Cadillac would cost $4.98, while ten minutes' labour would buy a year's worth of groceries.

Stage IV - By the late 1980s it was clear that much IT investment had found its way into management information systems (basically surveillance and control systems), where it could not be expected to be directly productive. At the same time, growing public alarm, fuelled largely by the business press, led to exploration of a host of possible explanations for the paradox. Individually, none was convincing and collectively they were confusing. While the economists explored, the business press, IT companies and governments tended to point to specific firms as examples of the 'successful introduction' of IT, examples that other firms were encouraged to follow.

Stage V - Since the late 1980s, much IT investment has been channelled into telecommunications. Therefore, it is argued, expectations of productivity increase are unrealistic. The paradox is not so much resolved as in abeyance (*Economist*, 2000).

Nearly all discussion of the productivity paradox focuses on the reasons for its existence. Eric Brynjolfsson (1993) has conveniently isolated just four of these reasons:

1) *mismeasurement of outputs and inputs* - outputs and inputs of information-using industries are not being properly measured by conventional approaches
2) *lags caused by the need for learning and adjustment* - time lags in receiving the pay-offs to IT make analysis of current costs versus current benefits misleading
3) *redistribution and dissipation of profits* - IT is especially likely to be used in redistributive activities among firms, making it privately beneficial without adding to total output

4) *mismanagement of IT* - lack of explicit measures of the value of information makes information particularly vulnerable to misallocation and over-consumption by managers.

Any one of these would have fed discussion for decades. In fact, there is rather more to the explanation than these four imply. This has not deterred individual commentators from taking the simple approach and isolating individual explanations. Those who have seized upon the mismeasurement explanation are most guilty of this simplification.

TO MEASURE OR ……

So absorbing was the challenge of finding better measurements for IT productivity that many of those who accepted the challenge seemed to forget that measuring productivity was merely a means to an end and not the end in itself. The very problems of measurement stimulated something of a productivity paradox industry (Diewert and Fox, 1997), the productivity of which was itself questionable. Many economists, and especially econometricians, became besotted by the problems of measuring the productivity of IT (Stoneman and Francis, 1994). Most concentrated on the almost intractable problems of measuring output, but some were equally content to examine the problems of measuring input (Barua and Lee, 1997). Input, it might be imagined, should have been easy enough to calculate, but it was not. The quality of inputs varied, including the quality of labour, and far more employees were involved with IT than were conventionally counted; often only those who manned central IT help desks were deemed to be IT workers. In one of the few pieces of British research on the productivity paradox, Paul Stoneman advised the Central Statistical Office to adopt hedonic pricing for computers, which would at least relate price to quality:

> "The hedonic analysis shows that the retail price of an average, constant quality, microcomputer fell by around £1430 over the six and a half year period from December 1986 to May 1992 representing a price reduction of 70%." (Stoneman, Bosworth, Leech and McCausland, 1992, p.i)

As hardware costs became unbundled from software costs and then dwarfed by these software costs, IT inputs became increasingly hard to measure. The difficulties resulted in software costs often not being measured at all. In addition, more and more IT costs were being incurred outside the central IT budget of organisations.

> "My best guess - and it is only that - is that the IT hardware investment data obtained from a central MIS manager is [sic] one-half to one-third of the firm's 'true' investment in IT." (Attewell, 1993, p.11)

The reliability of input measures was critical not only because these measures had to be compared with output, but because, at least in the United States, they often substituted for output. The US Department of Commerce (unlike statistical authorities in Western European countries and Japan) made no attempt to measure productivity in the finance sector, for example, but simply assumed that output was equal to input labour. Consequently, the US finance sector could never have more than zero productivity.

> "Given that knowledge work is fundamentally different from manual work, a redefinition of productivity for knowledge work intensive industries would be a useful endeavor." (Davis, Collins, Eierman and Nance, 1993, pp.339-40)

But even if input could be measured, it seemed that the output would prove somewhat trickier to measure.

> "Not surprisingly, when you can easily count the costs of computer investment but have a difficulty assessing the benefits, particularly those that take time to be realised, IT can look like a bad investment." (Brynjolfsson and Hitt, 1998, p.4)

The sorts of unmeasured benefits generated by IT were to be found in product development cycle time, customer convenience, consumer choice, quality control, the production and distribution of knowledge, and industry efficiency. It had been, if not exactly easy, at least easier, to measure outputs in the past because they were largely the countable outputs of manufacturing industry. But the nature of the economy had been changing and a rapidly growing proportion of its outputs was coming from the expanding service sector. Indeed, the value of even manufacturing output depended increasingly on such intangible factors as quality, timeliness, variety, and so on. If computers were still not actually everywhere, as Solow had suggested, they certainly proliferated in those areas (such as banking, insurance, business services) where productivity was hardest to measure. And if measuring productivity from IT in manufacturing was difficult, measuring it in the service sector was virtually impossible.

> ".... the term *productivity* is an artifact that reflects a workplace characterized by the transformation of tangible materials, via visible manual efforts, into measurable products." (Davis, Collins, Eierman and Nance, 1993, p.339)

> "The irony is that while we have more raw data today on all sorts of inputs and outputs than ever before, productivity in the information economy has proven harder to measure than it ever was in the industrial economy." (Brynjolfsson and Hitt, 1998)

In fact, so dominant was the ability to measure productivity in manufacturing that for a long time it seemed that the main influence of computers on the economy's productivity came from the sector making them, rather than from sectors using them.

> "While the impact of information technologies such as computer equipment on the productivity of sectors *using* this equipment is not readily observable, the productivity originating from the sector *producing* computer equipment is evident. In Germany, Japan and the United States, the computer sector has been the driving force behind manufacturing productivity gains in the 1980s. Nowhere is this more apparent than in the United States, where the computer sector has been estimated to have contributed fully two-thirds of the post 1979 rebound in manufacturing productivity growth." [emphasis in original] (Wyckoff, 1993, p.2)

It was at this point in the progression of the discussion that the economists chose not to delve deeper into the dynamics of the information economy, nor to follow where information economics led to explore the mysteries of information itself. Instead, workman-like, they blamed the data.

> "Much of the productivity shortfall of the 1980s was a mirage anyway. Our tools for measuring productivity - designed for counting bushels of wheat and Model Ts off Ford's assembly line - are blunt when called upon to measure the tremendous improvements in service, quality, convenience, variety and timeliness. This is especially true in the service sector, where output data is unreliable and things that can't be measured are assumed not to exist." (Bakos and de Jager, 1995, p.128)

The data were poor, the economists claimed, not only because of conceptual difficulties, but because they were badly gathered.

> "The problem then, is that the commercially-available data on firm level IT investment is dramatically undercounted, due to cheap survey methods which contact one person in a massive corporation. Academic or government surveys could do much better, but they have never been done." (Attewell, 1993, p.12)

The inadequacy of data at the national and sectoral levels encouraged the use of apparently superior data from samples of firms. If these data showed productivity growth, then clearly other data from other levels of investigation were inadequate.

> "The closer one examines the data behind the studies of IT performance, the more it looks like mismeasurement is at the core of the 'productivity paradox'." (Brynjolfsson, 1993, p.14)

So, the economists' answer to the problem was to find the right data. Paul Strassman's calculations of what he calls his ‘Information Productivity Index’ are one example of just what processing the data were, and still are, expected to endure.

> "For output, I use Stern, Stewart & Co.'s popular Economic Value-Added (EVA). If EVA is not available, output can be calculated by subtracting from operating profit after taxes the value of shareholder equity, multiplied by the cost of capital. The costs of sales, general and administration (SG&A) are a reasonable approximation of managerial costs. Divide EVA by SG&A to get the Information Productivity Index." (Strassman, 1994, p.45)

Somehow, Strassman's Information Productivity Index seems to miss the point. The productivity paradox had less to do with equations and data than with concepts and even faith. There were those who questioned whether productivity should be measured at all. The economists were not among their number; the economists were having a thoroughly busy and jolly time with their measurements.

If firms could not be relied upon to reap productivity benefits from their investments in IT, and productivity increases at the firm level might well be hidden at the industry or sector level, then the level at which the impact of IT on productivity was sought was clearly crucial. The productivity paradox, it seemed, was a consequence of searching at the wrong level. National productivity statistics were generally awful (Ralston, 1998), but statistics could also be unreliable at the industry level, especially when output and productivity are inferred from national input/output tables (Attewell, 1993). Productivity gains could often be detected at the level of the individual unit, or even the individual person, but they would disappear at the firm level. A sample of firms seemed to offer the best prospect of finding productivity increases attributable to IT, but where to find a suitable sample?

> "In my judgment, the greatest prospect for assessing the impact of IT investment lies in studies of productivity based on representative samples of firms. I am skeptical of the value of more aggregate-level studies which use government data .....The greatest problem is not the measurement of firm-level productivity but in obtaining accurate data on IT investment at the firm level." (Attewell, 1993, pp.10-11)

This was precisely the approach which eventually allowed Brynjolfsson and Hitt to declare the paradox resolved, but they were always open to the accusation that their sample, consisting entirely of large firms, had not been representative of firms as a whole.

The last resort of many of those determined to find productivity increases from IT, once the what, the how and the where of IT had been declared inappropriate for measurement, was the when. The argument was simple: there might not be any productivity gains from IT right now, but they would occur in time. Sometimes the argument focussed on firms; they would become better at using IT as they learnt from experience (Johannessen, Olaisen and Olsen, 1999): sometimes the learning was expected from economists themselves as they gained experience in searching out productivity from IT. Perhaps this is why the eventual declaration by Brynjolfsson and Hitt suggested a certain inevitability. The hunt was over.

> "We conclude that the productivity paradox disappeared by 1991, at least in our sample of firms." (Brynjolfsson and Hitt, 1996, p.541. See also Bryjolfsson and Hitt, 1993)

Equally predictable was the sudden rush of findings that confirmed those of Brynjolfsson and Hitt (Dewan and Min, 1997). By 1997, Brynjolfsson and Hitt had explored a variety of other data to produce productivity figures for 600 firms between 1987 and 1994. They found that the productivity increase was greatest for firms that had invested most in IT and that had used IT longest (Brynjolsson and Hitt, 1997). Others, however, are suspicious of this conclusiveness and find these results just a mite too convenient.

> "As to estimates by Brynjolfsson and Hitt that computers earn returns of 24 to 57 percent..... what friction of market failure prevented these firms from investing even more in computers until the returns were driven down to those on other types of capital?" (Gordon, 1994, p.326)

And while he was quite willing to admit that the situation may have improved since his own dismal assessment of computer productivity, Roach - the management consultant - considered Brynjolfsson's estimates of 81% gross annual return on IT investment for manufacturing and service companies together far too large (*Economist*, 1994).

Brynjolfsson's explanation for the end of the productivity paradox includes an expectation that there would be some lag before benefits would be realised; the transition to the Information Age would obviously take time (Brynjolfsson, 1993). Many economists agreed that they would have to wait to see the end of the productivity paradox. Indeed, so dedicated was this waiting that Jorgenson and Stiroh (1999) have referred to "a kind of Computer Cargo Cult among economists and economic historians, patiently awaiting a deluge of spillovers like those that supposedly accompanied earlier technological revolutions". However, Brynjolfsson had in mind a productivity lag of just two or three years (Brynjolfsson, Malone, Gurbaxani and Kambil, 1994), which suggests a decided lack of patience, certainly compared with the lag envisaged by Paul David. David likened the computer to the dynamo and considered that IT would take as long to make an economic impact as electricity had done - perhaps four decades or so (David, 1990). Not everyone thought his analogy sound. Jack Triplett and Robert Gordon found it totally unconvincing:

> "We have reached the fortieth anniversary of the commercial computer. The price of computing power is now less than one-half of one-tenth of 1 percent (0.0005) of what it was at its introduction. No remotely comparable price decreases accompanied the introduction of electricity." (Triplett and Gordon, 1994, p.322)

There were lots of other innovations of the late nineteenth and early twentieth centuries, they argued - chemicals and plastics, motor cars, household appliances, highways, supermarkets. Computers were just not in the same league. There was some support for their stance.

> ".... the puzzle about computer hardware in the 1980s was more apparent than real. To restate Solow's quip, computers were not in the productivity statistics because, it turns out, computers were not everywhere. Recall that in 1993 computer and peripheral equipment accounted for just 2 percent of the nominal net stock of business capital in the United States. By way of historical comparison, in 1890 railroads accounted for about 18 percent of this stock. Clearly computers have a long way to go before they become as widespread as railroads in the nineteenth century." (Oliner and Sichel, 1994, p314)

But David's main contribution to the discussion was not in the detail; he added an intellectual dimension which the discussion has sorely missed ever since its inception. For example, as Romer noted, IT investment was just too small a portion of total investment to have any but a tiny impact on the productivity statistics.

> "'What have all those computers been doing?' or, more prosaically, 'Why has the vast increase in investment in computer power not been reflected in higher measured productivity growth?' It seems to me that there is no mystery here at all..... Since computers are a quite small part of total investment, a vast increase in investment in computers would yield only a small increase in measured output even if all the computers were being used productively and were generating measured output." (Romer, 1988, p.427; see also Diewert and Fox, 1997)

That was in 1988, by which time the discussion of the productivity paradox had already acquired its own momentum and its own agenda. Romer was ignored. David himself argued that his analogy not be taken too far. Towards the end of a seminal paper, he emphasised the fundamental importance of the awkward characteristics of information. Information, he reminded those econometricians who expect their data to be aligned in neat rows, is just not like other goods (David, 1990).

…… OR NOT TO MEASURE

One objection to focusing on IT productivity is that while productivity is measured in terms of things being counted (number of employees, pounds of nails, and so on), IT investment is made to produce things that are not easily counted (such as quality and customer service) (Brynjolfsson and Hitt, 1998). Productivity, it was asserted, was not the right measure of IT performance, and could not capture its full impact. And perhaps policymakers and strategists did imbue productivity with too much importance from the late 1970s. Given its role in combating inflation, in wage bargaining and in social welfare (and also in the measuring of international competitiveness at the industry and

plant level), this would have been understandable (Agrawal, Findley *et al*.,1996; see also Attewell, 1993). This does not mean that productivity should be the only measure of IT performance, and certainly not that productivity should mean simply labour productivity.

There are, of course, other measures of performance than productivity, but they tend to be the sort of financial measures beloved by accountants, such as return on investment, return on assets, and earnings per share. Strassman (1997) may have valued such measures at the micro level, but most other authors considered them even more flawed in measuring the performance of IT than productivity measures (e.g., Johannessen, Olaisen and Olsen, 1999). Kaplan (1989) argued that existing accounting systems were totally inappropriate, not just for coping with IT, but for coping with any new technology. The productivity paradox simply demonstrated that accounting systems were decades out of date. Interestingly, accountants seem to have had the sense to steer well clear of the productivity paradox debate (Son, 1990). The US National Research Council published a report into the use of IT in the service sector in 1994 and also found that conventional measurements of productivity were woefully inadequate. The report's chief conclusions were that the outputs of many service industries are hard to define, that for many key service industries (for instance, banking, education, health care and government) outputs are actually measured by inputs, that the effects of new services and quality improvements are rarely well captured, and that competition often robs the investing industry of the benefits of its IT investments, forcing it to pass them along to customer industries (Quinn and Baily, 1994). This last point is important. The economists saw the problem as a failure of those who invested in IT to appropriate the benefits.

> "Although IT offered customers much higher quality, variety, convenience, reliability, and accuracy, service companies found it hard to capture these benefits in enhanced margins or measured output per person employed..... In industry after industry, information technology became essential to survival or growth and resulted in demonstrably enhanced convenience and value to customers - often without showing either definable increases in industrywide financial returns or measurable productivity increases." (Quinn and Baily, 1994, pp.38-9)

Another perspective might have suggested that something more fundamental was afoot than mere evasion of productivity indicators. IT, it would seem, was making a more basic contribution to the economy and to the performance of organisations than improved productivity. IT investment, it was argued, could not be expected to produce direct benefits, however measured. There would be benefits, but they would be indirect and long-term. They would be enabling, much like those from investment in electricity

or the steam engine (Bryjolfsson and Hitt, 1998). It was a waste of time trying to measure the benefit from what was basically an improvement in infrastructure.

> "The managerial decision for IT infrastructures is generally not *whether* to invest in IT, but rather how to obtain needed compatibilities at lowest cost....several firms noted that the only truly rigorous way of evaluating many infrastructure payoffs would be to calculate the opportunity cost of 'not being in that business'; i.e., the total business loss that would have been incurred if the investment had not been made." [emphasis in original] (Quinn and Baily, 1994, p.34; see also Banaghan, 1996)

The argument was basically that IT was essential just to remain in business. But how much IT? What was the appropriate level of investment? Organisations were quite capable of spending all they had on IT, and IT producers of letting them. To avoid this sink, senior managers became more and more attracted to contracting out much of their IT. That way, they could pay for precisely and only the services they required.

> "IT infrastructure is ....probably the most difficult IT investment to justify in advance and then to measure the resulting impact..... IT infrastructure has a large momentum requiring, seemingly, ever increasing resources. The costs of significant changes to infrastructure are high and well beyond the cost of the purchases and the associated information systems personnel.... Outsourcing is seen by some senior managers as a way to off-load these ever increasing costs of infrastructure." (Weill, 1993, p.571)

MEASUREMENT OR MANAGEMENT

The management literature paid little attention to economic explanations of the productivity paradox and offered, not surprisingly, management solutions to the problem. The most obvious blame that could be attached to managers was simply that they had bought the wrong IT. Had they bought the correct IT, there would have been lots of productivity increase. This may be a simplistic view, but then much of the management literature is just that. The doyen of management gurus, Michael Porter, was in no doubt about the benefits of IT.

> "The question is not whether information technology will have a significant impact on a company's competitive position; rather the question is when and how this impact will strike." (Porter and Millar, 1985, pp 149-60)

Senior managers often delegated responsibility for IT investment to specialist IT departments. The consequences have often been unfortunate:

> "..... one cannot expect a clear and direct link between IT-investments and productivity. The reason is that the effects of IT are mediated and depend on other factors. Some of these factors can probably be influenced by managerial action. But the managers have chosen not to get involved in the use of IT in their companies but have delegated this responsibility to systems departments. This

> abdication of responsibility may have resulted in both misdirected IT-investments and in a lack of attempts to find solutions to essential business problems with the help of IT." (Docherty and Stymne, 1993, p.2)

Under these circumstances, IT investment might be expected to benefit the organisation's IT department rather than the organisation as a whole. If it is only to be expected, from an understanding of the nature of organisation and the nature of information, that parts of the organisation should exploit IT for their own advantage, it should not be surprising that some parts of the economy do just the same. In so doing, just like individual managers, they may increase their own productivity without affecting the productivity of the whole. When firms use IT to increase market share, they can increase their own productivity while that of their industry remains unchanged. When firms have to invest in IT just to remain in the market, there may be no increase in productivity at any level.

> "Other firms will have to adopt the technology to stay in the market. They will not gain market share by doing so, and will nevertheless carry the cost burden of the new investments. The result, viewed across a whole industry, is that costs may increase, and productivity, in terms of revenue per operating dollar, may even decrease." (Attewell, 1993, p.8)

There are two arguments which stem from this observation: one is that investment in IT has not necessarily permitted the investors to reap the benefits of their investment, that these benefits have been seized by others to the joint frustration of investors and those who would measure productivity increases (Baily and Chakrabarti, 1988). Banking is frequently given as an example: individual banks had to adopt automatic telling machines in order to remain competitive in the industry, but the benefits seem to have been seized by their customers rather than by the banks (though the banks may now be using collusive power to force the return of some of this value).

> "... the success in managing the change to CAD, and other [IT]... would be better served by a greater understanding of its wider implications, e.g. its company-wide benefits, rather than a concentration on a narrow range of benefits confined to the drawing office.... a more strategic awareness of new technology needs to be developed at the apex of the organisation, which is not one solely based on an understanding of simplistic cost-accounting techniques." (Currie, 1989, p418)

But encouraging senior managers in an industry or even in a single firm to think strategically in their acquisition and use of IT is not guaranteed to resolve the productivity paradox either. Such encouragement may discourage them from bothering about productivity effects.

> "If such a scenario is correct, one would hypothesize a negative correlation between strategic IT investment and productivity growth, when measured across a sample of firms in one industry." (Attewell, 1993, p.9)

Moreover, senior managers are probably as reliant as ever on traditional accounting techniques, rather than on IT itself, to discover not only what investment there has been in IT, but what the organisation is doing with it. The other argument stemming from the observation that firms may have to adopt IT just to stay in business is simply that the benefits from IT, including increased productivity, cannot be expected to be universal and must be sought at the right level - individual, department, organisation, sector, economy.

If managers did feel that they had to have IT simply to stay in business, and if they were confused about what sort of IT and how much of it to have, just how logical were their investment decisions? Many of those who discussed the productivity paradox suggested that senior managers may have had very little idea what they were doing. Others insisted that managers should not worry about productivity from IT; they should be content that IT helps them serve their customers (Davis, 1991). Uncertain about the appropriate level of IT investment, it may be that many organisations simply followed the example of others.

> "Assess the amount of technology used by other organizations in the same industry. Technology investments should maintain at least threshold levels of IT for the industry." (McKeen and Smith, 1993, p.444)

While it may be that firms must have computers in order to compete, it may also be that what employees do with computers is almost impossible to manage. Without effective management, computers can easily be used simply to generate work for employee and customer alike.

> "A lot of PCs are on the desks in these large corporations because of the corporate decision to standardise on particular versions of technology. But apart from a few dedicated souls who really know how to work them, productivity of the computer's full power is actually very low." (Philip Moodie as quoted in Banaghan, 1996, p.72)

It is also argued that senior managers soon abandoned their initial attempts to achieve productivity gains in favour of new goals, such as greater market share or greater managerial control. This is what Attewell terms 'goal displacement'.

> "... studies of individuals using word processors have noted that instead of using the technology to produce more documents in a given length of time, employees make five times as many corrections as previously. They also pay more attention to fonts, graphics and so on. In other words, at this individual level, there is a displacement from the goal of increasing throughput productivity to the goal of enhancement of quality and appearance." (Attewell, 1993, p, 4)

It is perhaps easier to see that the goal has been displaced, or rather replaced, than just what the replacement goal might be. It seems that more IT has resulted in more information and more paperwork being processed, and it is widely observed that there is more paper than ever in the paperless office.

> "To economists this has a familiar logic. As the unit cost of a good falls, demand for the good increases. Thus even as the unit cost of computer-related work has fallen (due to productivity improvements), the demand for that work within the corporation has increased. With a price elasticity of demand greater than one, the total amount of information processing work after computerization, and its cost, can be greater than the volume and cost of information work prior to computerization. Thus even if the unit cost of doing information work falls dramatically due to computerization, the total demand for such work, and the total cost to the corporation may increase." (Attewell, 1993, pp.4-5)

Senior managers were often quite unable to control this pointless demand, perhaps because they had never really been sure why they wanted IT in the first place, but perhaps also because they did not really understand what the information part of information technology was all about. It is quite possible to see the productivity paradox as a combination of managerial failure to restrict and direct the resources consumed in the handling of information, and the nature of information. Information, with its peculiar characteristics, is hard enough to understand in itself, but in the context of organisational norms and culture is even more problematic. Organisations are information organisms; they exist because of their outstanding capacity to deal with information (Macdonald, 1995). Their managers use information in many ways, but value information more for reinforcing organisational structure and for control than for knowledge. Hence the eagerness with which MIS was adopted. It is into this extraordinary, even artificial, world that IT was introduced (Jonscher, 1994). In these circumstances, to expect IT merely to replace information workers and to have a straightforward impact on productivity was always somewhat naive (Arrow, 1974).

One matter generally neglected in the literature is the relationship between IT and information as a source of power in the organisation. It really would have been amazing if parts of the organisation had not tried to capture information, and thus the power it bestowed, through IT (e.g., Hoos, 1960). In the strange information world of the organisation, where forgetting - disposing of information - may be as important as remembering (Lundvall and Johnson, 1994), where the distinction between personal information and organisational information is hazy, where managers live in constant fear of information overload, the role of IT, and hence its contribution to productivity, is not

always clear. At the very least, some sort of balance had to be struck between the information requirements of the organisation and the information potential of IT.

> ".... companies need to balance their use of IT, enabling them to consider and incorporate both the explicit and tacit dimension of knowledge. In order to meet this challenge, we argue in favour of developing an information and a knowledge strategy prior to developing an IT strategy." (Johannessen, Oliasen and Olsen, 1999, p.18)

Just as very few governments have ever developed an information policy, so very few companies have ever developed anything like an information strategy. The consequence was that IT was acquired and installed and exploited impulsively, and often under the overall charge of the finance director, neatly codified numbers being the sort of information both the organisation and IT handle best. Under these circumstances, integrating IT with just about everything else in the organisation was likely to pose problems which might be reflected in productivity. Investing in IT was all very well, but IT could hardly be expected to change anything much on its own. There had to be complementary investment.

> ".... the greatest benefits of computers appear to be realised when computer investment is coupled with other complementary investments; new strategies, new business processes and new organizations all appear to be important in realizing the maximum benefit of IT." (Brynjolfsson and Hitt, 1998)

> "Computerization does not automatically increase productivity, but it is an essential component of a broader system of organizational changes which does." (Brynjolfsson and Hitt, 1998, p.11)

ENTER MANAGEMENT METHOD

The productivity paradox discussion has made clear that productivity cannot be expected from IT alone; IT must be accompanied by appropriate management. The customary stance has been that IT is primary and management is a secondary matter, an enabling technology in innovation terms. But it is just as valid to reverse this traditional argument so that productivity is considered to come not primarily from the IT, but from management methods underpinned by IT.

> "This is further supported by our finding that the rate of return for computer capital is highest for high performing firms - these are presumably the firms that have engaged in the most innovative improvements." (Brynjolfsson and Hitt, 1993)

The discussion also hints that new management methods are not simply facilitated by IT, but may actually be dictated by IT. The fashion of the ‘seventies was to perceive technology as deterministic, a fashion which did not survive growing appreciation that

how technology was used was at least as important as the technology itself. In IT, this was reflected in a growing suspicion that managers rather than IT were responsible for the productivity paradox. Obviously this allocation of blame suited the IT manufacturers and suppliers, but it also suited the management consultants, a group that had been evident in the identification of the productivity paradox in 1987, and that had fuelled the treatment of the subject in the business press. The management consultancy industry had become huge by the late 'eighties, and its continued growth depended on what is known as the 'churn', the supplementing of existing management methods with new ones (Abrahamson, 1996; Huczynski, 1993). Concern about the organisational change required to make IT investment productive was a godsend for management consultants, who both satisfied and fuelled the concern with management method (Sturdy, 1997). Indeed, much management consultancy, especially in the larger firms, had sprung from IT consultancy, a reality which is perhaps reflected in many of the methods of management consulting being possible only through the exploitation of IT. Indeed, though the measurement of IT productivity might be problematic, it was IT that permitted a great deal of the measurement on which so much management was focused.

What, then, was the relationship between the IT productivity paradox and management method? As we have seen, explanations for the paradox are dotted with reference to management methods, but do not identify them as a specific cause of the paradox. To be sure, there are plenty of others. Here we will explore the possibility that management methods were, at least in part, determined by IT and may have contributed towards the IT productivity paradox.

Consider first the importance that managers and management have assumed in the period under consideration. The 1980s was a decade of management in the way the 1970s had not been, in the way the 1990s continued to be, and in the sense that the prosperity of organisations was seen to be not so much a function of how well their IT performed as of how well their managers performed. They did not go short of advice on how to manage: MBA courses proliferated, the management consultancy industry was becoming gigantic, and a whole new language of management method was developed to communicate ideas from both. Management, much like IT itself, was in the ascendancy. In virtuous symbiosis, managers would unlock the value of IT and IT the value of managers. Drucker (1988), for example, predicted that firms rich in IT would progress to organisational change as fundamental as that of 1895-1905, when managers became

distinct from owners, and that of 1915-25 with the beginning of the modern command and control organisation.

Managers, of course, were not opposed to this elevation in their status, but it did leave them somewhat perplexed: if they were really so powerful, and IT was really so helpful, what was all this about an IT productivity paradox and why could they not manage their way out of it? Unless they could, IT, so promising as an ally, could turn into an awful enemy. Already there was the accusation that a major contribution to the IT productivity paradox was sheer mismanagement. The business press, always influential in forming the ideas of managers, had sunk its teeth into that explanation and was relishing the flavour. Managers sought a way out of their predicament and found it in the management consultant.

MANAGEMENT METHOD AND THE MANAGEMENT CONSULTANT

Management consultants sell ideas, the stuff of management method. These ideas are hardly foisted upon an unwilling market: managers are as eager to buy as consultants are to let them. It is easy enough to see why these ideas appeal to consultants – they sell – but just why do they appeal to managers? Accompanying the growth of the consultancy industry has been the transition of the manager from bumbling amateur, self-taught in the art of management, to professional manager, trained in business studies or even management science, probably sporting an MBA (Pascale, 1990). The typical senior manager of the 1960s was qualified to manage nothing: the modern manager is qualified to manage anything. Thoroughly compatible with this omnicompetence is the use of management consultants to keep up with the latest thinking. Thus armed, the manager can transform management from art to science (*Economist*, 1993a, 1993b), can exchange inspired creativity for mastery of method.

> "The key to successful management is the Three Cs, and the first of these is Change. What were the other two, Ian?"
>
> Vice-chancellor
>
> It's all about people learning the organisational approach to organisation.
>
> Manager

The manager must walk the line between knowing at least as much as his peers of what the gurus of management have to say without actually becoming bogged down in information by reading their books (Huczynski, 1993). Quoting Kenneth Burke in his review of *A Passion for Excellence*, Charles Conrad (1985, p.428) makes clear the real purpose of reading: "'I'll wager that, in by far the great majority of cases, such readers

make no serious attempt to apply the book's recipes. The lure of the book resides in the fact that the reader, while reading it, is then living in the aura of success'"

> "The last MD might have had an MBA, but it would not surprise me if his thinking came from reading."
>
> Manager

If managers do not need yet more information, what is it they do need? Their attitude to reading holds a clue. Basically they want comfort, security, re-assurance, someone to hold a hand. This is why the relationship between consultant and client is so often portrayed as a doctor-patient relationship (Tilles, 1961). Nanny-child might be more accurate, with the consultant's responsibility extending as far as discouraging clients from committing suicide (Weedon, 1990). The problem is that such a dependent relationship is really only practical behind closed doors and between consenting adults. While the macho world of the corporation tolerates no other leader than the CEO, it does permit the senior manager an offsider, a Robin to his Batman, a Tonto to his Lone Ranger, a loyal and trusted ally who will fight to the death alongside the manager (McGivern, 1983; Jackson, 1996). As Maid Marion, the consultant can play both nanny and partner roles nicely.

> "I recognise that look of complete joy on their faces when I say after a couple of days. 'Look girls, this is how you do it'. The look of huge relief on their faces tells me I have failed. Daddy has told them what to do."
>
> Management consultant

> ""Dependency is increased by using consultants. You can get hooked on consultants. You can become consultant-happy."
>
> Management consultant

The advice of management consultants is supposed to reduce the uncertainty of managers and thereby help them to manage better (Gattiker and Larwood, 1985; Washburn, 1991). But more information may increase rather than reduce uncertainty. When this happens, the advice the consultant gives to solve a problem also maintains the problem for future solution. This future solution will require different information; hence the constant churn of new ideas from management consultants (Huczynski, 1993). Figure 1 gives some idea of how transitory are the teachings of the leading gurus. It maps annual citations of their publications since 1975, and suggests that interest in their ideas is highly sporadic. An idea that makes an impact one year is forgotten and replaced by another the next.

It is not even essential that the ideas of consultants be novel; the organisation has little memory and managers and consultants alike have done what they can to reduce what

little it has. What is re-engineering but the deliberate deletion of corporate memory (Pollitt, 2000)? The manager gains nothing from confessing that an idea has already been tried, particularly when an obvious alternative to the churn of new ideas associated with consultants is the churn of new ideas associated with replacing managers. Management turnover is more popular among the new blood being infused than among the old blood being spilled. So, managers and consultants are united in their conviction that change is necessary: reduced demand for organisational change would mean reduced demand for both consultant and manager.

> "BT were sitting ducks for every notion that was going. In the early stages, managers could be seen with Dale Carnegie books sticking out of their pockets. They all knew that they had to adopt the buzz words and the jargon because they were now in the private sector. They embraced every fashionable management nostrum. "
>
> Manager

But managers welcome the churn, the frenetic succession of fad and fashion, for another, more personal, reason (Crainer, 1996). They are less concerned with the use of ideas to improve the competitiveness of the organisation than to improve their own competitiveness (Sturdy, 1997). New ideas are plausible less because they are rational than because they capture the spirit of the times (Grint, 1994). Their acceptance indicates a manager who is progressive, anxious to embrace change, enlightened and up to date (Gill and Whittle, 1992). After all, the professional manager is a mercenary, loyal to whichever organisation is paying and only as long as it is paying. And the management consultant is a prostitute, rendering personal services in return for payment. The organisation is no more than the stage on which they both perform. This may be why senior managers welcome ideas which require loyalty to the organisation: in demanding the loyalty of others, they mask the absence of their own.

> "Success for consultants means giving something different. All the time successful consultants are searching for something different to say."
>
> Management consultant

There is, then, competition in ideas among managers which is quite separate from any organisational requirement for these ideas. It is by catering for the managerial need rather than the organisational need that management consultants increase demand for yet more methods with which managers can compete (McGivern, 1983), always bearing in mind that the real competition in business is not between organisations, but between managers, often in the same organisation. Clearly this demand for ideas is largely independent of the success with which methods are applied in the organisation. Moreover, in as much as each new method compensates for the skills the manager is

assumed to lack, each serves to undermine self-confidence, adding to the anxieties the method is supposed to overcome (Sturdy, 1997). This stark reality makes the comfort of the illusion that uncertainty is being reduced the more compelling. Also preserving the illusion is continuing failure to quantify the impact of management consultants (Gill and Whittle, 1992). What work has been done seems to suggest that the organisational benefits from consultants are not great (Schaffer, 1997), even that random behaviour achieves results that are just as good (Pascale, 1990, p.22). It should be possible, even easy, to calculate the benefit from hiring management consultants. When the consultant's world of science and method is applied to the manager's world of performance indicators, some sort of measurement of the result should be almost inevitable. Apparently it is not; there is curiously little assessment – and much less measurement – of the organisational benefits arising from hiring management consultants.

One cannot help but be struck by the circularity of a system in which the supply of consultancy services has responded to demand, allowing this very supply to create yet more demand. The ideas supplied by consultants increase rather than reduce the uncertainty of managers, thereby increasing the manager's demand for yet more consultancy. The more that is expected of the professional manager, and the more that the consultant is seen as a necessary accompaniment to managerial professionalism, the less likely it is that the manager without a consultant will be seen to be managing professionally and responsibly. The more dependent the manager becomes on the consultant's services, the less confident the manager becomes in his own, unaided abilities. And the more the manager uses consultants, the more accepted – indeed, the more necessary – it becomes for other managers to use consultants.

IT productivity was not an issue that the manager was expected to address without consulting his consultant. The consultant, while nominally helping to solve the problem for the benefit of the organisation, was more concerned with maintaining the manager's dependency and uncertainty. The consultant was much more interested in securing benefits for the manager who hired him than for the organisation paying them both. These, then, are the circumstances the IT productivity paradox encountered in the organisation. The main parties, it would seem, were much more eager to exploit problems than to solve them. Particularly appropriate was the background of consultants from the large consultancies. These had originally been accountancy firms and had been attracted to management consultancy by its greater growth prospects. *En route*, they had

entered another growth area, IT consultancy. Their consultants, thirsty for ideas, knew all about IT.

THE IT PRODUCTIVITY PARADOX AND MANAGEMENT METHOD

One school of thought formed during consideration of the IT productivity paradox was that any attempt to measure the impact of IT on productivity was probably unwise, that IT was best regarded as infrastructural, much like R&D. The available measures were said to be inadequate to the task, and the main product of IT to be unmeasurable anyway.

> "This finding leads to more general observations about the way executives make decisions about IT. Just as they do with R&D, they depend heavily on intuitive and nonfinancial measures as well as formal financial justification..... The analogy with other forms of R&D is striking. Most other technical breakthroughs also take years or decades to achieve paybacks, with company and industry indicators in the meantime showing low (or negative) paybacks. As with IT, few companies routinely try to evaluate the aggregate impact of all their R&D projects. Instead, they appraise effects on a project-by-project basis in terms of how well each project supports other strategic goals. For both R&D projects and IT programs, payoffs are likely to be uncertain in both scale and timing." (Quinn and Baily, 1994, p.41; see also National Research Council, 1994)

This, however, was unacceptable in an age in which management and measurement were intertwined. In fact, there were measures aplenty that might have been developed and applied to the qualitative output of IT (Johannessen, Olaisen and Olsen, 1999). There had been consideration of what might be required to measure customer satisfaction (Ellis and Curtis, 1995; Hurley and Laitamaki, 1995), customer loyalty (Reichheld, 1993), employee satisfaction through teamwork (Henderson, 1994; Lumkin and Dess, 1996; Schrednick, Schutt and Weiss, 1992), product quality (Feigenbaum, 1985; Garvin, 1987; Teas, 1993), and service quality (see Freeman and Dart, 1993; Kordupleski, Rust and Zahorik, 1993; Quinn and Humble, 1993).

One problem with these measures and their ilk was that they would have constrained both manager and consultant. The goal was not actually to find a measure of IT productivity. If Paul David was right, measures related to output from IT investment would show nothing for 40 years, and that was of little use to the professional, mobile manager. The goal was to find measures that would reveal at best that managers increased the productivity of IT, and at least that managers were not to blame for any deficiency in IT productivity. Their own experience with IT, and especially their consultants', provided ideas galore for exploiting what IT might or might not do that were infinitely preferable to more productivity measures.

One consequence of assessing performance in the organisation by means of measures and indicators is that managers have a greater incentive to produce measures and indicators that will reveal appropriate performance than to produce the appropriate performance. We delude ourselves by assuming that we know from measures and indicators how a manager or an organisation is performing. We know much more about how well measures and indicators are being managed. Vast bonuses paid to senior managers of ruined companies are evidence enough of that. Take the performance of the Sussex police in 1998, exceeding by 1 per cent a target of 90 per cent of emergency calls answered within 10 minutes in urban areas and within 20 minutes elsewhere. This improved performance was no doubt a credit to managers, but it was also associated with 873 accidents involving police cars, 39 injuries and 3 deaths (Bennetto, 1999). The mantra of 'what gets measured gets managed' is stronger than ever in these days of management method with the result that management attention is focused on what can be measured most easily and neglects what is less easy to measure. IT has allowed much performance to be quantified very easily - every finger tap at the supermarket checkout - but has trouble with the qualitative (Willcocks and Lester, 1996). To paraphrase Rebecca Boden, writing in the context of scientific laboratories, accountability has become synonymous with accounting (Boden, 1998).

It is possible that the customer orientation of so much modern management method may be IT-driven in that giving extra value to the customer is one thing that IT seems determined to do, despite the best endeavours of companies that have invested in IT to prevent this (Quinn and Baily, 1994). Method had to be found that would justify the appropriation by customers of a whole tranche of benefits from IT. True, the organisation might gain from customer satisfaction in the long run, but the discount rate of the mobile manager is high, and the long run may not stretch as far as Christmas. Management method came to the rescue with the notion of serving the customer, of the organisation being close to the customer, being customer-driven, market-led. Organisational change would be guided by market-pull rather than old-fashioned technology-push. The irony is acute in that customer-led strategy, inspired by IT, encouraged many firms to forsake their own technology development lest they be accused of being technology-driven (Macdonald and James, forthcoming). Such firms unwittingly remained technology-led, but led by IT technology. Anyway, what might have been construed as management failure to get to grips with IT could now be displayed as management success in leading the organisation in a bold, new strategic direction. The productivity paradox debate

disclosed other supposed benefits of IT too qualitative to be easily measured. A degree of ingenuity was required to encapsulate them in management method that would capitalise on just how quality-related they were. Within Total Quality Management there was room for any stray impact IT might have on product or service.

Management method was also applied to the nagging problem of just how much to spend on IT. Contracting Out dodged the problem by letting someone else decide. In a sense, most managers had long done this by abdicating responsibility for IT to IT departments. The disadvantage of this tactic had been that the IT department had seized the opportunity to expand its power base. Contracting Out not only undermined the IT department, but also helped contain spiralling IT costs. Contracting Out may have been determined by IT, but it was justified in other terms altogether: it was a measure to increase organisational efficiency. And where Contracting Out could not be relied upon to determine IT investment levels, managers took other steps. Basically, they looked at what other organisations were spending and followed suit, a process that could be termed keeping up with the Joneses or Benchmarking. Managers tended to favour the latter term.

The organisation's IT bestowed considerable advantage on those whose tasks related to what IT did well. Sensible managers re-configured or re-defined their own tasks to align them with the capability of IT (Pinsonneault and Rivard, 1998). The specialist manager, the MBA who could exploit the explicit, codified information of IT, prospered: the generalist, reliant on only years of experience, did not. The latter, the middle manager, went to the wall as organisation after organisation made savings by Downsizing, thereby eliminating much of the corporate knowledge base. After all, in Drucker's Flat Organisation, Knowledge Management exploited IT to store whatever information was required and to distribute it where and when it was needed. Knowledge Management also entitled the manager, as guardian of the organisation's intellectual property, to appropriate the employee's personal information. The managers of the new, Flat Organisation were reluctant to be seen, or even to see themselves, as passively dependent on whatever information IT provided. Much more appealing was management method that could portray IT as servant, as part of a Management Information System (MIS). Of the mountains of information that IT could produce, just about all of it could be justified as being of some use sometime to some part of management.

But most satisfying of all was the managerial response to the observation so often made in the productivity paradox debate that the whole organisation had to change if it was

ever going to reap the full benefits of IT. The observation smarted because it suggested management incompetence. The solution was Business Process Re-engineering. BPR gave managers *carte blanche* to change whatever and as much as they wanted to change in the organisation (Kling, 1995).

> "... successful moves towards the factory of 'the future' are not a matter of small adjustments made independently at each of several margins, but rather have involved substantial and closely coordinated changes in a whole range of the firm's activities. Even though these changes are implemented over time, perhaps beginning with 'islands of automation', the full benefits are achieved only by an ultimately radical restructuring." (Milgrom and Roberts, 1990, p.513)

Driven by the requirements of IT and inspired by their consultants, managers re-invented the IT productivity paradox. They converted problem into opportunity. Unfortunately, opportunities too greedily seized can so easily turn back into problems. The new problem was that many of the new management methods did not actually work very well. Given their esoteric provenance in the requirements of IT, this is perhaps hardly surprising. Business Process Re-engineering is a good example; Benchmarking, Materials Requirement Planning, and Total Quality Management are probably others (Thackray, 1993). As IT investment grew, and as the turnover of managers and their consultants increased, many organisations endured new management methods in extraordinarily rapid succession. Figures 2 and 3, derived from abstract analysis of publications in the fields of business and economics, give some idea of how rapid and extreme has been the churn in management methods. The method that everyone was using at one moment is suddenly discarded and replaced by another with equal enthusiasm. Consider the plight of one of Robert Pascale's (1990, p.19) managers:

> "In the past eighteen months, we have heard that profit is more important than revenue, quality is more important than profit, that people are more important than profit, that customers are more important than our people, that big customers are more important than our small customers, and that growth is the key to our success. No wonder our performance is inconsistent."

The report of the Inquiry into the Parkhurst Prison escape in the UK reaches a similar conclusion:

> "Any organisation which boasts one Statement of Purpose, One Vision, five Values, six Goals, seven Strategic Priorities, and eight Key performance Indicators without any clear correlation between them is producing a recipe for confusion." (Micklethwait and Wooldridge, 1996)

And as Jenny Stewart (1996, p.30) observes:

> "Any organisation seeking to follow these various forms of guidance would have had a confusing time of it. Over the past ten years, it would have been successively downsized, flattened, shamrocked, strategically planned, diversified, concentrated, re-engineered and, in all probability, bankrupted"

But failure, whether of manager or of management method, was not to be countenanced. The latter can be readily replaced from an inexhaustible supply of new fads, the former just as readily with other managers more enthusiastic and less willing to contemplate the prospect of failure. So, while much is heard about the failure of IT systems (e.g., Collins, 1997), the concept is not considered appropriate for managers and the methods they use. Consequently, there is no need for embarrassment among managers that BPR and TQM (Grint, 1994) and quality circles (Pascale, 1990, p.21) were accepted with such unquestioning enthusiasm. It hardly matters that empowerment of workers has turned out to mean just the opposite (Collins, 1994; Collins, 1997), or that the original opus of Peters and Waterman, *In Search of Excellence*, has failed the test of time (Nikiforuk, 1995; Guest, 1992; Berry, 1983; Pascale, 1990). It does not matter even that management consultants admit that their methods are not always soundly-based.

> " We do have a model. I tend to steer away from it. Other consultants use their models as hatstands. A lot of them are just bollocks."
>
> Management consultant

> "It's all Emperor's New Clothes. It's a con trick. Consultants go in because senior managers cannot be bothered to get off their backsides and do it themselves."
>
> Management consultant

> "If you tell people you have a certain set of knowledge and skills, they will generally believe you."
>
> Management consultant

As Peters says, that there are ideas is more important than what the ideas are:

> "There are a lot of charlatans about. There's a lot of bullshit around. I have no reason to believe that I am or am not either one of the bullshitters or one of the charlatans, nor am I very interested. What's simply fascinating to me is that it's a time of ideas. The fact of the matter is that the average manager is buying lots of books. He or she is not an idiot and these people are desperately thirsty for ideas" (quoted in Dwyer, 1993).

Under these circumstances, IT was as good a source of ideas as any. There is, of course, no reason to suppose that management methods derived from the requirements of IT were any more successful in the IT context than in the organisational context. Ironic to think that management methods determined by IT should fail when applied to IT, and doubly ironic that methods determined by IT should be applied to rectify the failure associated with IT – and should fail there too.

CONCLUDING THOUGHT

It is possible that a contributing factor to the failure of so many of these management methods is that they were inspired not so much by the requirements of the organisation, as by IT. To be sure, they were justified in terms of their value to the organisation, but it was much more important that methods determined by IT be of value to managers and their consultants. It may be worth reflecting upon the management methods apparently inspired by the most conspicuous exploitation of modern IT – telecommunications. Computing equipment that fits more properly within the telecommunications category is usually not regarded as IT at all and so has no impact on IT productivity as measured. It is an emphasis on communication that distinguishes recent rashes of enthusiasm for management method from those which have preceded them (see Dasgupta, Sarkis and Talluri, 1999). The real power of IT, it is said, lies not in stand-alone computers, but in whole networks of computers. To what extent are De-centralisation and Empowerment determined by the technology of telecommunications rather than by corporate strategy (Malone, 1997)? Is Globalisation a product of the sheer ability to communicate easily around the world rather than of any grander strategy? Is even Networking less enabled than determined by telecommunications? If so, the failure that awaited so many management methods determined by IT may well await those more specifically determined by telecommunications.

> "The more modern thinking about empowerment as autonomy actually fits [this organisation] very, very well..... I mean you just can't manage that matrix other than at the local level. The principle by which we try to manage our business was the notion of global localisation. Or was it local globalisation?"
>
> Interview with senior manager

REFERENCES

Macdonald, S., Anderson, P. and Kimbel, D. (2000), 'Measurement or management?: Revisiting the productivity paradox of information technology' *Vierteljahrshefte zur Wirtschaftsforschung*, 69, 4, pp.601-617.

Boden R., (1998), 'The Y-field thing – Semantics, big science and accounting', seminar paper given to PREST, University of Manchester, October.

Bennetto, J. (1999) 'Police to scrap 999 call targets', *Independent*, 20 February, p.6.

Macdonald, S. and James, A. (forthcoming), 'A dynamic view of technological acquisition', *International Journal of Technology Management.*

Micklethwait, J. and Wooldridge, A. (1996), 'Gurus of gobbledegook', *Sunday Telegraph Review*, 27 October, pp.1-2.

Collins, A. (1997), *Crash. Learning from the World's Worst Computer Disasters*, Simon & Schuster, London,

Agrawal, R., *Findley*, S. *et al*., (1996): Capital Productivity: Why the US Leads and Why it Matters, McKinsey Quarterly, Vol. 3, 38-55.

Arrow, K. (1974): The Limits of Organization, New York.

Attewell, P. (1993): Why Productivity Remains a Key Measure of IT Impact, paper presented to the Productivity Impacts of Information Technology Investments Conference, Charleston SC., 4-5.

Baily, M. & *Chakrabarti*, A. (1988): Electronics and White-Collar Productivity in Innovation and the Productivity Crisis, Washington DC.

Baily, M. & *Gordon*, R. (1988): The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power, Brookings Papers on Economic Activity, Vol.1, 347-420.

Bakos, Y. & *de Jager*, P. (1995): Are Computers Boosting Productivity?, Computerworld, Vol. 27, 128-130.

Banaghan, M. (1996): The Productivity Paradox, Business Review Weekly, 70-73.

Barua, A. & *Lee*, B. (1997). The Information Technology Productivity Paradox Revisited: A Theoretical and Empirical Investigation in the Manufacturing Sector, International Journal of Flexible Management Systems, Vol. 9, No. 2, 145-166.

Brynjolfsson, E. (1993): The Productivity Paradox of Information Technology, Communications of the ACM, Vol. 36, No.1, 67-77.

Brynjolfsson, E. & *Hitt*, L. (1993): New Evidence on the Returns to Information Systems, Technical Report, Sloan School of Management.

Brynjolfsson, E. & *Hitt*, L. (1996): Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending, Management Science, Vol. 42, No. 4, 541-558.

Brynjolfsson, E. & *Hitt*, L. (1997): Computing Productivity: Are Computers Pulling their Weight?, MIT and Wharton Working Paper (available at http://ccs.mit.edu/erik/).

Brynjolfsson, E. & *Hitt*, L. (1998): Beyond the Productivity Paradox: Computers are the Catalyst for Bigger Changes, Communications of the ACM, forthcoming.

Brynjolfsson, E., *Malone*, T., *Gurbaxani*, V. & *Kambil*, A. (1994): Does Information Technology Lead to Smaller Firms?, Management Science, Vol. 40, No. 12, 1628-1644.

Cash, J. & *Konsynsk*, B. (1985). IS Redraws Competitive Boundaries, Harvard Business Review, Vol. 63, 134-142.

Currie, W. (1989): The Art of Justifying New Technology to Top Management, Omega, Vol. 17, No. 5, 409-418.

Dasgupta, S., *Sarkis*, J. & *Talluri*, S. (1999): Influence of Information Technology Investment on Firm Productivity: A Cross-Sectional Study, Logistics Information Management, Vol. 1/2, No. 12, 120-129.

David, P. (1990): The Dynamo and the Computer: A Historical Perspective on the Modern Productivity Paradox, American Economic Review Papers and Proceedings, Vol. 1, No. 2, 355-361.

Davis, G., *Collins*, R., *Eierman*, M. & *Nance*, W. (1993): Productivity from Information Technology Investment in Knowledge Work in R. *Barker*, R. *Kauffman* and M. Mahmood (Eds.), Strategic Information Technology Management, Harrisburg, 327-343.

Davis, T. (1991): Information Technology and White-Collar Productivity, Academy of Management Executive, Vol. 5, No.1, 55-67.

Dewan, S. & *Min*, S. (1997): The Substitution of Information Technology for Other Factors of Production: A Firm Level Analysis, Management Science, Vol. 43, No. 12, 1660-1675.

Diewert, W. & *Fox*, E. (1997): Can Measurement Error Explain the Productivity Paradox?, University of New South Wales, School of Economics Discussion Paper No. 27.

Docherty, P. & *Stymne*, B. (1993): Mediators of IT-Effectiveness, paper presented to the Productivity Impacts of Information Technology Investments Conference, Charleston SC.

Drucker, P. (1988): The Coming of the New Organization, Harvard Business Review, Vol. 66, No.1, 45-53.

Economist (1994): What Computers Are For?, 22 January, 68.

Economist (2000): Performing Miracles, 17 June, 118.

Ellis, L. & *Curtis*, C. (1995): Measuring Customer Satisfaction, Research Technology Management, Vol. 38, No. 5, 45-48.

Farbey, B., *Land*, F. & *Targett*, D. (1992): Evaluating Investments in IT, Journal of Information Technology, Vol. 7, 109-122.

Feigenbaum, A. (1985): Total Quality Control, New York.

Freeman, K. & *Dart*, J. (1993): Measuring the Perceived Quality of Professional Business Services, Journal of Professional Services Marketing, Vol. 9, No. 1, 227-247.

Garvin, D. (1987): Managing Quality, New York.

Gordon, R. (1987): The Postwar Evolution of Computer Prices, National Bureau of Economic Research Working Paper 2227.

Gordon, R. (1994): Comment on S.D. Oliner and D.E. Sichel, Computers and Output Growth Revisited: How Big Is the Puzzle?, Brookings Papers on Economic Activity Vol. 2, 273-333.

Henderson, R. (1994): Managing Innovation in the Information Age, Harvard Business Review, Vol. 1: 100-105.

Hoos, I. (1960): When the Computer Takes Over the Office, Harvard Business Review,102-112.

Hurley, F. & *Laitamaki*, M. (1995): Total Quality Research: Integrating Markets and the Organization, California Management Review, Vol. 38, No. 1.

Johannessen, J.-A., *Olaisen*, J. & *Olsen*, B. (1999): Strategic Use of Information Technology for Increased Innovation and Performance, Information Management and Computer Security, Vol. 7, No. 1, 5-22.

Jonscher, C. (1994): An Economic Study of the Information Technology Revolution, In T. *Allen* and M. *Scott Morton* (Eds.), Information Technology and the Corporation of the 1990s, New York, 5-42.

Jorgenson, D. & *Stiroh*, K. (1993): Investment in Computers and U.S. Economic Growth, paper presented to the Productivity Impacts of Information Technology Investments Conference, Charleston SC..

Jorgenson, D. & *Stiroh*, K. (1999): Information Technology and Growth, American Economic Review, Vol. 89, No. 2, 109-115.

Kaplan, R. (1989): Management Accounting for Advanced Technological Environments, Science, Vol. 25, 819-823.

Kling, J. (1995): High Performance Work Systems and Firm Performance, Monthly Labour Review, 29-36.

Kordupleski, R., *Rust*, R. & *Zahorik*, A. (1993): Why Improving Quality Doesn't Improve Quality (or Whatever Happened to Marketing?), California Management Review, Vol. 35, No. 3.

Lumkin, G. & *Dess*, G. (1996): Clarifying the Entrepreneurial Orientation Construct and Linking it to Performance, Academy of Management Review, Vol. 21, No. 1, 135-172.

Lundvall, B-A. & *Johnson*, B. (1994): The Learning Economy, Journal of Industry Studies, Vol. 1, No. 2, 23-42.

Macdonald, S. (1995): Learning to Change: An Information Perspective on Learning in the Organization, Organization Science, Vol. 6, No. 5, 557-568.

Malone, T. (1997): Is Empowerment Just a Fad? Control, Decision Making and IT, Sloan Management Review, Vol. 38, No. 2, 23-35.

Mandeville, T. & *Macdonald*, S. (1980): Reflections on the Technological Change Debate, Australian Quarterly, Vol. 52, No. 2, 213-220.

McKeen, J. & *Smith*, H., (1993): The Relationship between Information Technology Use and Organizational Performance. In *Barker*, R., *Kauffman*, R. & *Mahmood*, M. (Eds.), Strategic Information Technology Management, Harrisburg PA, 405-44.

Milgrom, P. & *Roberts*, J. (1990): The Economics of Modern Manufacturing: Technology, Strategy and Organization, American Economic Review, Vol. 80, No. 3, 511-528.

Monteiro, L. & *Macdonald*, S. (1996): From Efficiency to Flexibility: The Strategic Use of Information in the Airline Industry, Strategic Information Systems, Vol. 5, No. 3, 169-88.

National Research Council (1994):. Information Technology in the Service Society: A Twenty-First Century Lever, Washington DC.

Oliner, S. & *Sichel*, D. (1994): Computers and Output Growth Revisited: How Big is the Puzzle?, Brookings Papers on Economic Activity, Vol. 2, 273-333.

Pinsonneault, A. & *Rivard*, S. (1998): Information Technology and the Nature of Managerial Work: From the Productivity Paradox to the Icarus Paradox, Management Information Systems, Vol. 22, NO. 3, 287-308.

Porter, M. & *Millar*, V. (1985): How Information Gives You Competitive Advantage, Harvard Business Review, Vol. 63, 149-160.

Quinn, J. & *Baily*, N. (1994): Information Technology: Increasing Productivity in Services, Academy of Management Executive, Vol. 8, No. 3, 28-47.

Quinn, M. & *Humble*, J. (1993): Using Service to Gain a Competitive Edge. The PROMPT Approach, Long Range Planning, Vol. 26, No. 2, 31-40.

Ralston, G. (1998): No Productivity Paradox, Educom Review, 36-38.

Reichheld, F. (1993): Loyalty-Based Management, Harvard Business Review, Vol. 71, No. 2, 64-73.

Romer, D. (1988): Comment, Brookings Papers on Economic Activity, Vol. 2: 425-428.

Schrednick, H., *Schutt*, R. & *Weiss*, M. (1992). Empowerment - Key to World-Class Quality, MIS Quarterly, Vol. 16, No. 4, 491-505.

Solow, R. (1987): We'd Better Watch Out, review of S.S. *Cohen* and J. *Zysman*, Manufacturing Matters: The Myth of the Post-Industrial Economy, New York Times Book Review, 36.

Son, Y. (1990): A Performance Measurement Method which Remedies the Productivity Paradox, Production and Inventory Management Journal, Vol. 2, No. 31, 38-43.

Stoneman, P. & *Francis*, N. (1994): Double Deflation and the Measurement of Output and Productivity in UK Manufacturing 1979-89, International Journal of the Economics of Business, Vol. 1, No. 3, 423-437.

Stoneman, P., *Bosworth*, D., *Leech*, D. & *McCausland*, D. (1992): Quality Adjusting the Producer Price Index for Computers in the UK, report to the Central Statistical Office, London.

Strassman, P. (1985): Information Payoff: The Transformation of Work in the Electronic Age, New York.

Strassman, P. (1994): How We Evaluated Productivity, Computerworld Premier 100, Vol.19, 45.

Strassman, P. (1997): The Squandered Computer: Evaluating the Business Alignment of Information Technologies, New Canaan CT.

Teas, R. (1993): Expectations, Performance Evaluation, and Consumers, Journal of Marketing, Vol. 57, No. 4, 18-34.

Thackray, J. (1993): Fads, Fixes and Fictions, Management Today, 40-42.

Triplett, J. & *Gordon*, R. (1994): Comments on *Oliner*, S. D. & *Sichel*, D. E. Computers and Output Growth Revisited: How Big is the Puzzle?, Brookings Papers on Economic Activity, Vol. 2, 273-333.

Weill, P. (1993): The Role and Value of Information Technology Infrastructure: Some Empirical Observations. In R. *Barker*, R. *Kauffman* and M. *Mahmood* (Eds.), Strategic Information Technology Management, Harrisburg PA, 547-572.

Willcocks, L. & *Lester*, S. (1996): Beyond the IT Productivity Paradox, European Management Journal, Vol. 14, No. 3, 279-290.

Windschuttle, K. (1979): Unemployment, Ringwood, Victoria.

Wiseman & *Macmillan*, I. (1984-5): Creating Competitive Weapons from Information Systems, Journal of Business Strategy, Vol. 5, 42-49.

Wyckoff, A. (1993): The Impact of Computer Prices on International Comparisons of Productivity, paper presented to the Productivity Impacts of Information Technology Investments Conference, Charleston SC.

Abrahamson, E. 1996. Management fashion, ***Academy of Management Review***, 21, 1: 254-85.

Berry, J. 1983. Review of *In Search of Excellence*, ***Human Resource Management***, 22, 3: 329-33.

Collins, D. 1994. The disempowering logic of empowerment, ***Empowerment in Organizations***, 2, 2: 14-21.

Collins, D. 1997. Two cheers for empowerment: Some critical reflections, ***Leadership and Organization Development Journal***, 18, 1: 23-8.

Conrad, C.1985. Review of A Passion for Excellence, ***Administrative Science Quarterly,*** September: 426-8.

Crainer, S. 1996. That was the idea that was, ***Management Today***: 38-42.

Dwyer, J. 1993. Who gains but the gurus from the business bull market?, ***Works Management***: 13-15.

Economist (1993a), 'Art or science?', 24 April, p.91.

Economist (1993b), 'Quacks and coaches', 17 April, p.81.

Gattiker, U. & Larwood, L. 1985. Why do clients employ management consultants?, ***Consultation,*** 4, 1: 119-29.

Gill, J. & Whittle, S. 1992. Management by panacea: Accounting for transience, ***Journal of Management Studies,*** 30, 2: 281-95.

Grint, K. 1994. Reengineering history: Social resonances and business process reengineering, ***Organization***, 1, 1: 179-201.

Guest, D. 1992. Right enough to be dangerously wrong: An analysis of the *In Search of Excellence* phenomenon, ***Human Resource Strategies***: 5-19.

Huczynski, A. 1993. Explaining the succession of management fads, ***International Journal of Human Resource Management,*** 4, 2: 443-63.

Jackson, B. 1996. Re-engineering the sense of self: The manager and the management guru, ***Journal of Management Studies***, 33, 5: 571-90.

McGivern, C. 1983. Some facets of the relationship between consultants and clients in organizations, ***Journal of Management Studies***, 20, 3: 367-86.

Nikiforuk, A. 1995. The dangerous antics of business gurus, **Canadian Business**, 68, 6: 157.

Pascale, R. T. 1990. ***Managing on the Edge***, New York: Simon and Schuster

Pollitt, C. 2000. Institutional amnesia: A paradox of the information age?, ***Prometheus***, 18, 1: 5-16.

Schaffer, R. 1997. Making consulting pay off: Its time for a new deal, ***Industrial Management***, 39,6: 1-6.

Stewart, J. 1996. Management, ***Qantas Club:*** 29-33.

Sturdy, A. 1997. The consultancy process – An insecure business?, ***Journal of Management Studies***, 34, 3: 389-413.

Tilles, S. 1961. Understanding the consultant's role, ***Harvard Business Review***, November/December: 87-99.

Washburn, S. 1991. Let's call it asset-based marketing, ***Journal of Management Consulting***, 6, 4: 4-10.

Weedon, R. P. 1990. Potentially suicidal clients. Whether and how to intervene, ***Journal of Management Consulting,*** 5, 3: 37-40.

Macdonald, S., Anderson, P. and Kimbel, D. (1990), *Government Policy and the IT Productivity Paradox*, report to Department of Trade and Industry, London, November.