

Elephants Rarely Pirouette (ERP)

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Peter Drucker in his book "Post Capitalist Society" contends that as the world move "from capitalism to a knowledge society" one implication is that

"Every organisation today has to build into its very structure the management of change."

Whilst industry has been evolving and changing since the eighteenth century and the slogan *"There's always a better method"* has been common coinage since the 1940's, the phenomenon, which Drucker noted in 1993, was of a different order. R.B. Reich's seminal work "The Work of Nations"ⁱ had already described a world economy where capital has become knowledge, industry has become international and manufacture is fractalising to smaller groups, or cells, of highly specialised teams of "Symbolic Analysts".

Whether the predictions of Reich and Drucker will happen in detail, or whether changes as yet undefined will modify the outcome remains in doubt, but the trends are there for all to observe. As early as 1961 John Burbageⁱⁱ explained how the complexity of modern products and the uncertainties of production make responsiveness the key to process design. His "Group Technology" (which J. Parnaby has since described as "Cellular Manufacturing") addressed this need by devolution of power of decision. A large factory can be arranged in groups of machines, each of which has a defined "product" and a responsible person who will adapt its activity to meet plan as circumstances change.

What Burbage, to whom the theory of manufacturing control owes so much, had in his sights was large centrally managed production control systems. He was highly critical of Joseph Orlicky's "Material Requirement Planning"ⁱⁱⁱ when it was published in 1974 and indeed developed a particular hatred of MRP in general and MRPII in particular. It was not that Burbage disputed the need for a bill of materials, the power of the computer nor the need to order materials in advance, but that the implicit assumptions of constant lead times and infallibility of humans and machines rendered the whole edifice unrealistic and ineffective.

"MRP assumes infinite capacity for a finite plant"^{iv} as Rice and Yoshikawa wrote in 1982, and in 1984 Bojanowski^v was claiming one of the advantages of the system was *"MRP increases the length of production runs"*. Burbage maintained that local decision-making was the only effective means of ensuring responsiveness in an ambience of complexity and uncertainty. Production runs should be as short as total capacity allowed.

Although Burbage was ahead of his time, the recognition of the need for flexibility became more widespread in the 1980's, when recession and international competition brought customers and their needs more forcibly to the attention of managers. Denis Towill's^{vi} mind worked in the same direction as that of Burbage and he proposed in 1988 a more flexible use of computers for production control. A decision support system based on

algorithms *"Which offer a range of possible alternative actions..."*, *"The DSS may leave the final decision to the manager most concerned"* – was developed by the team at UWIST.

In proposing the need for "Agility" in 1995, Bryan Kelln^{vii} recognised the impact of the economic changes described by Reich and Drucker, ascribing much of it to deregulation. *"Change will not be evolutionary and gradual but immediate and revolutionary: The new market place will not be static and homogeneous but dynamic and multidimensional"*.

Undoubtedly deregulation has accompanied the knowledge revolution, although whether as a contributory cause or merely as an effect is open to question. Deregulation and the removal of tariff barriers (GATT 1948, followed by EU, NAFTA, APEC, SACU) have reduced tariffs to one tenth of what they were fifty years ago.^{viii}

From the changes which have already been brought about by management actions in the last few years it is clear that most companies have recognised the need to embrace change and know that responsiveness is necessary. This is evidenced by a very widespread acceptance of Prahalad and Hamel's^{ix} "Core Competence" notions. In effect, this recognition is an extension of Burbage's principle of delegation of power of decision. Complexity is addressed by subdividing systems and delegating some specialisms to other people, in this case, other companies, hence the growth of "Outsourcing". In 1991 the Strategic Planning Director of Rover^x wrote:

"It has been evident for some time that competitiveness cannot be achieved in the 1990's by the OEM alone. Success will reward manufacturers able to align key suppliers to their strategic vision. Effectiveness will depend on market insight and flexibility and responsiveness to competitive thrusts, and efficiency in the use of their combined assets".

Research involving Automotive Supply Chains in Europe between 1993 and 1996 (FWS)^{xi} confirmed the rapid pace of outsourcing and general acceptance of concentration on "Core Competences" in the European Automotive Sector. Delegation of "systems" to first line suppliers has become not only common, but also universal. This does spread the risk among a larger population of shareholders, but, primarily, it is a route to handle complexity and gain responsiveness – a move towards "Agility". Coupled with the removal of trade barriers it should speed the dispersion of manufacture not only among companies but also among countries. To date this "Globalisation" which is said to be on everyone's agenda is limited. For example General Motors, the most internationally minded motor group, still retains 70% of its production in North America^{xii}. In Europe, each Automotive Group still has a preponderance of suppliers in its own country (FWS Study, *ibid*). However, a growth in world trading overall in the past fifty years by a factor of 16 (Financial Times, *ibid*) certainly lends weight to the belief that outsourcing will become increasingly international.

There can be little doubt that complexity, uncertainty and risk will all affect manufacturers to an ever-increasing extent. What have we learned about managing them effectively?

From the literature it does seem clear that dispersing intelligence throughout the manufacturing system (vide group technology, cell manufacturing, outsourcing) is the best known way of achieving a responsive system. Central control of a dispersed and complex system subject to fast variation and uncertain demand would seem to have proved

ineffective. The term "Supply Chain Management" in these circumstances might sound like oxymoron. Multi-proprietor supply chains have displaced vertical integration because vertical integration was impossible to manage. However, supply chains can be structured and they can be influenced for good or ill by the behaviour of the individual participants.

It usually falls to the final player in the chain, who faces the consumer, the only source of real income, to try to regulate or rationalise the operation of the supply chain, by structure and by leadership.

How discordant then sounds the notion of "ERP" (Enterprise Resource Planning).

According to "Cyber India Online" ^{xiii} *"The Enterprise Resource Planning (ERP) software vendors are experiencing unprecedented global expansion."* This is not unbelievable on looking at the growth of options being offered for example "R3" by SAP, "Triton" by BAAN, "Marshall" by Ramco, "Protean" by Marcom, "Systime" by J.D. Edwards, and offerings by SSA and Oracle. All of this is in pursuit of an ERP software market which Gisela Wilson of AMR is reported (ref ^{xiii} *ibid*) to have estimated at 9.6 billion US \$ in 1997. Albert E Sharp, ^{xiv} puts the total market in 1997 at a mere four billion dollars (US), as shown in the table below, but whatever the true figure, it is a large number, and Sharp claims a market growth rate of 44% in 1997.

	1994	1995	1996	1997
SAP	692	1350	1730	2370
BAAN	60	113	224	437
MARCAM	33	43	45	57
SSA (e)	225	227	226	303
JBA (e)	55	77	113	156
JD Edwards	108	134	180	248
TETRA	15	16	15	17
PEOPLESOFT	69	134	253	433
TOTAL MARKET	1258	2093	2787	4021
GROWTH %		66	33	44

Table 1. GROWTH IN THE ERP MARKET (Licence Sales Revenue in \$US Million)

Vendors claim that ERP will plan the total resources, viz people, money, materials and plant – in a whole enterprise or even over an extended enterprise, a "Supply Chain"

If profit conscious and experienced managers throughout the world have invested, in only one year, close on \$10¹⁰ US (or even \$4 X 10⁹) in this belief, it is hard to dismiss it out of hand. But does the King have any clothes?

Elsewhere George Rzevski has argued that the economic trends described by Reich and Drucker are manifestations of the continuous search for economy. Early mass production was founded in **economy of scale**. In response to greater diversity demanded by the market, focused factories gave lean manufacture – **economy of scope** – later, the limitations of this focus pointed to flexible factories, flatter hierarchies, review of competence and more outsourcing – **economy of governance**. Gordon Brace explained these trends^{xv} as a change of focus from INPUT ("*Time is money*" and "*Lean*") to OUTPUT ("*My job is to make our products obsolete, before the competition do*" – Akio Morita) flexibility starts with considering the customer's needs, rather than navel gazing at internal expenditure. Equally, "*It is difficult to believe that there is any alternative to the devolution of power among different proprietors which will deliver responsiveness and flexibility*"... "*A manufacturer's resolution to buy a component rather than make it in house is, at least in part, a decision to change the contract with those who make the component. It was an employment contract but it is now a commercial contract.*"^{xvi}

ERP does not appear to resonate with economy of governance or with contracts, which grant plenipotentiary powers. It has the morphology of vertical integration. According to a competitor^{xvii} who could be biased, an ERP solution "*from SAP, R/3 will cost a minimum of \$4million US to implement and may take as much as three years*" A three year implementation may give pause for thought for those seeking an engine which builds the management of change into "*the very structure*" of his enterprise.

The argument runs that the cumbersome nature of early MRP applications arose partly from delays in communication, which allowed allegedly identical data to exist in two or more incompatible versions in different locations simultaneously, and partly in low computer power, inadequate to cope with vast amounts of data in a short time. With modern computing power and everyone concerned on line in real time to a common data warehouse these difficulties evaporate. The problem remains however, that a database is finite. It can store only data, which its designers foresaw may have to be stored.

Although mainframe computers are ultra-reliable, faster beyond expectations, have huge memory capacity and first class communication facilities, they work within the framework of the system design. Direction and control is necessarily central. As with the automatic factories of fifteen years ago emphasis is on efficiency – doing things right -, rather than on effectiveness – doing the right things. In the original PC revolution it was noted that whilst computerisation had initially robbed individuals of independent initiative and imposed delays, PC's re-empowered individuals. ERP is potentially a counter-revolution, extending the empire beyond the dreams of the early potentates. In a dynamic and fractalised wealth generation system the "fit" is not immediately obvious. In May 1998, at their conference in Denver, Colorado Jan Baan of BAAN and Bill Gates of Microsoft announced the release of "BAAN SERIES", an ERP system to be distributed among many PC's. This, at least, appears to be swimming with the tide of the world economy. SAP (according to the

Financial Times (01/07/98 – *ibid*) is moving its system towards componentisation so that users can mix and match, but this appears to refer to functions rather than to units, or areas of responsibility for results.

It is neither desirable nor practicable to stop or slow down the development of computer systems to increase the effectiveness of wealth creation. The question is however, are we using development energies and creativity in the right direction. Ever since Henry Ford's successors abandoned the fully integrated car plant it has been clear that productive systems in which the intelligence is distributed, rather than centralised, are more responsive and more economic of resource. Frederick Taylor's contention that work was performed by "workers" but "management" was the prerogative of "managers" who laid down precise and comprehensive methods for "workers" (possibly necessary in 1898 with an illiterate labour force) has long been abandoned; the Japanese taught us that we all have brains.

However, just as the engine was put in front of car passengers because the horse preceded the carriage, so in the development of computer systems the vestigial thinking that "operators" need a boss lives on. The organic systems of the natural world are self organising. Stafford Beer^{xviii} drew the analogy of natural "homeostatic" systems with industry as early as 1957. Since then the theme has been obscured by our obsession with incremental improvements of existing structures. Even automatic data capture, which could be a step in the right direction, has been seen simply as a cost cutting measure or a way of speeding up a mechanical process. The current moves to local empowerment by group technology and outsourcing are a reaction to complexity, but only a tacit recognition of the aim – a self organising production system. We grope for ERP as a traffic warden looks for yellow lines.

For the future "Virtual Enterprise" to be effectively self organising we require distributed intelligence but much of the "intelligence" required is of a fairly low level. It is not beyond human competence to create perhaps half of the "Intelligence Nodes" in a supply chain as electronic devices, rather than people. Once the vision is firmly established

"We aim for the perfect self regulating system not the dominance of other people"

then we can progress from ERP to VERA – the "Virtual Enterprise Resource Allocation" algorithm. This is the aim of the second project of "GLORI" – the Global Logistics Research Initiative, and it is based on the premise that the productive process is fractalising as producers grapple with the complexity and fast changing nature of products. The economic system is moving towards smaller productive units each specialising in a particular knowledge base or technology niche. Hence products will emerge from supply chains of many self regulating cells, and whilst these must work effectively together, the management of the total process will, by definition, be fractalised. The essence of the strategy is that the total process is too cumbersome for unitary management and hence the self managing cells.

A latter day "MRP II" system is an unlikely candidate for assisting the process, but nevertheless, free and full interchange of information is essential. The system requirement then is more like a highway code than an auto pilot. Each cell has to adapt itself to the macro-environment of the total supply chain and to the micro environment of its own

particular stage in the total process. “VERA” must be a combination of a common language, a shared highway, and a set of laws. Part of the contractual obligation undertaken by any player in a particular supply chain will be to agree and adhere to the transparency limits of his own database to co-traders; he will also agree certain common protocols, both electronic and commercial and these will include his “Open hours” and his read/write capabilities as well as agreed area of responsibility for informing the rest of the enterprise of progress, stocks, hold-ups and capacities. Each cell will manage itself as does each driver on a highway, but the manner of communicating intentions and the road manners will be common.

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ⁱⁱ BURBAGE, J.L. “The New Approach” to Production ISBN 0-671-71081-8

ⁱⁱⁱ ORLICKY, J. “Materials Requirement Planning” McGraw Hill 1974

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^{vii} KELLN, B. “The Agile Corporation is Learning to Thrive in a Deregulated Environment” Logistics, Fall 1995, Mercer Management Consultancy

^{viii} FINANCIAL TIMES, “World Trade Systems at 50” 18/05/1998

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^{xi} BRITE EURAM Programme "Future Working Structures" University of Warwick "Task 3 Report"

^{xii} "The Observer" 10/05/98

^{xiii} http://www.ciol.com/newspoint/np_243.html

^{xiv} SHARP, ALBERT E quoted in "Better Routes for Decision Makers" in the Information Technology Supplement to the *Financial Times*, July 1st 1998, page 10

^{xv} BRACE, G & PRATT, F "Time Compression – The Key Skill" *Proc. ILDM National Conference, Birmingham, June 1993*

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^{xviii} BEER, S. "The Scope for Operational Research in Industry" George Bray Memorial Lecture 1956, Institution of Production Engineers, Sheffield City Memorial Hall 18/03/97 Maxwell Love & Co., White Lion Street, London N1