

Thinking in Systems; Working on Processes . . . The New Business Paradigm.

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The aim of this paper is to help explain why so many quality and improvement initiatives have not achieved their sponsors' expectations. It will explain how these failures are linked to a lack of socio-technical (people/process) understanding. The paper stresses the importance of people, differentiates their capabilities from those of processing machines and accordingly identifies a systemically useful role for information processing ('IT') as a contributor towards superior business performance results. In doing this a knowledge-based framework is described that enables managers to devise their own specific solutions based on the powerful principles of organisation found within the Natural Order. (This paper was first presented at a colloquium on quality improvement organised by the Institution of Electrical Engineers).

"Human subtlety . . . will never devise an invention more beautiful, more simple or more direct than does Nature, because in her inventions nothing is lacking, and nothing is superfluous."

Leonardo da Vinci (1452-1519)

INTRODUCTION

In the beginning there was Chaos. And from Chaos there emerged the Natural Order that we form part of and know so well. And as order emerged from chaos so patterns of natural variation emerged from the surrounding randomness. Thus the power of prediction was subtly made available to intelligent life.

Nature decrees variation in all things and this variation - or variety, if you prefer - gives rise to what we call change. The consequences of change can be life-enhancing or life-diminishing. Managers have to deal with change and in doing so they need to be able to either successfully guess or knowledgeably predict future outcomes. The ways in which they do this vary. How they deal with the data-streams which surround them is critical to their ability to solve the problems caused by chance and the virus of variation.

Consider an example to reinforce the prime importance of appreciating the all pervading presence of variation¹. Imagine an expert system faced with a trivial task. You will expect it to perform such a task reliably and without variation, just as any customer requires of their supplier. You want the task carried out in a way that allows you not only to predict the

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successful outcome to the trivial problem, but also leaves you free to solve your next problem.

In this lecture theatre each one of you has unique and privileged access to just such an expert system. Yourself. Prepare, therefore, to perform the simplest of tasks, reliably and predictably. For this you will need no more than a preferred writing instrument and a piece of paper.

The task is simple and the methodology well rehearsed by you over many years. You are in total charge. Just write one lowercase letter "a" at the top of the piece of paper. Then copy this a number of times below along a line as separated characters. Identically, of course. Remember that you have been an experienced practitioner of writing for tens of years. Your process is mature and has not been re-engineered once. The task is simple.

Next ask your neighbour how many "a's" in your lower line are each identical to the top specimen and thus each other. I can predict that the answer will always be none, using the theory of variation already noted. And that was a simple little exercise!

Variation is best understood as a virus which infects all our efforts. We can never remove it totally but it can be reduced with care and attention to detail. If you take nothing else away with you today than a heightened awareness of the critical importance of understanding the impact of variation on business and everything you do then your capability as a problem solver will have been enhanced ².

WITHOUT WORDS WE ARE LOST

This subject of this colloquium, "IT Support for BPR", is concise, particularly when the well known abbreviations are used. Like most things in life, the subject matter appears very straightforward - until you think about it.

Now I suggest that no two readers will give identical definitions of either abbreviation. 'IT' is well known to stand for 'information technology' but what does that really mean? Is it conceptual, or all about software or hardware or both?. Does it include the World-wide web. Would it perhaps be better for the purposes of improved business performance if it stood for Informed Thought? or Information Transformation?, perhaps.

'BPR' is even harder to agreeably define. To many it might seem best summed up as 'belligerent people reductions'. Professional cost cutters, who are literally more than decimating organisations around the world, of course would not agree. They are firm in their, in the author's opinion, naive belief that real sustained performance will follow their slash-and-burn tactics. Few in number are the organisations that have escaped the simplistic Hammer-blows of fresh-faced MBA consultants armed with clean sheets of paper, a strong brand-name and elegant sophistry. Fortunately however, recent reports suggest that even the self acclaimed experts may be having second thoughts³. 'Better productive results' might be a more enlightened translation of the intention, if not the consequence, of 'BPR'.

The way we use the spoken word - our language - is important. But the way we use the printed word is even more important. For some 5,500 years writing has been our traditional way of operationally defining and recording what we mean for use by others. It enables us to agree standards for operations amongst a group of like minded people. The English language is particularly powerful in this regard, being lower in entropy than any other major language. This is a major reason why the West, in a period of sustained development from the mid-18th to mid-20th centuries, was able to achieve economic pre-eminence⁴.

Binary clarity in a relatively steady state environment nourishes economic progress better than scalar uncertainty. Clear questions lead to equally clear answers. Command and control can thus provide the executive means to resolving problems and coping with the relatively slow-paced change that characterised the Industrial Era until the last World war.

Change the nature of the environment to one of faster, and accelerating, change and then binary clarity will be found less able to provide valuable answers to questions that are in themselves not well formulated. The questions are now more important than the answers. In framing the initial question (how many people are in this building?) we begin to ask further questions that beg our initial query. (At what time of day are we interested in the number? What will we do with the information when we have got it? What margin of error can we tolerate?)⁵. In the complexity and variety that characterise the edge of chaos we do well to remember the sensitivity of subsequent events to initial conditions, assumptions and questions.

With the transition to the information era consensus and conformity now replace command and control as the socio-economic guidance system. The military/industrial hierarchy evolves into a socio/technical heterarchy. Just as the temper of the English language itself was ideally suited to the growth of this nation's industrial Empire so the consensual nature of the Japanese language has powerful qualities that have helped build consensus with communication and allow long-term gearing in economic decision making.

A people's language serves as its root directory of meaning. It provides the building blocks for communicating and storing knowledge. If we are to cope with the inevitability of higher variety futures then we must recognise that what was once a strength may become a weakness if we further confuse the issue with ill-defined strategic abbreviations such as "TQM", "BPR", "IT" etc. Only a very few time tested abbreviations have a clear meaning, understood by millions, such as - SOS, DIY, TNT, OED. Each of these provides an operational definition. The software industry should be well aware of this - although error rates in some applications often prompt the thought that "reliable software" is a phrase in danger of being perceived of as an oxymoron.

Before proceeding further I believe it would be as well to set out what differentiates process oriented management from financial oriented management. The traditional purpose of business has always been to make a profit by the sale of goods and services at a price greater than the cost of their supply. This approach has been sustained by financially oriented, functionally focused management. When price competition appears this approach naturally favours directed cost cutting without regard to the systemic implications that are

unknown and uncoded. This is the piecemeal approach. The desired effect is chased after by brute force. In competitive markets financially oriented management is destined to fail.

By contrast, the prime purpose of business today is to make a profit by meeting the preferences of the market at an acceptable price. This approach depends for its success upon process oriented, customer focused management. It has nothing to do with cost reduction per se, rather it is directly concerned with reliability and predictability - improvements to which will incidentally drop unit costs dramatically faster than by any other means. This is the wholemeal approach. The desired effect follows from causes changed by knowledge. (Perhaps, therefore, we would be advised to think of the title of today's colloquium as *Informed Thought supporting Better Productive Results.*)

CARTESIAN METAPHORS

Just as our forefathers tended to separate us from the Natural Order so Descartes made the mistake of divorcing the mind from the body. *I think therefore I am* is in fact no more the conscious imperative today than the alternative *I am therefore I think*. As we grow in our understanding of embedded systems and emergent properties perhaps we should reflect on the fact that just as we are conscious beings in nature so we have a unique aptitude to handle immense complexity and find the "elegant simplicity that lies beyond complexity" ⁶.

Our feelings, emotions, motivations and beliefs are all formally seated in our brain but have now been shown to also be co-rooted throughout our body. Age old expressions such as: "I can feel it in my bones. . . ; "This gives me a bad feeling . . . ; "From the bottom of my heart . . . ; "I'm going to follow my gut feeling on this issue" are familiar and they are more often than not a reflection of an integral part of our decision making mechanism. Indeed research by the distinguished American neurosurgeon Antonio Damasio has indicated the importance of what he calls 'somatic markers' ⁷ in helping us in the rapid sorting of available options to solve urgent problems.

Our organisational structure of cells and organs sum to produce our body and from this physical form emerge the higher entities of mind and soul which characterise us within the animal kingdom. This organising structure is found throughout the Natural Order and there is reason to believe that the development of human enterprises benefits from application of the same viable principles ⁸. Ants, bees, birds, fish, herbivores, carnivores all organise around generically similar rules of performance that favour their maintaining equilibrium within changing environments. As we re-organise the way we work and exploit our 'somatic thinking' capability to orchestrate the whole we will increasingly need to be supported by 'computational machinery' that can keep pace with the endless torrents of data that are now an intrinsic part of global business.

"We are what we repeatedly do. Excellence, then, is not an act, but a habit."

Aristotle (384-322BC)

SOCIO-TECHNICAL SYSTEMS

Despite ample popular evidence to the contrary people and machines can work in perfect harmony. Just think of a symphony orchestra. The piano is every bit a machine as the flute or the violin. They may be 'low tech' kit by today's standards maybe, but none the less in the hands of well trained, intrinsically-motivated, highly practised and ably led ordinary people they can be used to produce amazing results.

Let us for a moment take the orchestral analogy further. Why is it that a group of a hundred or so young instrumentalists (no small complexity!) of differing abilities can come together for a few evenings a month and then deliver an enjoyable and loudly applauded performance of a work that they have never before performed or even heard? This is not an unusual event. Schools, colleges and universities around the world achieve this feat of excellence daily. In each case success is due to standardised musical scores; high levels of intrinsic-motivation and able leadership. Why cannot our places of work emulate this simple achievement?

Sadly most arrangements of people and machines do not achieve the high levels of excellence taken as the norm in the world of music. Once upon a time proud craftsmen fashioned their products by hand for people they knew. Then machines tended by operators with a self-esteem proportional to their meagre pay supplied faceless and unknown customers and a new set of performance standards came into play. The intimacy of the local market square and its wise - if not wily - merchants (only now found in the remaining souks of Arabia and parts of the Far East) gave way to the anonymity of the global marketplace and its faceless, selfish traders.

As less labour was invested in the artefact more effort was put into marketing it. Real value was slowly replaced by perceived value. Friday cars looked good in the showrooms twenty years ago. Locally made television sets once worked well for at least a year or so before they had to be repaired or replaced. The sale was everything, the life-cycle experience was the customer's problem. Pride in work was fast becoming an alien concept.

That this need not be the norm was grasped by the Japanese early in the fifties as they struggled to recover from the last war and set out to occupy the centre of the industrial stage ⁹. They viewed their entire nation as a socio-economic system, respected the connectivities and took on the world manufacturing giants and won. It didn't take them long. In many industries five years was enough ¹⁰.

Their success was due to understanding the socio-technical continuum. People truly were their most important resource. In a land the size of the UK with 85% uninhabitable and a population over double ours they had evolved a society based on consensus and respect. Facing starvation after the war and with virtually no natural resources at all they had to seriously face the issue of their survival. America was only able to provide limited help - mainly as knowledge. They took the knowledge and released the power therein.

Their economic leaders in JUSE quickly recognised that variation would need to be mastered if they were not to waste the rare resources that they were able to acquire. The

Americans had by example and theory taught them how to respect variation. Ever since 1926 the basic principles had been understood in the US. Without it the remarkable success of the US telephone system would not have been possible ¹¹. Without it freedom itself may not have survived the last war.¹²

The Japanese also had asked simple questions such as: "How does the work get done?", and then "How can we continually improve the way it gets done?" They discovered the value of working on processes continually to improve them. They also grasped the essential hierarchy of work, seeing the way processes aggregated into systems and devolved into sub-processes and work instructions.

Those of you who have been involved with BPR initiatives and IT support of them may be glimpsing some of the issues which may or may not have been fully addressed in those studies. So often the mask of BPR has been used to legitimise the traditional CEO's approach to financial fire-fighting on a corporate scale - laying people off. Down size the payroll to upsize the profits!

"Do you know that doing your best is not good enough? You have to know what to do. Then to do your best. Draw a flowchart for whatever you are doing. Until you do you do not fully understand what you are doing. You just have a job."

W. Edwards Deming (1900-1993)

MANAGEMENT IS ABOUT PREDICTION

Managers have little time for the past. The present almost totally occupies them while the future always looms large in their good intentions. Such spare time as they have from meetings which are deemed important and dealing with outbreaks of spontaneous combustion more usually revolves around institutional freewheeling than continuous improvement. Incidentally, there is a pleasing correlation in my experience between performance excellence and operational tranquillity. Visit the Toyota factory near Derby to experience ordered productive calm. Or listen to its quiet spoken and thoughtful leader, Carl Klemm ¹³, describing the Toyota Production System based upon what the innovative motor manufacturer calls, significantly, 'The Thinking Way'. Continuous improvement as a life-style has no room for the fire-chief's klaxon and other emergency sirens.

When future planning is taken seriously - typically at budget time - the simplistic assumption that the future is but an extension of the past is usually sufficient to fob off any deeper synthesis and prediction. However a deeper examination of the information flows present within an organisation will reveal an ordered sequence that can be adopted to advantage by management. The hierarchy of added value domains sets a regimen for the emergence of knowledge from data by successive contextual exercises.

In truth most managers tend to operate as the custodians of a Heath Robinson machine - keepers of the mechanistic model of their organisation. True Newtonians to the end. Sometimes more liberally minded managers may be inspired to follow the principles of not

Newton but Darwin, recognising that they are part of an organisation which shares more commonality with the natural world than the mechanical one. Here we find the 'market' is always lauded as the right model due in part to the appeal of the concept of 'survival of the fittest', mistaken as a metaphor for the strongest rather than the most suitable (as Darwin actually meant).

With the advent of a growing understanding of natural complex adaptive systems over the past 15 years it is increasingly apparent that as with any other organisation the socio-technical systems mentioned earlier are typically examples of productive entities flourishing at the edge of chaos. They exhibit no mechanical certainties; they do not conform to any consistent rules of market testing. Rather they are seen to exhibit an enduring tendency to adapt themselves to their surrounding by the timely emergence of new properties rooted into their current environment.

While Newtonian and Darwinian models of organisations each in their own ways appeal to the command centred thinking of traditional management the Santa Fe - or network centric model - relies for its appeal upon recognition of the less than predictable way in which the real world actually works over the medium and long term (i.e. beyond a week!).

THE POWER OF THEORY

To judge from the promotional literature issued for management courses conventional managers have a strong preference for practical case studies as opposed to theoretical approaches. Copying others is more appealing than thinking and innovating. Since 1900 only 16 of the then top-100 companies (and 1 of the top 12) are still in business. In the UK only 32 of the top-100 companies of 1965 are today in The Times' top-100. Survival is clearly not obligatory.

The me-too copy-cat culture has provided many organisations with adequate short-term business opportunities. The mature nature of most markets however dictates that only those organisations that shun the copy-cat model and recognise that variation invalidates such a simplistic approach will stand a chance of prospering in the new millennium. So if copy-cat practices won't work, what will?

The answer is theory - that is the predictive mechanism that is based on an act of faith and a suitable world-view - such as the new business paradigm of thinking in systems and working on processes. *Thea* is Greek for viewing. The theatre provides us with a useful mental image. When the stage is viewed by an observer it is easier to understand what has passed and predict what is likely to be coming.

But in a changing world theories must be rigorously tested. Each time the theory passes the predictive test we may be reassured but always remember that it only needs one failure to disprove a theory and thus encourage us to improve upon it and frame a better one. The test of a theory is that it can be proved wrong not that it can be confirmed. This brings me to a related point. We only advance by our failures. If you doubt this have you ever

watched a baby learning to walk? Sir Karl Popper, certainly one of the greatest scientific philosophers of this century, tells us that all life is concerned with problem solving ¹⁴.

Theory cannot help in truly chaotic situations. Its power comes in the context of stable conditions where there are detectable signals not overwhelmed by noise. It will serve to guide us in circumstances where the process is balanced at the edge of chaos - as in the case of processes that are part and parcel of complex adaptive systems. Now IT depends upon models of the real world. Overtly or otherwise the software will be related to algorithmic models. There is a strong sense of theory in all software.

BPR has no theory. Just case studies. It is generally marketed as a mechanism heavily biased towards eliminating redundant but experienced middle managers. Results over the short run can be assured. Cost savings will be achieved due to a simplistic - even naive - rationalisation of the process fabric by observers rarely expert in systemic understanding and thus unaware of the wider implications of their actions. For instance while the cost savings for the next year of closing a training department or reducing an R&D budget can be calculated with verisimilitude by an accountant who can compute the value lost to the organisation by such actions.

We now come to address the defining relationship between IT and BPR. That is the difference between convergent and divergent problem solving ¹⁵. Convergent problems are those for which there is a unique, unarguable, finite, calculable solution. This is the stuff of IT. Divergent problems are those for which there is no single definitive answer, but instead a value judgement to be made between extremes - such as ethical and unethical; freedom and restriction; imagination and slavishness; people's self-esteem and the cost of human resource. This should be the stuff of BPR.

Socio-technical systems contain ample measures of both divergent and convergent problems. In turn these require requisite applications of divergent and convergent solutions. Care needs to be taken not to waste time trying to solve problems of one type with solutions of the other type if chaos is not to be traded for order.

People can excel in devising divergent solutions. Computer programmes will not since they cannot execute judgement. They will however outperform any person when it comes to the solution of convergent problems provided they have been prepared with appropriate algorithms in the first place.

The analogue world of the carbon-based intelligence of humans thus can powerfully combine with the digital and silicon-based computational skills of computers to provide effective answers to the varied convergent/divergent problems of a socio-technical organisation such as a modern business. BPR has tended to simplify these complex issues by replacing expensive people (and their knowledge base) with cheaper computing mechanisms (and their data base).

Scalar solutions from teams of people and binary solutions from networked PC's hold the promise for levels of efficiency barely seen in the average enterprise today. If we consider

the framework, or architecture, of a business and compare it with the technics by which the business gets done we can identify the leading attributes of the socio-technical continuum:

<i>The Socio-Technical Continuum</i>	
Inputs forming BUSINESS TECHNICS	Inputs forming SOCIAL ARCHITECTURE
Vision Corporate Targets Leadership Judgement & Synthesis	Vision Wisdom/Purpose/Aim Knowledge People
Information Analysis Data	Management
Processes Quantitative Targets	Processes Qualitative Targets
Output: CONNECTIVITIES/ENTITIES	Output: PRIDE IN WORK/PROFIT

The freedom that is available to people, but not to machines, is what gives rise to divergent characteristics. As highly articulated functional command and control structures are replaced by flatter, more liberal and intrinsically motivated management emphasises the need to recognise socio-technical self-adaptive complex systems in place of mechanistic automata becomes readily apparent.

By adopting systemic thinking the heterarchy of dependent processes can be identified in a way which will facilitate the emergence of new aspects of organisation better suited to respond to the changing nature of the wider environment The case study of the prosperous 700-old Swedish company Stora is noteworthy in this respect ¹⁶.

And just as in other natural models of complex adaptive organisations, such as a colony of ants or a flock of starlings, there will be a simple set of rules which, adopted by every member of the organisation, will drive it forward with a harmony that exceeds normal levels of teamwork amongst people.

Five rules emerge from the foregoing pages which will help management teams charged with a “BPR” responsibility bring about Better Productive Results based upon our emerging belief in the benefits of enterprises being modelled on the natural viable systems approach to problem solving. They are: Purpose-Seeking; Self-Organisation; Variation Reduction; Real-Time Responsiveness and Enhancement of Pride in Work.

The test of the suitability of an appropriate Intelligent Transformation (or IT) support tool will be its capability to demonstrate a sensible and coherent contribution to each of these five following rules:

RULE #1: PURPOSE-SEEKING

The ready identification of, and contribution towards meeting the targets defined by, the common purpose of the organisation.

(The IT contribution will need to be available to everyone within the organisation who has value to add and provide a framework in which product, service and process improvements can continually be developed in real-time.)

RULE #2: SELF-ORGANISATION

The capability of each person alone and in process teams to self-organise within the leadership model and with the minimum of external intervention without invitation.

(The IT contribution will need to be responsive to supporting the needs of corporate PDSA problem-solving methodologies and an individual's need for real-time distance learning; local coaching and tutoring and intellectual networking.)

RULE #3: VARIATION REDUCTION

The ability of every person to contribute to the endless reduction of variation within the process heterarchy.

(The IT contribution will need to be able to support the flow of real-time data, its analysis into information and the subsequent synthesise of this information into knowledge. The information network will need to be tailored to enable rather than inhibit the emergence of new insights and corporate ambitions related to the surrounding environment.)

RULE #4: REAL-TIME RESPONSIVENESS

The ability of every person to respond in real-time to any event within their process domain.

(The IT contribution will need to run as a real-time machine fully processing the impact of process variation on the operation of the various and appropriate levels of the organisational structure.)

RULE #5: ENHANCEMENT of PRIDE in WORK

Meeting the need of every person to maintain and raise their self-esteem through pride in their work and recognition by others within the context of appropriate levels of organisational complexity.

(The use of IT will contribute to this end in as much as it responds to the needs of the user in learning new skills, understanding current issues and working on value-adding priorities.)

I suggest that these five rules will tend to be met where a candidate software platform supports the following characteristics:

- **Graphical** (rich-business pictures) user interface.
- **Co-operative** process-team mapping default.
- **Heterarchical** object-oriented architecture.
- **Network-centric** deployment with universal access.
- **Multi-media** support for learning, communication and performance evaluation.
- **Problem solving emphasis** based upon Shewhart/Popper approach.
- **Real-time** dynamic process monitoring
- **Off-line** dynamic modelling of process improvement and innovation studies.

CONCLUSION

As stated earlier: survival is not obligatory. Traditionally prosperity has been largely left to chance. Best efforts have conventionally been the way in which management - devoid of profound knowledge, rich in opinions and driven by the bottom line - have led the members of an organisations to bust via boom or an indifferent and steady decline.

Knowledge is obligatory for survival in tomorrow's world. And so is theory. Best efforts are no longer sufficient. Practice without theory will be insufficient. Management has to employ profound knowledge to reach down to the root issues which now shape our futures. BPR, as every other three-letter management fad, has generally been exposed for what it is - instant pudding that leaves you feeling distinctly hungry later on.

IT, despite its chequered reputation, is the only means available to managers and leaders to process the information load that they face in achieving Better Performance Results. But as with everything else in life, IT will only deliver to the extent that the users/owners knowledgeably integrate it into their new learning organisation.

As you will realise success is not a matter of luck so may I conclude my presentation by wishing you 'successful systemic thinking'!

"Those who are obsessed with practice, but have no science, are like a pilot who, setting out with no tiller or compass, will never know for certain where he is going."

Leonardo da Vinci (1452-1519)

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