

TRIZ And Complexity:

Systematic Innovation For Business & Management

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Abstract

There are approximately 2000 management texts published every year. The paper describes the outcome of a research programme, starting in 1996, aimed at distilling 'best practice' from these and other public domain business literature. The foundations of the research emerge from definitions of 'best practice' identified and distilled from TRIZ. The paper describes the factors common to both technical and business applications of the TRIZ philosophy, method and toolkit. It then describes a more fully integrated business and management methodology, constructed from TRIZ foundations, but now integrating ideas and concepts from Cybernetics research and Complexity Theory. A final section of the paper then goes on to examine some of the individual situation definition and solution generation tools found in the resulting new methodology. Given their broad level of applicability, specific focus is placed on the new business conflict-elimination matrix, discontinuous trends of evolution, and a definition tool – originating outside TRIZ – aimed at helping users to obtain a better understanding of complex people situations.

Introduction - Compatibilities and Contradictions

TRIZ or TRIZ-like concepts have been used experimentally in business and non-technical arenas for some time now, albeit with few if any published success stories. What appears clear from the limited experiences to date is that a) all of the main philosophical pillars of technical TRIZ continue to be relevant, b) the technical context within which classical TRIZ has grown is some considerable distance away from that recognized by the large majority of managers and business leaders, and, c) TRIZ alone is probably insufficient to adequately deal with many business problem and opportunity situations.

A large part of the power of technical TRIZ comes from the fact that so much engineering and scientific innovation has been studied and best practices have been able to be distilled into a generic framework. Analyse a couple of million successful innovations, in other words, and you are likely to uncover a large part of the DNA of the creative process. Until the mid-1990s there was no equivalent TRIZ-based distillation of business knowledge and therefore no business equivalent of what had been achieved in the technical arena. Even after this time, when a serious programme of research had been in place for some time, the job of extracting best practice from the world of business was severely hampered

by the lack of a formal knowledge repository such as the global patent database. Formal, in the technical context means a structure in which an inventor has to describe what problem they were trying to solve, how others had failed to do it, and how they in turn did manage to achieve a valid solution. This formal structure played a significant role in allowing the original TRIZ researchers to construct the well known abstraction-based problem solving scheme illustrated in Figure 1.

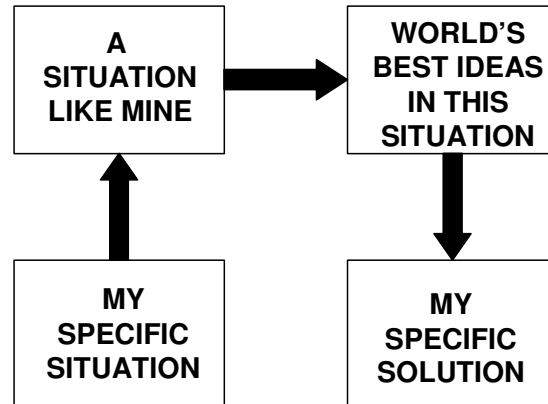


Figure 1: Abstraction-Based TRIZ Problem Solving Scheme

There is little if anything in the business domain that readily enables the creation of an equivalent knowledge structure. On the other hand, there is a considerable mass of published business information – 2000 texts per year and rising (the total in 2004 was around 3500) in fact. It just happens to be information arranged in a form far less amenable to the abstraction of general ideas. This hurdle, however, turns out not to prevent the construction of knowledge frameworks equivalent to those present in the technical version of TRIZ. It merely means that the job of knowledge-mining requires an ability to distill what is useful from stories that contain considerable fuzziness, incompleteness and – frequently – biased reporting.

Fortunately, the task is made rather easier when the main pillars of technical TRIZ are used as a lens through which to view the world of business. The recognition in classical TRIZ that strong solutions emerge when conflicts, paradoxes and trade-offs are successfully challenged, for example, provides a means whereby an enormous proportion of the management literature can be consigned to a bin marked 'nothing to contribute to a definition of best practice'. As in the vast majority of engineering education, close examination of any MBA curriculum will quickly reveal that much of what is being taught is the science and mathematics of trade-off and 'optimization'. And in TRIZ terms, neither is consistent with a definition of 'best practice'.

Just as contradiction-elimination turns out to provide a good lens, other TRIZ pillars – the importance of function and functionality, the maximization of resources, the need to think in space and time, and the drive for more ideal solutions – also allow considerable amounts of the published literature to be placed in the same 'nothing to contribute' bin. All in all, based on the ongoing management literature distillation research, around 90-95% of all management texts will be seen to have little or nothing to contribute towards what TRIZ would define as 'best practice'. That this figure is comparable to the proportion of patents that never pay back the cost of filing is perhaps a sign of some kind of fundamental human dynamic in operation.

The pillars of classical TRIZ, of course, may have turned out to be a poor test of 'best practice' from the business perspective. The striking correlation between what successful businesses do and what the pillars define as best practice, however, would appear to

suggest that there is something universal about them. This is not to say that this will always be so, or indeed that they represent a necessary and sufficient set.

Evidence that the technical TRIZ pillar set is insufficient in the business context in fact turns out to be abundant. In particular, it does not take too long to observe that the level of complexity involved in any business system is an order or orders of magnitude greater than will be found in even the most advanced technical system. We can see this effect very starkly in action by examining function analysis models for technical and a business situations. Figure 2 shows such a comparison.

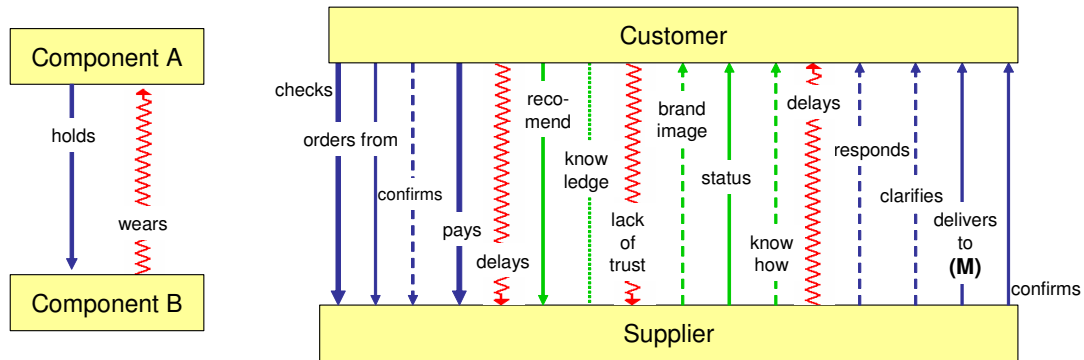


Figure 2: Comparison Between Typical Technical And Business Function Analysis Models

As suggested by the figure, the number of interactions in even the most simple of customer-supplier relationships is inherently bound with a host of spoken and unspoken, tangible and intangible, and positive and negative interactions. Never mind the additional complexities that emerge when we start looking at the effects of time on any model. Any attempt to apply TRIZ-like processes to this type of business situation cannot realistically expect to deliver sustainable benefit unless the manifest complexity is somehow accommodated.

Fortunately the enormous complexity handling problem is alleviated somewhat by past and ongoing research in the complexity and cybernetics fields. Of particular importance in the cybernetics regard is the concept of recursion. Recursion, in the context we will use it here, concerns the discovery that highly complex systems often emerge from small numbers of very simple rules (think 'DNA'), and that these rules often re-appear at different hierarchical perspectives on a situation. We can see this recursive effect in technical systems when we zoom-in our viewing perspective to examine the architecture of an atom, and then zoom-out to view the solar system and galactic formations. We can likewise see similar recursive effects in things like the increasing-decreasing complexity trend, the oscillating shift between horizontal and vertical domination in industry (Reference 1), and in the viable system model of Stafford Beer (Reference 2). Recursion doesn't occur everywhere of course, and it does not allow us to transform all complex people problems into simple ones, but it does at least hold open the possibility that we might be able to do a better job than if we would otherwise have been able to do.

In time, it seems likely that the effects of both complexity and recursion will be shown to be as relevant to technical systems as they are to business ones. If complexity and recursion are already necessary pillars of a business version of TRIZ, they are destined to become pillars of technical TRIZ too. In actual fact this split between 'technical' and 'business' is an increasingly false one in the TRIZ and complexity context. Distinction between people who are 'technical' and those that are not is one of the fall-out phenomena of the 20th Century education system; a system that – by necessity admittedly – sought increasing levels of specialization. More and more people knowing progressively more and more about

progressively less and less. This silo mentality is now becoming a major hazard to progress in an increasing number of businesses. Not least of the reasons being that very often we may see that the solution to a 'business problem' turns out to be technical, and the solution to a technical problem turns out to come from business. As suggested in Figure 3, in TRIZ terms – or rather let us call it 'Systematic Innovation terms' since many in the TRIZ-community appear to have serious silo-mentality issues when it comes to defining what is and what is not TRIZ – the two worlds of business and technology are in actual fact merely parts of the same single world.

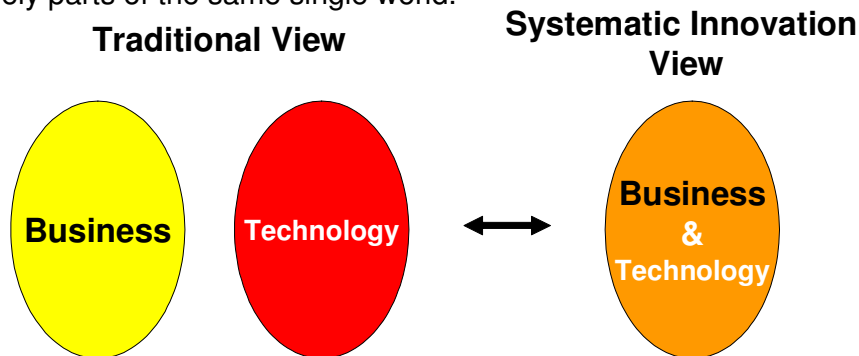


Figure 3: The More Holistic World View Of Systematic Innovation

So having explored some of the differences between classical TRIZ and this new complexity-linked 'systematic innovation' methodology at a philosophical level, let us now delve into slightly more detail and examine some of the effects the pillars have on the methods and tools that result from them. Let us first return to the world of contradictions and contradiction elimination:

Business Conflicts

As hinted earlier, challenging trade-offs and compromises turns out to be as important in business as it is in technical situations (Reference 3). It also appears to be a somewhat less frequent phenomenon in business, despite there now being several thousand case study examples contained inside the systematic innovation database.

Perhaps one of the reasons we don't see as many business contradictions being solved as technical ones is that a successful challenge on just one contradiction can have a sufficiently major beneficial impact on business performance that everyone working in the organization has to become focused on servicing the demand from customers. Perhaps another is that business contradictions seem to be so much more fuzzy than their technical equivalents.

South West Airlines (Reference 4) presents a good example of what we mean here when we talk about fuzziness. The key trade-off challenged by South West was that between quality and cost; airline passengers were mentally conditioned to expect that the service on a budget airline was going to be inferior to that on a higher price airline. When it turns out that it is perfectly possible to run a profitable low-cost airline that offers better service than a full-price alternative, customers are inevitably drawn to that service, and what we end up with is an airline that is not only extremely popular with its clientele, but one that has - uniquely in the industry - stayed in profit since the 1970s. The rub with the South West story, at least as far as distilling the generic elements of their success is concerned, is that although the key conflict being challenged is easy to see, *how* the airline actually achieved what they did is a whole different story. There is no one single inventive step here, but a whole series of inter-related improvements and innovations that only together

produced South West's profoundly better business performance. Reading through the best analysis of the South West story (Reference 4 again) quickly reveals the presence of a host of small and big jumps that can be mapped to almost a third of the Inventive Principles found in TRIZ. Not that anyone in South West used TRIZ of course. That is not the issue here. Our issue is 'can we distill some generic sense from the South West story that will allow others to repeat their success'?

Answering this question has been the main thrust of the research that has now resulted in the new Conflict Elimination Matrix for business problems, and a re-framing of the 40 Inventive Principles for business situations (Reference 5). It is not our task here to get into the detailed mechanics of these tools. Rather it is to make the point that we believe a knowledge framework has been found that allows all of the South West Airlines-like business innovations to be made available in a form relevant to anyone in any other industry. This knowledge framework has deliberately sought to achieve this in a way that forces a manager or business person to devise their own specific solutions to their own specific problems. This has caused several problems already in the implementation of 'TRIZ for Business': Managers are, almost by definition, busy people. Busy people tend to want quick answer to problems. In such circumstances, the human brain seems hard-wired to veer towards apparently already existing solutions. Unfortunately, as we shall discuss later someone else's 'already existing solution' comes from their specific preceding problem and not yours. According to the old Indian saying 'you can never step in the same river twice'. And so an apparent short-cut to an off-the-shelf solution is highly likely only to be a short cut to failure. It is often said that people will go to extra-ordinary lengths to avoid having to think. The TRIZ for Business toolkit has been designed precisely so that it will only deliver generic solutions. Turning those generic solutions into specific ones by definition needs detailed domain knowledge and thus awareness of the complexities and fuzziness that are present in and around the actual situation at hand.

On the other side of the coin, thinking about conflicts and contradictions in their business context can do much to enable an organization to examine highly complex situations and be able to discriminate between what is important and what is not. Two aspects of this belief are worth conveying here:

- 1) According to the Hoshin Strategic Planning philosophy, smart companies should focus on just one or two breakthrough innovations at a time. Hoshin uses the analogy of large boulders blocking a road (Reference 6). In TRIZ terms, each of these boulders represents one of the contradictions preventing a business from delivering 'ideal' solutions. In Hoshin terms the emphasis is on aligning the organization so that everyone is focused on moving one of the large boulders at a time. In TRIZ terms it is about staying one contradiction ahead of the competition. Any company that is able to achieve this feat is, based on the case study evidence of others, well on the way to a sustainably successful future.
- 2) Many large organizations have a strategic planning function. Many too have developed considerable expertise in identifying and mapping customer and industry trends. Having done this, just about companies fail to turn that information into meaningful business innovation. The main reason for this is that much of the trend information is fuzzy (that word again!), often inconsistent, always incomplete, and frequently contradictory. Looked at through the lens of contradictions, however, much of the confusion over what to do with the information disappears. According to the research done to assemble the 'TRIZ for business' methodology, the really important stuff happens when one trend comes into conflict with another – Figure 4. In the same way that the smart organizations stay one contradiction ahead of their competitors, the smart

organizations are the ones that use the market trend conflicts to identify precisely what that next contradiction will be.

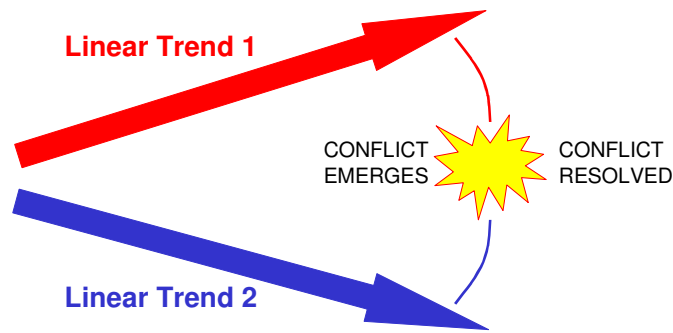


Figure 4: Linear Trends As Conflict Finders

Discontinuous Trends

As we analyse the breadth and quantity of Inventive Principles that contradiction-challenging organizations deploy, it is possible to construct a tool that can usefully communicate which sorts of Principle work in which sorts of situation. While a typical technical solution might emerge through the application of just one Principle, case study evidence suggests we are far more likely to see multiple Principles being deployed in combination in the majority of business innovations. This fact re-enforces the importance of generating lots of ideas during the ideation phase of the business innovation process, since, put simply, the more ideas you have, the more likely it is that you will have sufficient to create a winning combination.

On the other hand, this sounds like hard work to many managers. At the very least it requires a degree of familiarity with the Inventive Principles. An aspect of the business version of the TRIZ toolkit that appears to offer an easier route to the creation of winning solutions comes through the uncovering of a number of discontinuous business evolution trends. In essence these trends – Reference 5 reports 31 of them in all – give a high level description of solutions that have consistently delivered ‘more ideal’ businesses. This concept is probably easiest to describe by way of an example. Figure 5 illustrates a discontinuous evolution trend known as ‘customer expectation’. The roots of this trend come from the pioneering work of Joe Pine (Reference 7) in the field of mass-customization (another important business contradiction!) and the experience economy. For those that haven’t seen this trend before, essentially each stage represents a discontinuous shift from the previous stage. The overall trend is a pattern that can be seen repeating across an exhaustive range of different industries.



Figure 5: Typical Discontinuous Business Evolution Trend – Customer Expectation

The reasons and methods by which organizations have made the jumps from one stage to another are many and varied. But – and here is the important bit – irrespective of those various reasons and means, the same trend pattern is present. So, to take a specific example, the shift from a business model in which a company sells a product to one in which a company delivers the function achieved by that product (the ‘service’) can happen in many, many different ways using many different inventive strategies, but irrespective of

what strategies were deployed in what circumstances, the same trend jump can be seen in the end result. Hence, we could reverse engineer all of the Principles deployed by other organizations and try and repeat them in our situation, or we can simply take the direction suggested by the trend and work out how to make it happen in our own way. Again, what we are doing when we do this is distilling rather than filtering complexity.

This trends versus Principles issue is not an either/or suggestion of course; a smart company will use both the trends *and* the contradiction/principles part of the toolkit. What the trends alone do, however, is allow a business leader to rapidly see which directions are going to deliver more ideal outcomes (in the sense that each trend is a signpost to a more ideal business solution), and which are not.

Finally, then, the 'evolution potential' concept (Reference 5 again) allows a simple and rapid means of combining all of the trends together, benchmarking how far an organisation is along these trends, and therefore, identifying which jumps it still has not taken advantage of. Figure 6 illustrates a typical evolution potential radar plot. In the plot, each spoke represents one of the trends deemed relevant to the given business model being examined, and the coloured region indicates how many jumps along the business model has made along each of those trends.

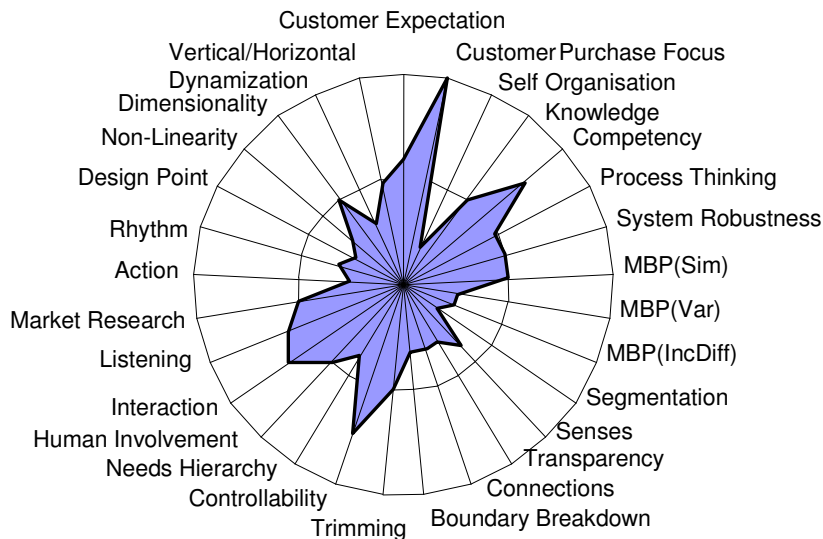


Figure 6: Typical Global Benchmarking 'Evolution Potential' Radar Plot

In this combined form, we have a simple picture that somehow also manages to encapsulate all of the complexity contained within a business. It is intended to offer users simple means of identifying what the important elements of that complexity are.

Perceptions

Examine the appalling success record of just about any so-called management improvement initiative and it might just make a sane person wonder how management consultants are able to earn any kind of living. Many of these initiatives seem to follow a highly repeatable formula;

- Step 1 – a company begins making a lot of money
- Step 2 – management commentators notice the success and seek to understand what the company is doing to make them so successful
- Step 3 - a theory is formed, and, thanks to the drive of the publishing industry, a book is written (often preceded by an article in a recognized journal)

- Step 4 – parts of the business community read this message and, because by definition it has to be packaged well, some will actually try to implement what is being advocated
- Step 5 – a proportion of these initiatives will succeed. If only a few succeed, the book will disappear into oblivion. If a lot of them do, more books will be written as more and more authors/consultants jump on the bandwagon
- Step 6 – a proportion of the initiatives will fail in any event, if the failure is bad enough, some may be inspired to write an article to refute the message of the book. Alternatively, if it is not in the interests of a competing author to jump on the bandwagon, they might anyway write a book pointing out the flaws in the original book
- Step 7 – the market becomes confused by the conflicting messages, or, more likely, the next initiative is born from another success in another company, in either case the initiative begins its fade into the annals of history

The cycle then repeats ad nauseum, eventually moving to a higher level when someone writes a book on ‘fad-surfing’ or ‘initiative fatigue’. Which in turn provokes yet another go around the cycle.

There are many reasons why this downward cycle is allowed to flourish. Fortunately the number of reasons why so much writing and so many tons of paper have achieved so little beneficial output are rather fewer. In many ways the complexity might be distilled down to one simple equation:

$$\textit{Wisdom} = \textit{Knowledge} \times \textit{Context}$$

Management consultants are generally speaking good at the ‘knowledge’ part of this equation, since it is their knowledge that will generally speaking cause a client to hire them. The same thing applies to TRIZ – it is in many ways simply a knowledge repository. Albeit a very big one. Neither the management consultant or TRIZ, however, can know much if anything about the ‘context’ part of the wisdom equation. Context here means the environment in which a specific situation exists. In terms of the TRIZ process described in Figure 1, context is the thing that facilitates the shift from a set of generic solutions down to a single ‘best’ specific solution to the specific problem at hand. Making this shift, by definition, requires the specific domain knowledge that only the problem owners can possess.

While TRIZ can do little about the context part of the equation, it can at least offer assistance in helping the domain specialists to understand what is and is not important in a situation. The key again here is tools to distill rather than filter complexity. A key part of TRIZ’s context-framing capability centres around recognition that every individual person sees the world through different eyes, and therefore sees different problems and different ways to solve those problems. Different people with different perceptions is where – based on the experience of this author at least – the root cause of well over half of all ‘business problems’ lies. A major issue then is how we might handle situations where differences of perception – ‘right versus right’ – are present. It is indeed a complex issue. One that traditionally few managers cope well with. There is nothing in classical TRIZ capable of doing much in these situations either. In true TRIZ ‘someone, somewhere already solved your problem’ style, though, we can see a number of tools and strategies that have been designed to help in perception problems. Reference 5 describes an evolved version of a tool first developed by Edward DeBono, now called ‘perception mapping’. An example perception map is reproduced in Figure 7. It is not necessary for us to get into the details of what is happening in this particular map. What is important to note is that here is a technique that enables the user to simply and quickly record all of the perceptions

of brainstorming solutions. Evidence here has shown that for most of the Principles, good ideas can be triggered with only a few hours – and in some cases, minutes – of prior familiarization. Using combinations of solutions generated from the Principles enables the creation of solutions that match and accommodate all of the inherent complexity of a given problem situation.

The discontinuous business evolution trends present generic signposts to more ideal business solutions. By bringing together clusters of inventive solutions that may be seen to recur across many different industries, these trends offer the potential of even more rapid means of defining where a business is and where it should be heading in the future. Again, these tools represent a distillation rather than a filtering of complexity.

The trends represent the collapsing of considerable amounts of complexity onto a relatively small set of highly reproducible patterns; in many ways they represent the DNA of successful business. The set is not complete of course – nor is it ever likely to be (which is why the distillation of new and emerging knowledge needs to continue) – but it is a considerable advance on having nothing.

The discontinuous trend DNA is one of the outputs to emerge from a systematic search through massive amounts of fuzzy, complex information. Taken together with the Inventive Principles, the trends offer means to create generic solutions that distill rather than filter the inherent complexities of the world. Neither, however, is capable of delivering specific solutions. Specific solutions, valid ones at least, can only come through appropriate integration of TRIZ-provided generic knowledge, and the contextual knowledge of the domain specialist. A knowledgeable person knows that a tomato is a fruit. A wise person knows not to put it in a fruit salad. A wise person, too, seeks to embrace complexity, recognizing that ‘keep it simple, stupid’ is often little more than a shortcut to stupid.

References

- 1) Fine, C.H., ‘Clockspeed: Using Business Genetics to Evolve Faster Than Your Competitors’, Time Warner, 2001.
- 2) Beer, S., ‘The Brain Of The Firm: The Managerial Cybernetics Of Organization’, Professional Library, 1972.
- 3) Freiberg, K., Freiberg, J., ‘Nuts: Southwest Airlines’ Crazy Recipe for Business and Personal Success’, Texere Publishing, 2001.
- 4) Silverstein, M.J., Stalk, G., ‘Breaking Compromises: Opportunities For Action In Consumer Markets’, John Wiley & Sons Inc., 2000.
- 5) Mann, D.L., ‘Hands-On Systematic Innovation For Business & Management’, IFR Press, 2004.
- 6) Cowley, M., Domb, E., ‘Beyond Strategic Vision: Effective Corporate Action With Hoshin Planning’, Butterworth-Heinemann, 1997.
- 7) Pine, J., ‘The Experience Economy’, Harvard Business School Press, 1999.
- 8) Mann, D.L., ‘If TRIZ IS So Good, Why Isn’t Everyone Using It, Part 7: Plausible Deniability & Spiral Dynamics’, paper presented at TRIZ Kongress, Frankfurt, June 2005.