

CREATIVITY AND INNOVATION MANAGEMENT RESEARCH: AN EXPLORATION OF CURRENT THEMES AND FUTURE POSSIBILITIES

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Abstract

There is a widely sustained managerial interest in the generation and appropriation of novelty as means of gaining competitive advantage. This interest fuels research into the processes of creativity and innovation. In this paper, I suggest that a link between managerial actions and theoretical themes can be made through an examination of the structures deliberately designed for stimulating creativity and innovation. The most influential of these structures take the form of creativity techniques and innovation stage models. I am proposing that such techniques and stage models are manifestations of managerial action which I refer to as benign structures. They represent alternatives to habitual managerial structures and practices that are appropriate for sustaining the status-quo, but are less appropriate for achieving desired changes through novelty generation and appropriation.

An analysis of creativity-supporting structures (concentrating on brainstorming and lateral thinking approaches) indicates that the benign structuring modifies behaviours and performance primarily at levels of the individual and team. A similar analysis of innovation structures reveals related moderators of behaviours and performance primarily at the levels of teams and organisations. Unreflective organisational practices have been widely constrained by a dominant organisational paradigm of structural functionalism associated with hierarchical structures and bureaucratic functioning. The benign structures offer a radical alternative to these practices. They complement wider radical restructuring (total quality; business process re-engineering).

However, current practices have not adequately transformed business practices through widespread introduction of structures that stimulate creativity or innovation. Future possibilities for creativity and innovation management may well be suggested by a deeper investigation of the nature of benign structures and their effective deployment within 21st century organisations. At present, their treatment has tended to ignore recent work on knowledge flows and knowledge management. Other important considerations may well be those involving the very nature of discovery processes, organisational structures, and relationships between creativity and innovation processes. Theoretical support may be

required by considering notions of structure-in-action (structuration theory); discovery as a form of sense-making; and the need for alternatives to the simple application of creativity techniques and linear stage-gate models in any search for creative and innovative outcomes.

INTRODUCTION

To survey the state of the art within creativity and innovation management is a challenging assignment. To couple this consideration of future possibilities is bordering on the foolish. Nevertheless, a great deal of writing about creativity and innovation emphasizes the necessity of risk-taking and the obligation to make leaps in the dark. That offers me the consolation that I am at least not likely to be refuted by someone who already has worked out all there is needed, and who will be able to reject my argument out of hand.

We are entering a time in which traditional business disciplines are being subjected to serious re-examination. The new era has been marked by assertions that many old ideas are dead or dying. Serious commentators have asked whether the classical organizational pyramid is heading for extinction, to be replaced by firms with indistinct boundaries, operating in virtual networks. Some have challenged the continued viability of economics pointing to the continued failure of economic modeling to predict business cycles. Others have asked a similar question of marketing in its traditional format. Even science is no longer the absolute arbiter of the real and the feasible. Scientists seek explanations of human consciousness with models that seek to connect mathematical theories and cosmic notions of universality of being. These are but a few selected themes and instances of relevance to our Millennium-spanning generation. Almost everything to be found in current business education predates these themes. At very least, the challenge is on to take the old knowledge, and find ways in which it makes sense in this new and complex world.

One proposal is that we need new metaphors or images of organisation (Burrell & Morgan; Morgan; Rickards, 1999a). Some of the metaphors I have found valuable are shown in Table 1

TABLE 1 THE METAPHORS ENLISTED TO EXPLORE THE DOMAINS OF ORGANIZATION THEORY

Metaphor	Sense-making provided through the metaphor
The Journey of exploration	Discovery as a journey of exploration
Platform of understanding	Knowledge as a socially shared construction ('platform') identifiable through influence leaders and their texts
Jigsaw puzzling	Discovery involves puzzling out 'the big picture' from examination of incomplete set of 'bits' for inter-connections
Handful of books	Heuristic for a short-cut in process of locating influence leaders and the platform of understanding of a region of interest
Dominant and silenced voices	Dominant voice tends to silence alternative voices. Sensitivity to the processes of dominance helps amplify messages of silenced voices

This jigsaw analogy or metaphor reminds us that as we approach any research topic, the overall picture may be incomplete, and that we may have to work hard to find some of the missing pieces. As we try to assemble a jigsaw we are also searching for a platform of understanding to establish firm ground on which to stand in order to find fresh ground and alternative possibilities. From an understanding of 'where we stand' it becomes easier to investigate the grounds for our stance. These contain a great deal of knowledge and experience. They also are shaped by unconsciously held assumptions and beliefs. These are sometimes referred to as paradigmatic beliefs. Sharing a platform of understanding is a means of joining an exclusive club. However, it does not provide the means of differentiating between rules that make sense and those that are outmoded or inconsistent.

I found that the process of building a platform of understanding could be seen as gathering a handful of key books or texts. (Of course, this search has become increasingly metaphorical. However, I am glad I began my searches literally, constrained by the number of books I could carry. The dangers of information overload are very real!)

This process reveals the dominant paradigm. It may make us more sensitive to the treatment of less dominant beliefs (silenced voices). Later in this paper, I will show that the dominant organisational orthodoxy has been partly responsible for weakening the alternative voices speaking up for new structures for creativity and innovation. To take a simple example, early management 'science' assumed that a strictly rational approach could deal with all managerial problems. This assumption meant there was no immediate justification for investment in more creative approaches to management for many years.

Once we have arrived at different 'ways of seeing' we are faced with a tough question. How are we to reach a view on the value of any particular way over others? One of the shortcuts is to look for evidence of 'voices' and to seek understanding of their platforms of understanding. The voices have to be studied in terms of the beliefs about knowledge and reality. The theory of theory deals among other things with the 'what, how, and why' of 'what how and why'. Not surprisingly, this moves us away from the content and process of everyday thinking.

Managerialism, and three 'suppressed voices':

Approximately a decade after Thomas Kuhn's ideas of paradigms had attracted attention of social scientists, another influential theoretical text on paradigms appeared. The book, 'Sociological Paradigms and Organisational Analysis', by the British sociological theorists Gibson Burrell and Gareth Morgan, was concerned with paradigmatic beliefs within the social sciences. This set of procedures resulted in a 'theory of theories' matrix which within which theories could be classified according to their assumptions. I have borrowed from the original classification that had one dominant paradigm, and three competing paradigmatic positions.

The dominant paradigm has been labelled as the functionalist paradigm. Once sensitized to the possibility, it becomes easy to identify the influence of the dominant paradigm in every major component of the business studies curriculum. Its platform of understanding reveals that managers and management theorists alike treat management studies as a form of scientific endeavor. The beliefs are summed up in the old expression 'what gets measured gets managed'. The sense of what is real comes from these beliefs. We

must emphasize that the paradigm can rightly claim great advances in the practice of management, as this has been studied from the orthodox platform of understanding.

So what are the suppressed voices? We will be exploring them in the context of creativity and innovation.

One of the paradigms concerns itself with revolutionary alternative structures that can substitute for existing social structures. We might expect new and innovative structures for stimulating organizational change to be radical structural challenges to orthodox approaches. In this paper, I suggest that the structured of creativity techniques, and the most influential innovation structures have been introduced in the spirit of radical structuralism. The most famous radical structuralist theory was built up by Karl Marx and his followers as an alternative to capitalism. It is interesting to note that the managerial professionals were experimenting with radical structures such as business process engineering, and total quality approaches long before scholarly theorists took them seriously.

The two other paradigms seem to me to be worth more attention. I suspect they have been under-explored within the literatures of creativity and innovation. I will return to them as sources of future possibilities. The one is the so-called interpretive paradigm, the other the radical humanist one. Organizational systems within the interpretative paradigm have existence ultimately only in terms of the sets of meanings developed by people within the organization. Their actions provide clues to the meanings and which give sense to their mutual interactions. Researchers in this tradition seek to understand and explain the 'real' significance of everyday transactions, rejecting studies of large samples in favour of deeper investigations of specific contexts. In some contrast, the radical and humanistic way of engaging in organisational life might include communitarian approaches based on ethical rather than economic beliefs. It may also be an approach captured by the vision of a charismatic leader/entrepreneur. (The credibility of the path of the entrepreneur is problematic from the dominant paradigm).

We are now equipped to make our journeys of exploration into the territories of creativity and innovation management.

CREATIVITY: THE SLUMBERING GIANT OF ORGANIZATIONAL STUDIES

The traveller's platform of understanding of creativity

Among theorists and practitioners alike, there is a view that creativity is 'something to do with' processes that produce new and valued ideas. The novelty and value may be primarily an assessment by the person doing the thinking and creating. Or it may be an assessment by wider social groupings. There is something of a split between those who would regard creativity as something extraordinary, and those who consider the process as natural as breathing, and a universal human characteristic. There is also mostly agreement that the process is complex and multi-faceted. Most authorities agree that there is no universally agreed creativity test, nor universally agreed definition. The processes are regarded as partly unconscious, and may leap into consciousness as a moment of inspiration or insight. Additionally, many practitioners explicitly or implicitly believe that creative

processes can be partially influenced by deliberate efforts on the part of the explorer/creator. These interventions may be directed towards securing favourable environmental conditions, including the application of structures or techniques. These views are among the most widely accepted views among practitioners of the so-called creative problem-solving techniques.

My own platform of understanding has some points of departure from the more widely shared views. I tend to support the view that creativity is a universal human characteristic not unlike a form of intelligence. Whatever creativity is, we all have some of it, although we are unlikely to have received the same endowment or the opportunity to develop it. I agree there is no wide agreement about definitions or measures. I do not particularly surprising, nor believe it be a justification for rejecting the concept for a fundamental lack of definitional precision.

In this journey, I began by obtaining enough handfuls of books to build a platform of understanding from the point of view of practitioners. I was looking for important bits that did not quite fit. In the study of the practitioner literature, creative thinking and creative problem-solving are repeatedly placed in opposition to rational thinking and problem-solving. Various non-orthodox themes are detected dealing with personal transformation, mystery/magic; and the unexplained something special of creativity. In the study of influential stories there is further evidence that creativity deals with issues that are difficult to manage from the dominant rational paradigm. There is also evidence that many researchers have tried to work 'with the grain' of the dominant orthodoxy. This has helped the orthodox view to preserve its integrity. It is as if creativity is a slumbering giant whose strength, once awakened could be harnessed to bring about much needed changes in many fields of management theory and practice.

Building a platform of understanding of practitioner perspectives of creativity

I wandered around my personal bookshelves and took out as many as I could carry of the popular books dealing with creativity and creative thinking. I noted also another set of books dealing with creative problem-solving. These would be two bits of the jigsaw to be assembled. As a kind of control I took down what might be termed a contrasting set of books that dealt with problem-solving that was not classed by the authors as creative. To my pleasure, a clear pattern of beliefs emerged from the stated and implicit messages in the books. Most authors were unconcerned about precise terminologies, writing as if their audiences of practitioners had no reason to bother about precise definitions. After some jigsaw puzzling, four regions were identified, each having a consistent theme. The four themes repeatedly dealt with creativity as something special; personal transformation; magical and mysterious; and opposed to logical thinking and problem-solving. These ideas were subsequently combined into the two wider themes of creativity associated with as a special and supercharged version of thinking or of problem-solving.

The practitioners were intuitively aware of the limitations or 'pure' rational thinking and problem-solving. Within what we have called the old orthodoxy such a view has little significance, as rationality is the main defense against irrationality. Furthermore, the ideas of practitioners can always be dismissed as irrational and devoid of theoretical content. We are led to believe that creativity is being ignored because of the orthodox or dominant view of aspects of human behaviour regarded as 'irrational, individualistic, and subjective'. Studying creativity may help. It opens up the possibility that greater attention might be paid to what might be called the 'humanistic stuff' in business studies. The implication is that business

orthodoxy has a structure that is too intolerant of the very processes that would permit it chances of challenging its own assumptions.

The creativity techniques

Within these accounts, the repeated focus for managerial action was the creativity technique. Authors have catalogued over a hundred (see Parnes, 1992 for an excellent compendium of such techniques). Almost certainly, the most influential family of techniques derives from brainstorming, a benign structure originally introduced to overcome social inhibitions in business meetings. Its battle cry of 'postpone judgement' was derided as an invitation to indulge in 'cerebral popcorn' (See Rickards, 1999b for a recent review). There have been many efforts to demonstrate that creativity techniques 'do not work', the paradox is that they persist. In evolutionary terms, many practitioners chose to ignore the scholarly reservations.

Recently a partial restoration of the validity of the techniques was made by Sutton & Hargadon (1996) The authors found that a well-known design firm consolidated its reputation for creativity through using, creativity techniques. The benefits in use were far more subtle than a simple 'quantity per minute' analysis. De Bono has made a multitude of claims for the practical impact of lateral thinking (with personal endorsements from managers in many countries).

It is not my intention here to 'prove' that the benign structures for stimulating creativity 'work'. Rather I am trying to show how a dominant view may have damaged their chances of a fair hearing. Also I suggest that we have to understand these social forces before reaching a simplistic conclusion of their merits. My own view is that structures successfully oppose the habitual structures that damage creative thinking, thereby at very least sensitizing some users to more open and creative thinking. Various governments and global organisations have invested sufficient resources to suggest I am not alone in holding this view.

To summarise: creativity is widely regarded with suspicion within organisations. However, advocates of creativity techniques as benign structures subscribe to a view that habitual behaviours inhibit creative processes, and radical structures offer prospects of overcoming these difficulties.

INNOVATION REVISITED

Creativity is generally regarded as an individualistic and capricious process. In contrast, innovation is far more widely regarded as a process offering promise of economic advantage. This can be inferred from the willingness of governments to support research into innovation policy, and the willingness of organizational executives to take seriously consultancy packages that promise innovations in the shape of new products or processes.

Attention has recently been drawn to the tendency of partial views to be presented of innovation. Specifically, innovation has been presented as if it is were only associated with technological changes. Other partial views include beliefs that only substantial breakthroughs count as 'real innovations'. Yet there are difficulties in seeking to characterize innovation in a more comprehensive way. The innovation process, assumed as encompassing all sorts of

changes, in all sorts of firms, has to justify why it differs from a general management of change process.

I selected a wide representative 'handful of books' on innovation to form the basis of a platform of understanding of innovation studies. The dozen books covered a remarkable range of human endeavours. They included macro-level economic treatments and organization-level studies. Some of the authors had engaged in exhaustive searches of literature of one specific aspect of innovation. Others had collected together views of authorities, selected on grounds of reputation. There were also study textbooks for practitioners, and popular, yet influential, 'how-to-do-it' texts.

The pieces of our jigsaw will be seen to come from two related traditions, the economic and the organizational. It turned out that these groupings could be assembled into two platforms of understanding, which will be described in the next two sections.

The economics platform of understanding

The handful of books from the economic perspective gave us the richer theoretical concepts, but fewer ideas of how the ideas might be applied in practice. An important bridging piece of the jigsaw was found in the extensive and influential work of the somewhat maverick economist Joseph Schumpeter. Schumpeter proposed that economic growth derived from the efforts of entrepreneurs. This offered economics a way of dealing with discovery processes that fell outside the bounds of their models. He later incorporated into his theories the discovery processes arising within the newly emerging technological teams within large organizations ('R&D laboratories').

Another version of entrepreneurial activity developed by the Austrian School of economists emphasized its contribution to a market-smoothing effect. These ideas were extensively taken up in studies of diffusion of innovation and new product development. These topics were themselves appropriated into marketing theory especially via work on product/market development, and so made some inroad into the business studies orthodoxy.

Schumpeter was interested in the questions that most economists prefer to ignore. In particular he was acutely aware that prevailing economic theories avoided the issue of economic growth, environmental uncertainties. Schumpeter was far more interested in a turbulent world he had experienced in which equilibrium was disrupted in unpredictable and violent ways. His early theorizing focused on the characteristics of entrepreneur, a figure who was to figure prominently in later writings on innovation. In one famous illustration he outlines how the discoveries of an entrepreneur trigger innovation. The entrepreneur, either through intentional search, or by accident, stumbles upon gold-bearing rock. Thereafter, the conversion of gold leads to infrastructural activities: roads, guides, provisioning, refining facilities, commercial exchange and legal arrangements. The central thrust of Schumpeterian theory of entrepreneurially-driven innovation is a two-step process of discovery followed by diffusion or exploitation. These two stages involved an initial 'alpha' innovation which produced the conditions favouring emergence of multiple smaller or 'beta' innovations.

In earlier literature the entrepreneur had been regarded as a person who co-ordinated resources, rather than created them. Schumpeter's basic idea offered an explanation for an empirically observed ebb and flow of economic activity, known as the economic long-waves. It also connected up innovation with technological change, a relationship that has persisted to

modern times. The first observed economic long-wave was associated with the rise and impact of steam power, (say 1770-1840); the second (1845-95) was that of railways, and the third (1895-1950) automobiles and electric power.

Schumpeter later became more interested in the development of systematic innovation efforts in the form of institutional departments for discovery. He anticipated the growing influence of Research and Development (R&D) as an initiator of innovation projects within organisations. He also made an important connection between creativity and innovation, describing the actions of entrepreneurs as bringing about 'a gale of creative destruction'. He considered that these entrepreneurial gales would blow in unpredictable fashion, favouring some economic sectors at the expense of others.

In this world of disequilibrium, technology was identified as a major engine through which entrepreneurs created alpha-innovations and as a consequence triggered great economic changes. He had the sense of the importance of the specific and contextual favoured before him by the great Adam Smith. His economics was one of insight applied to detailed argument. He felt that such analyses overlooked the structural mechanisms of change that he considered of greater importance. In this sense he was out of alignment with the developing body of economic theory that was becoming more statistically sophisticated and rigorous. The Schumpeterian world of heroic entrepreneurs has some attractions today for its anticipation of chaotic environments. As we will see in chapter 10, his work is located outside the mainstream of neo-classical economics, and has tended to be disregarded outside the specialized fields of those economists interested in the management of change under real-world conditions.

Schumpeter, although Austrian himself, had somewhat different view to those of a so-called Austrian school of economics. The important differences were summed up by one of their number as follows:

'Schumpeter's entrepreneur acts to disturb an existing equilibrium position. Entrepreneurial activity disrupts the continuing circular flow. The entrepreneur is pictured as initiating change and as generating new opportunities. By contrast, my own treatment of the entrepreneur emphasizes the equilibrating aspects of his role. I see the situation upon which the entrepreneurial role impinges as one of inherent disequilibrium rather than equilibrium. The entrepreneur, in my view, brings into mutual adjustment those discordant elements which resulted from prior market ignorance'.

Schumpeter's position recognizes creativity as an unpredictable discovery process connected with discovery of alpha-innovations. For the Austrian school, the creative processes deal with more modest challenges, and do not require exceptional personal attributes. This is the 'business as usual' school of beliefs in which discovery is an extension of ordinary human behaviours.

The Austrian tradition leads naturally into diffusion theories of innovation. The theories occupy a kind of half-way house between strictly economic theorizing, and the work directly concerned with the innovation process within organisations. As the name implies, diffusion theories present innovation as a passive process. The metaphor is of a gas gradually spreading from one region to another. Diffusion theories have favoured quantitative models that describe patterns of uptake of innovation. This tradition has its own dominant pioneer, the American Everett Rogers. Early studies looked at the diffusion of technological

innovations such as hybrid corn among farmers, and new drugs among doctors. In essence the models present a world in which the changes are smooth and inexorable. We do not find any evidence of Schumpeterian jolts here. If they occur, they occur prior to the diffusion processes being studied. Nor, is there much direct evidence of the entrepreneurial efforts that smooth out markets as proposed within the Austrian School.

One of the favoured methods of analysis of the diffusion theorists is to construct elegant curves mapping the growth of an innovation. These can easily be turned into some version of an S-curve, typically with a slow start-up period, and steep acceleration, and a final 'tail' where the 'creative gale' of the innovation is coming to an end. An interesting practical application of S--curves is to map the decline of one innovation and the rise the innovative replacement. The pair of S-curves can be analyzed to indicate the most favourable time-window for abandoning the earlier technology and investing in the newer one.

Such applications have real-world implications as they offer prescriptions of how a desired innovation might successfully be promoted. They also appeal to marketing executives for similar reasons at the level of diffusing a firm's new product development into its market environment. They are perhaps less appealing for managers, as they describe how an entrepreneurial innovation might penetrate the market without indicating how the entrepreneurial innovation might be discovered and shaped.

Organizational-level studies of innovation

Several distinguished researchers have attempted to summarize the field, generally presenting an update or progress report. There is widespread concern over the absence of any coherent over-arching theory. Nevertheless, by concentrating on what the authors reveal of their beliefs, important bits of the innovation jigsaw began to reveal themselves. The platform of understanding seemed to have a small number of shared beliefs that are not necessarily totally consistent. In everyday terms the beliefs can be stated as a process involving implementable novelty, associated with technology, and involving considerable levels of ambiguity and features specific to a given innovation

It is about novelty that is implemented: Most accounts of innovation describe a novel idea that appears at the start of a process and which gets introduced into practice as an innovative product which can take a variety of forms. Academic studies tend to indicate the diversity of definitions, perhaps then attempting a synthesis. Researchers West and Farr , for example, offer the following as a definition:

'the intentional introduction and application within a role, group, or organization of ideas, processes, products or procedures new to the relevant unit of adaption, designed to significantly benefit the individual group, organization or society'.

Another writer, offering a practitioner view, described creativity as 'the thinking process that helps us generate ideas', and innovation as 'the practical application of such ideas towards meeting the organization's objectives in a more effective way'.

These views are echoed in journalistic writings, typified by a remark of Alvin Toffler's: 'Technological innovation consists of three stages, linked together into a self-reinforcing cycle. First, there is the creative, feasible idea. Second, its practical application. Third, its diffusion through society'.

These examples typify a belief that the innovation process is widely regarded as connected with creativity 'at the front end'. There are important consequences flowing from isolating creativity in this way. It inexorably leads to so-called stage models of innovation in which the uncertainties of discovery are decoupled from the later stages of the system. These have dominated the pages of 'how to do it; innovation texts, as well as more theoretical treatments. The numbers and labels of the stages may differ, yet the various models do appear to be variations on a theme. An archetypal description of stages within the innovation process can be derived from Toffler's observation, namely:

- (a) An initial idea generation or capture stage
- (b) a development stage, and
- (c) a commercialization or implementation stage.

Some authors equate innovation with technological innovation. Even if this is not directly stated, the preference is implied in the examples selected. The most celebrated and repeated examples refer to innovations that took the form of technologically advanced products. This may be something to do with the perceived focus of novelty in the innovation. Technically advanced products clearly focus on technological novelty. Process innovations tend to be mentioned with emphasis on efficiency gains rather than technological gains, and are less frequently cited. Even fewer reference can be found to various other kinds of innovation where the focus is on marketing or environmental or social enhancements.

The complexities have been treated in two rather different ways. The first way emphasizes the uncertainties and ambiguities of the process. 'The management of ambiguity' leads to the formulation of strategic responses appropriate to conditions of uncertainty. This treatment leads to material that is covered in more detail in the next chapter on marketing and strategy. We have already seen that the ambiguities can sometimes be loaded on to a front-end that requires discovery of the correct recipe to be applied at a later stage in the process

Various other strategies are also considered managing the ambiguities of innovation. For example, one widely-advocated approach is to break down communication and cultural barriers by setting up cross-disciplinary teams. Other approaches are based on developing skills at reflection and learning. 'Innovation is particularly about learning, both in the sense of acquiring and deploying knowledge in strategic fashion and also in acquiring and reinforcing patterns of behaviour which help this competence-building to happen' The simplified stage-models can be taken as starting points to the development of far more firm-specific routines arising from such learning activities.

The second way addresses the complexities of innovation by adapting what is known as a contingency perspective. Contingency theory has found favour in organisational studies generally. The term implies that outcomes of a given situation are depend on or contingent on various factors. The task for the theorist is to indicate these factors and to collect empirical examples of how the contingencies operate from case to case.

The notorious instability of factors influencing success and failure of innovation efforts was observed many years ago when it was found that factors that were established as supporting innovation in one study were found to have a different effect in other studies. This is accepted by contingency theorists who expect different contextual nuances to produce such variations in outcomes of innovation studies.

From theories to practice: Stage models of innovation

Innovation has been widely studied as a series of stages. I select three such structures.

NewProd: One of the most thoroughly tested recent stage-models has been advanced by the Canadian researcher, Robert Cooper. 'New Prod' incorporates into a model empirical information of factors possessed by new product projects that have succeeded and that have differentiated them from projects that have failed. The work demonstrates the benefits as well as the limitations of the orthodox research search for regularities within the subject of interest. Cooper sampled approximately 100 relatively successful and unsuccessful new products. He found that the most important success factors were that the new product was perceived as superior by users; that the organisational process had attended efficiently to market characteristics; and that the project had 'technological and production synergy and proficiency'.

He later examined his own and other models of new-product development and developed a version of the archetypal model of initiation, development and commercialization. His initiation stage involved marketing, technological and production considerations all of which contribute to a new product proposal. The development stage incorporates assessments of market competitiveness and potential leading to a new product launch. The commercialization stage then occurs, and is ultimately evaluated against pre-agreed criteria.

Cooper developed and tested a series of hypotheses against the model. He found that the most significant success factor was associated with product superiority. This was followed by a factor based on effectiveness of pre-development activities and the gaining of acceptance of a strategic plan for implementation. Other success factors were based on marketing and technological synergies.

An interesting conclusion emerges from these results. Cooper suggests that factors falling inside the control of the project manager and team play a significant part in the success or failure of a specific innovation project. He also indicates that the factors can be considered as check-lists to sensitize managers to the need for creative problem-solving efforts to continue throughout the innovation process.

This brings into focus a difficulty in taking results from large sample studies and seeking to infer from them action points for a specific innovating organization. The orthodoxy seeks regularities that permit predictions. The regularities are abstracted from models that assume some kind of closure or boundedness from unanticipated influences for change. However, the introduction of techniques that can make a difference between success and failure amounts to an invitation to treat the system as open to change. There is every reason for a manager to welcome this. It implies that the new product team still has some scope for influencing its fortunes. It also implies that creativity and uncertainties will remain important aspects of any innovation project.

Newprod is a well-researched research project. It deserves study for the kinds of check-list factors it provides. It may well provide benefits to innovating teams that are seeking check-lists of factors to support their own creative efforts. However, the claims of the system to distinguish success and failure are based on assessments made on projects whose fates have already been established.

The originator points out that 'clearly if a project alters course, the link between actual and predicted results is greatly attenuated'. In this accurate and honest comment we see the difficulties inherent in predicting innovation. Once those operating within an innovating system learn that the system has weaknesses that might hinder it, those workers have the power to act. Indeed, Cooper suggests that the nature of the success factors makes them open to modification. This means that however comprehensive the previous data available, there can be no precise rules predicting outcomes for a future innovation. There is a saving device that gives the model practical application. It indicates the need for creative problem-solving to 'fill in the gaps' to deal with specific contingencies.

Triz : Triz is the acronym for a Russian innovation system which in translation means Theory of Inventive problem-Solving. It is a system that is becoming better-known worldwide, after many years during which it was studied in the former Soviet Union. The system is based on one of the most comprehensive analyses of the process of invention that has ever been made. The innovator of Triz, Genrik Saulovich Altshuller, studied the entire available set of patent applications at the time. His search involved analysis of over one and a half million patents in order to find patterns of discovery that could then be reapplied to creating new patents. His work on Triz began in 1946. Over 7,000 people studied it during the period 1972-1981, and generated 4,000 patents by following the system. Training involves studies of a classification of the invention patterns and reapplying the general principles identified.

Altshuller considers that inventive problem-solving proceeds along trial and error lines that can be substantially improved upon. The central concept is that trial and error is inefficient, especially for complex situations. Human approaches reduce the complexity, but in ways that are over-influenced by experience. Altshuller claims to have developed more effective approach through identifying what he calls a directing mechanism. Through its use, uncertainties are reduced, and complex problems are transformed into easier ones. For situations not matching data within Triz, then the solver has to work at expanding Triz through a higher-level set of procedures known as Ariz, claimed as a systematic means of moving from the unknown to the known.

Triz is interesting as a strong candidate for a means of supporting the part of the innovation process that is most widely regarded as least manageable - the creation of technological novelty. In doing so Altshuller appears to reconcile the apparently irreconcilable. He does so by departing from the strict canons of scientific orthodoxy.

Within the former Soviet Union the political system of Marxism-Leninism also incorporated its own scientific orthodoxy of dialectic materialism. Triz was founded on this philosophy which presumes a reality or objectivity which can be studied and understood through dialectics. A fundamental aspect of dialectics is the tension and struggle between opposites within all systems. The resulting contradictions are resolved as the system develops. From this theoretical starting point the objective nature of creativity reveals itself in evolution and development of natural and man-made systems. The creativity exists of itself, waiting to be discovered through objective analysis. The creativity of human beings may be seen as having a subjective character, although in time the objective evolutionary process will increasingly reduce the subjective elements of the process. Discovery will become more purely scientific and objective.

Scimitar : Substantial claims have been made for Scimitar as a means of generating new products. I worked with the inventor of the Scimitar system during its development, and was

co-author with him of the first book describing it. The original work was conducted in the United Kingdom during the late 1960s and early 1970s by a new products manager, John Carson, then operating within a medium-sized chemicals conglomerate. By the late 1980s he could claim that the system had been used by over 700 companies in 200 different industrial settings, and had generated over half a million new business ideas. Carson's experience in new product development had included technical training and employment in major Chemicals organizations in American and the UK. He had also studied extensively the popular literature of entrepreneurship and technological innovation. He concluded that in-house innovations could be more successful if the team deliberately followed the principles unconsciously applied by entrepreneurs who founded and built-up their own businesses.

Carson had grasped the importance of the in-house entrepreneur as proposed by Schumpeter, and then sought to minimize the risks of adapting the change to the organization, in the spirit of the Austrian entrepreneurs. He constructed a scheme for systematically evaluating business opportunities and for developing them into working prototypes, and then into new products. Carson found a way to model the company and its environment so that 'systematic creativity and integrative modeling for industry, technology and research' (Scimitar) became more routine.

At the heart of the systematic analysis was the Scimitar box, a three dimensional cube - physically constructed from clear plastic sheets and struts. Each box was composed of cells indicating a unique combinations of materials, processes, and markets relevant to the company. The systematic search involved a cross-discipline team examining each cell, armed with information from the market, especially user needs. All possible ideas dealing with a perceived need were noted and allocated to the appropriate cell. Special attention was paid to cells in which the organization had no existing product. In this way, project teams generated large numbers of promising new product ideas. Screening of ideas is based on rather well-known quantification approaches involving checklists, risk assessments, and criteria evaluation. Through these screens, the numbers of promising ideas are whittled down to front-runners for investment as new-venture proposals.

Scimitar offered a structure for idea search and development that had wide face-validity for users. These included the explicit proposition that a deliberate and systematic search process for new ideas was more likely to succeed than their previous approaches. The formation of a cross-disciplinary Scimitar team also made sense to users. The screening approaches encouraged decisions based on available best-judgment across the firm.

The blue-print for a Scimitar project indicated a start to the idea search once the corporate go-ahead had been received. There is a very important rite of passage that occurs at some agreed point, marking the beginning of the commercialization stage. The short-listed set of ideas, each with a tangible output, and commercialization justification is presented to the corporate sponsors of the project. The ceremony involved the Scimitar team and senior corporate executives. Some senior-level commitment is required for the concepts to receive further corporate support. Those projects that are accepted acquire corporate legitimacy and the necessary resources to proceed to the marketplace. The reported evidence showed that teams following the Scimitar approach consistently generated ideas believed to be new and valuable to organizational clients at the time of its application.

A large number of ideas are generated systematically within a domain identified by participants from the client company. The agreed selection criteria favour ideas that are

relatively easy to convert to prototypes. Furthermore, the ideas that fail to reach the prototype stage in a given agreed time are shelved. Thus many ideas which have been over-optimistically rated are taken out of the game early on. Adequate numbers of ideas progressing to plan reduces the likelihood of team members transferring energy to rescuing their favourite ideas. The process acts to screen out rather than select in. The process can be seen as one in which the more quantifiable risks are articulated and minimized as far as is practically possible. Furthermore, the ideas have high acceptability for the strategic decision-makers involved in the process. In principle, the decisions can reflect a firm's willingness to back higher risk projects in search of higher rewards.

Carson went on to develop more refined search models for strategic studies. These retained the basic three- dimensional structure of Scimitar models, as well as many of its operational components.

Beyond the stage models of innovation:

The handful of books approach reveals innovation studies as sharing a set of beliefs and assumptions that we now look at in a little more detail.

Front-end loading of creativity: Many of the innovation stage models have an initial stage in which creativity is said to occur. This front-loading of creativity means that the whole tricky question of discovery processes has been got out of the way so that the subsequent stages can be presented as rational and logical sequences of activities. Creativity, if addressed at all, is isolated and controlled.

Concealing the learning requirements within the process: As with the creative problem-solving systems, innovation models tend to permit learning, while concentrating on the learning of task related 'data'. In Cooper's Newprod, for example, its interest lies in the possibility of the system predicting outcomes of innovation actions. However, as we have seen, the checklist of success factors can at best serve as a sensitizing device through which users focus their learning efforts.

Until recently, innovation as a learning process was a minor theme in innovation studies and even more concealed within technique systems. More recently far more attention paid to organizational learning. Indeed a whole learning school may be emerging within innovation studies. A good question for examining techniques for innovation: 'how is learning managed within the technique's structures?'

Deterministic claims for the techniques: Uncertainties can be denied if processes are claimed to be deterministic. We have seen how placing creativity at the front-end of an innovation process was one means of isolating the uncertainties and presenting the rest of the process as highly plannable. Triz claims that discoveries are objective, and can be objectively reached. This is asserting determinism for the discovery process. Other models also imply determinism in implementation. The claims in a technique of predictable outcomes is one that aligns the technique with the implicit assumptions of the dominant managerialist orthodoxy. A good practical question of techniques becomes 'how do they address the issues of openness of systems to unpredictable events?'

Excessive reliance on empirically claimed knowledge: The dominant orthodoxy of managerialism requires hard evidence before accepting a new theory or system. Its

requirements are for empirical evidence. This evidence turns out to be hard to collect in ways that satisfy independent evaluations. This explains the reluctance of more theoretical management researchers to endorse complex systems for enhancing innovation. It also explains the efforts of technique advocates to present convincing empirical evidence of its successful utilization in practice. Yet all such efforts fall short of answering the most important question for would-be innovators. 'What will happen when I use this technique under my particular set of circumstances?' To break out of this box the innovating manager has to go beyond the empirical evidence and consider the kinds of ways the system is proposing for overcoming the complexities of innovation.

Procedures claiming to manage risk: If innovation is generally accepted as inherently risky, how might risk be managed in the innovation systems? We might expect that the systems would indicate ways consistent with those acceptable to an orthodox view of management. If so, we might also expect risk to be controlled by procedures involving the acquisition of 'reliable' information and subsequent rational treatment of that information. Inspection of the proposed model will reveal whether the system has been designed to conceal risk or manage it! Techniques that claim to deliver low-risk innovation are denying or concealing risk. To break out of this box, the innovative practitioner might ask the question 'what is the system doing to manage risk.'

Denying complications of the innovation process: The models conceal complexities in various ways. For example, the platforms of understanding recognize that innovation is highly context dependent. A pointed question might be 'how does the model deal with situational or contextual factors and their varying significance?'

Where the innovation jigsaw puzzling is taking us

Schumpeter historically developed his economic theory of alpha-innovations or revolutionary discoveries. Here the whole process generated change in a creative gale of destruction generated by heroic entrepreneurs. These ideas are too threatening for the dominant managerialist perspective, and not surprisingly have hardly been given a voice in courses on innovation.

Listening to the hidden voices: The heresies are silenced or tamed by being forced into the conceptual box occupied by the orthodoxy. Schumpeter's creative gales of destruction have been ignored as unmeasurable and unpredictable. The novel structures or technique systems for innovative change have been accepted because they have tamed and confining creativity to 'the front end' of the process. The dangerous subjectivity of sense-making and learning within innovation processes has been made safe by concealing the learning needed within the stages of the innovation techniques.

Innovation studies offer ways of understanding and influencing organizational change processes. We have also found various claims made for technique systems that deserve to be taken seriously. However, the more theoretical ideas have been resisted by processes we have connected to a dominant managerialist orthodoxy that denies the uncertainties and ambiguities in which innovation flourishes.

The technique systems are in some way aligned to such beliefs, in that they conceal the uncertainties, and confine creativity to a special place at the front end of the innovation process. This means that uninitiated managers have no direct means of assessing the merits of

techniques from the managerial orthodox perspective. We have shown that an assessment can be made by puzzling out the assumptions of techniques and of dominant platforms of understanding of innovation. I believe it will lead the way to more powerful ways of thinking about organizations and organizational change.

BENIGN STRUCTURES REVISITED

What are the dominant themes and future possibilities for the management of creativity and innovation? I have tried to show that current themes are still too influenced by unchallenged assumptions. There is a need for structures supportive of creativity and innovation. The building bricks for promising structures are available already as indicated above. (I hope that is not too solid a metaphor). However, we have to become masters of structured interventions. This calls for creative leadership so that the various stakeholders (team players, customers, etc) have increased ways of interacting constructively. The leadership will also help in the unearthing of old assumptions and the discovery of new ways of building teams and organisations. The innovations will have to include discoveries of new roles and strategies. The outcome will be organisational practices that are open to change (creative in climate), and reactive to the unexpected turbulence from outside influences

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