

**Permanent Discovery
or
Collective Caprice?**

Optimising the Learning Organisation.

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Permanent Discovery or Collective Caprice?

During the first half of the 1990's, the 'learning organisation' achieved hallowed status as the corporate ideal. In facing the challenge of a turbulent and highly competitive environment, managers have been seeking to maximise learning, to maximise dialogue, to increase creativity, even to encourage change and uncertainty. While embodying the fundamental principles of systems thinking which Peter Senge popularised in *The Fifth Discipline*¹, this article seeks to present a wider view of organisational learning. Rather than applying the 'one best way', management decisions should be contingent on the precise outcomes to be achieved. The drive to maximise teamwork and innovation runs the risk of merely replacing one set of imperatives with another. In contrast to this, the message of this article is, "Don't maximise, optimise!"

The PRIME² model, presented below, has been developed and applied by the author in organisational consulting to multinational corporations, international governmental bodies, and a smaller number of national and medium-sized businesses. It provides clear, generic guidelines for optimising organisational learning according to the task at hand and is of use to managers with responsibility for organising people and processes, including team leaders, project managers, functional chiefs, strategists and CEO's. In addition, it can assist Human Resource specialists in matching working conditions to the challenge and desired outcome of specific tasks.

The applications of the model include:

- creating the conditions for organisational learning to flourish;
- dealing with major uncertainty and risk;
- assessing the impact of corporate culture on business results;
- making good use of cultural diversity;
- guiding development projects through their life cycle;
- ensuring that inventions and discoveries become innovations;
- matching team or other work structure to business context and outcome.

The model is inspired by work on change in the natural and social sciences published by German-American sociologist, Stephan Fuchs³. It remains close to the original approach,

¹ Senge, Peter M. et al., *The Fifth Discipline: The Art and Practice of the Learning Organization*. Doubleday, 1990.

² PRIME™ (Periodic Role Indicator for Market Evolution) was developed by the author over several years, in the course of consulting projects for which existing models did not prove adequate. It is used by Boas Consulting, to guide organisational development and transformation projects. An associated sociometric instrument is currently being developed. For more information please contact Boas Consulting at 38 Fitzroy Road, London NW1 8TY; tel. +44 20 7586 4986.

³ Fuchs, Stephan. 1993. "A Sociological Theory of Scientific Change". *Social Forces* Vol. 71 (4): 933-953.

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while extending its conceptual scope. In addition, priority has been given to the development of the model as a management tool.

The beauty of the model lies in ease of use combined with enough multidimensionality to correspond to real world complexity. The initial impetus for developing the model was to guide the management of highly uncertain business processes where continuous organisational learning is of the essence. This compares with the types of scientific knowledge production Fuchs pays most attention to, in which "competition drives change, because it forces people to say something new"⁴. In some business activities, as for some sciences, success is based on the rate of knowledge production and collective learning. However, the model is now being used to optimise, rather than necessarily maximise, organisational learning. The competitive edge is not *always* maintained by continuously knowing or doing something new. This article describes the model and outlines how it works in practice to guide management decisions.

The core of the model is two crucial organisational variables, Uncertainty and Interdependence. Uncertainty relates to the inherent and perceived qualities of the task at hand. Interdependence relates to the social organisation of the people engaged in the task. These two concepts correspond to Fuchs' 'task uncertainty' and 'mutual dependence', respectively.

Both of the core concepts relate to perceived as well as inherent qualities of a situation. Although this article does not explore in detail the effects of values, feelings and perceptions, it must be emphasised that they are elements in any human system and have a vital role in determining business results⁵.

Uncertainty

Uncertainty is high ... "when many exceptions and unexpected situations are encountered during work, when there are no clear procedures and rules for doing the work ... [also] when information is incomplete and inadequate, when it is difficult to anticipate outcomes, and when the evaluation and interpretation of results are controversial and ambiguous"⁶.

In these turbulent times, managers in almost every business sector will recognise inherent Uncertainty in many of their areas of responsibility. The level of Uncertainty is especially high in new and immature disciplines, ranging from multimedia telecommunications to business re-engineering; also in research & development generally, when entering a new

⁴ *ibid.*, 937.

⁵ Since this model was developed, there appears to be a growing trend toward optimisation models and away from maximisation as an ideal. Parallel developments place similar emphasis on socio-cultural dimensions which interact to give rise to a number of potentially viable organisational types. For comparison, see e.g. Goffee, Rob & Jones, Gareth. 1996. "What Holds the Modern Company Together?". *Harvard Business Review* Nov.-Dec.. 1996:133-48.

⁶ *ibid.*, 938.

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geographic or cultural area and in certain specialised activities such as subsurface and space exploration.

Uncertainty clearly relates to perceptions as well as intrinsic qualities of the task. This covers many different types of uncertainty and includes feelings of uncertainty about future employment or inadequate information flow, as well as inherent ambiguity and unpredictability. One application of the model is as a guide to dealing with high given Uncertainty. However, there are situations in which it is desirable to *promote* a high level of Uncertainty.

Interdependence

Interdependence refers to "the level of social integration in a group or network"⁷, or the extent to which group members share common beliefs and practices and depend on one another to achieve results. Where Interdependence is high, communication networks are closely coupled and information in any part of the system quickly influences the whole system.

Interdependence is inherently higher in some national and regional cultures than others. Furthermore, it is influenced by corporate culture, structure and processes. For instance, where resources are scarce and need to be shared or competitively allocated by group members, Interdependence is increased. Likewise, Interdependence is high in organisations with dense communication networks, where career development is coupled to peer recognition of performance and where reward systems are based on team results.

With 'team' having been the buzzword of the early 1990's, many managers are seduced by the idea that the high level of Interdependence which characterises teamwork is *always* desirable. For many companies, use of the model will indicate that Interdependence should be increased. However, there are situations in which it is preferable to actively reduce Interdependence. One should bear in mind that when a company develops a team work structure, it raises the level of Interdependence within the teams but, paradoxically, this may tend to reduce it on the company-wide scale, as the cultural outlook of the organisation as a whole becomes more cosmopolitan and pluralistic. The level of Interdependence in a group is not always evident from a formal description of its work structures; much depends on the density of the communication networks, the coupling of feedback loops within the overall system and the extent to which group members are truly dependent on one another to achieve individual and group outcomes.

Knowledge Systems

The interaction of levels of Uncertainty and Interdependence in an organisation engenders variation in the processes of collective learning and knowledge production (Fig. 1). These processes may typify a team, a division, a company or an entire industry. In order to

⁷ loc. cit.

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create a simple working model, these processes can be reified and classified as types of organisation. To emphasise their significance as dynamic systems for handling and producing knowledge, they have been named the four knowledge systems:

- Bureaucratic Efficiency
- Diversification
- Technical Specialisation
- Permanent Discovery

Bureaucratic Efficiency

Where both Uncertainty and Interdependence are low, the resulting knowledge system can be characterised as Bureaucratic Efficiency. This is a situation in which there is little change over time. Knowledge effectively remains stable. People know exactly what they are doing and how to do it, staff can get on with their job with little supervision and results are predictable. In addition, information is widely accessible and job security, if not high, is at least known. By way of example, a well functioning routine testing laboratory that monitors established products is likely to have Bureaucratic Efficiency as its predominant knowledge system.

Diversification

A high degree of Uncertainty, when combined with low Interdependence, gives rise to Diversification. This type of knowledge system includes pluralistic fields, with dispersed resources and little agreement about what constitutes 'truth'. Diversification is characterised by localised information flow within separate sub-disciplines, which have their own world views. For example, in Executive Development, a multiplicity of models of learning and personality⁸ exist alongside one another. The fact that the presuppositions of the various approaches contradict each other is tolerated and even seen to add richness to management learning. In such fields, Diversification is at the heart of the ability to view knowledge of the world as relativistic and contingent.

Technical Specialisation

The opposite applies to Technical Specialisation, which arises when Uncertainty is low and Interdependence high. This knowledge system is characterised by a group of people who subscribe to a single paradigm and a shared set of truths. Change is incremental and cumulative and appears as reform rather than revolution of the established order. Technical Specialisation is typical of mature sciences, particularly those in which research resources are costly and concentrated and managed within a closed group. This recalls Fuchs' description of scientists working in dense networks '...with a well-defined collective

⁸ Psychometric and sociometric instruments based on different models can be used together to provide a useful basis for dialogue in leadership coaching. For example the Myers-Briggs Type Indicator is juxtaposed with the model of Metaprograms is being developed in Neuro-Linguistic Programming. The former has its roots in Jungian notions of archetypal personality, the latter in cognitive science and structural linguistics. It is fascinating to note the facility with which one can combine discourses based on seemingly incommensurable beliefs.

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identity, clear boundaries, and a confident belief in shared practices⁹. It is reminiscent of the state which used to be typical of expert technical tasks in heavy industry involving costly plant and machinery.

Permanent Discovery

The fourth and perhaps the most alluring knowledge system is Permanent Discovery. Both Uncertainty and Interdependence are high, corresponding to the currently fashionable image of organisation, in which change is constant and teamwork is the norm. In this knowledge system, innovation is continuous and radical. People need each other and work closely, but 'truths' are challenged by the abiding ambiguity of data interpretation. Permanent Discovery is the breeding ground for new knowledge and for new paradigms. This is the archetype of Senge's learning organisation.

This type of structure may be compared with closely coupled technosystems such as nuclear power plants, in which the feedback effects of an incident in any part of the system quickly and unpredictably ramify to produce the inevitable "normal accidents" of such systems. The elements of speed, unpredictability, cumulative feedback and inevitable change are reminiscent of the understandings of systemic processes now emerging from chaos and complexity theory¹⁰.

In these turbulent times, Permanent Discovery will be the optimal knowledge system for the wide range of business activities in which change and innovation really are the key to competitive advantage. In a relatively stable environment, one would associate it with a flourishing R&D department involved in new product development in a technologically based industry.

A high degree of Uncertainty also tends to lead to more informal and decentralised social structures, with individual autonomy and idiosyncratic working styles¹¹. This seems to imply that Permanent Discovery, when optimal, may need to be continuously created and managed, in order to ensure that a high degree of Interdependence is maintained alongside high Uncertainty. In addition, it should be remembered that Permanent Discovery is costly to a company. The high Uncertainty implies that not all initiatives will be profitable; there will be risk taking and collective learning by trial and error. The high Interdependence means that time and money are spent on the sharing of information and on resource allocation.

⁹ op. cit., 939.

¹⁰ For a highly accessible account which develops existing metaphors and updates the notion of optimisation, see Kevin Kelly. *Out of Control*, Element, 1995.

¹¹ op. cit., 943.

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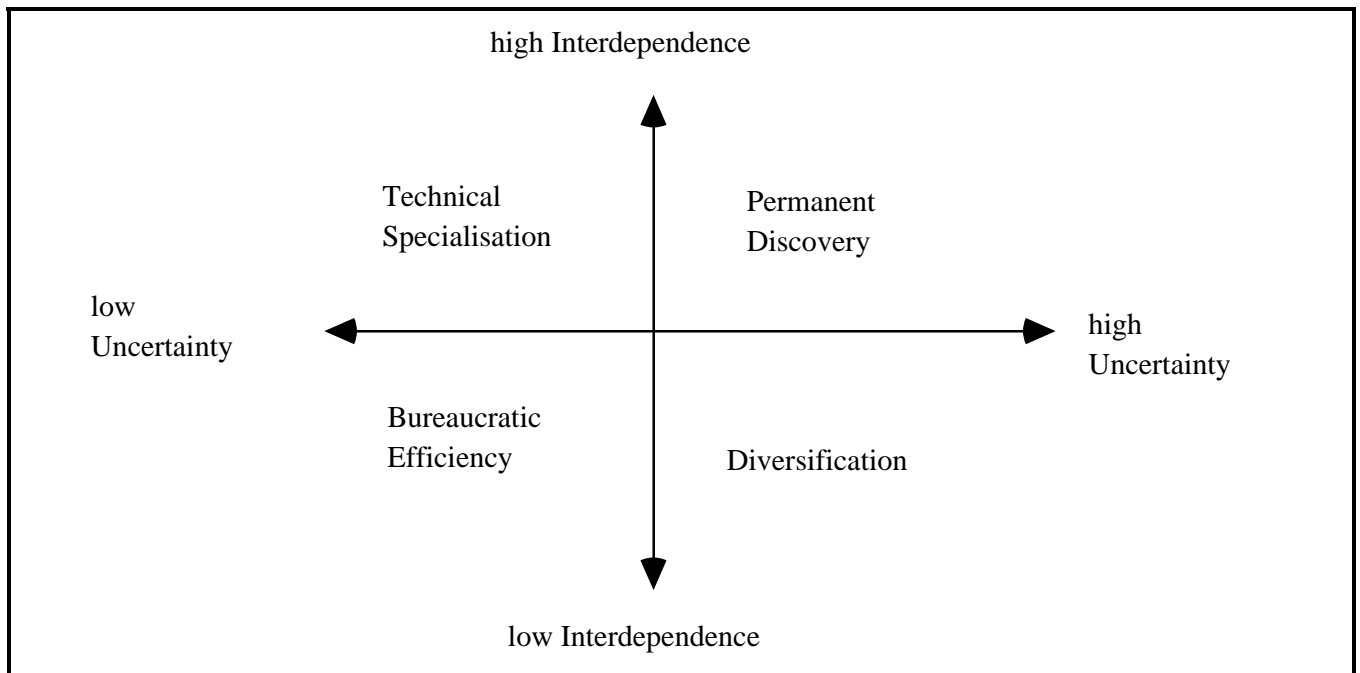


Fig. 1

Permanent Discovery also describes the great leaps made in theoretical physics in the early part of the 20th century¹². Embodied in the work of the likes of Einstein, Heisenberg and Bohr are radical changes to our understanding of how the universe works. The revolution in physics occurred in a context of high Uncertainty and high Interdependence, and is epitomised today by global research fronts in molecular biology and quantum physics. Faced with the need for new paradigms in business, one can emulate these outstanding examples of knowledge production and of profound, rapid collective learning. Current understanding of paradigm shifts owes a great deal to the work of Thomas Kuhn¹³. However, Kuhn's work pays little attention to the social aspects of science; it also presupposes an alternation between normal and revolutionary science. Building on Fuchs' work, this paper takes as given both the relevance of social organisation and a wider variation in types of knowledge production¹⁴.

Given the appeal of Permanent Discovery and the intellectual fashion for maximising learning, it should be emphasised that all four knowledge systems are valid and effective. Which one is best depends upon the specific task, the context and the stages of a project life cycle. Readers may well be familiar with the frustration experienced by professional, managerial and other staff when a certain structure or process is imposed without regard to optimisation. The frustration is the same whether the 'one right way' is in the nature of

¹² For an outstanding study of the creative scientific thinking which gave rise to new forms of knowledge in the period 1900-1950, see Arthur I. Miller, *Imagery in Scientific Thought*, MIT Press, 1987 [1984]. Miller's discussion of Niels Bohr, Ludwig Boltzmann, Albert Einstein, Werner Heisenberg and Henri Poincaré pays particular attention to the intensive dialogue both among them and between them and their contemporaries in other disciplines.

¹³ Kuhn, Thomas S. *The Structure of Scientific Revolutions*. 2nd ed. University of Chicago Press, 1970 [1962].

¹⁴ *op. cit.*, 933-4

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hierarchical command and control, or the unthinking use of cross-functional teams for every decision that needs to be made. When the knowledge system is optimised, it is possible to achieve the desired business results *and* enhance employee satisfaction.

Business Ignorance

There is no obvious user-friendly way to measure Uncertainty and Interdependence¹⁵. More fundamental than the question of degree, however, is the issue of whether a particular type of knowledge system is apt for a given task and context. It is not a quantitative question but a qualitative one; an issue not of maximisation or minimisation but of optimisation. What happens when you fail to optimise, when the knowledge system does not match the current requirements of the task and context? In this instance, the *negative* aspects of the knowledge systems appear, as different types of incompetence or inadequacy to the task at hand. These are referred to as the four forms of business ignorance:

- Stagnation
- Fragmentation
- Tunnel Vision
- Collective Caprice

All four of these are characterised by absence of learning; they are the real enemies of the learning organisation. Each corresponds to one of the knowledge systems. The only difference is that the levels of Uncertainty and Interdependence are *inappropriate* to the task, context and moment in time. Business ignorance is the result of failure to optimise.

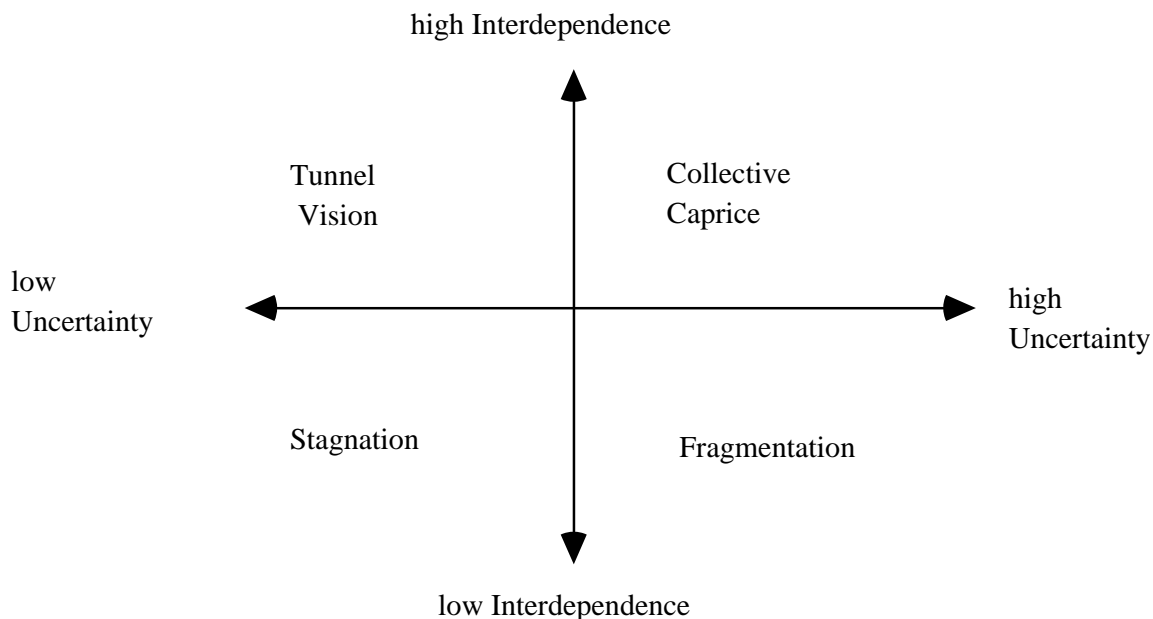


Fig. 2

¹⁵ We are currently investigating the possibilities, in collaboration with corporate clients. In the mean time, subjective assessment, based on an understanding of the many possible influences on Interdependence and Uncertainty levels, is proving to be a satisfactory and effective approach. This avoids the many pitfalls of forced quantification and enhances employee awareness and involvement.

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Stagnation (low uncertainty, low Interdependence)

When misapplied, Bureaucratic Efficiency appears as Stagnation. This may be seen in R&D departments where only individual performance is rewarded and procedures are dictated by management; the same knowledge is recycled and no significant discoveries are made for years on end.

Fragmentation (high Uncertainty, low Interdependence)

The downside of Diversification is Fragmentation. A Fragmented field is perceived as erratic and unfocused in its actions. This can be witnessed in companies attempting radical culture change without proper guidance, where HR specialists embarking on new and uncharted territory are left to find their way as individuals.

Fragmentation is the loss of a shared reality. Attempts at R&D generate discoveries, but these fail to become major innovations, due to the low level of Interdependence. In this situation, staff morale falls and the R&D department may find themselves unable to provide the basis for new product development.

Tunnel Vision (low Uncertainty, high Interdependence)

Technical Specialisation in its negative aspect appears as Tunnel Vision. When professionals become so sure of their shared model of the world that they fail to question their own assumptions, they attach themselves to one interpretation of events and are blinded by their own expertise. This is encountered in situations where the company culture is such that ambiguity is not tolerated. Rather than risk a state of unknowing, managers remain faithful to their familiar model of the world. This reduces the ability to perceive, let alone utilise, new information.

Collective Caprice (high Uncertainty, high Interdependence)

Permanent Discovery, when inappropriate, appears in the guise of Collective Caprice. This is an expensive form of ignorance. Time and money are invested in one costly initiative after another; the group is swept up in fads and fashions to no profitable end.

The PRIME model in Action

The most basic use of the model, then, is to avoid becoming trapped in any of the four forms of business ignorance. To do this, it is first necessary to determine which knowledge system will improve productivity in a given context and to create the conditions for that knowledge system by influencing the levels of Uncertainty and Interdependence. In practice, this can mean anything from fine-tuning reporting procedures, to company-wide cultural change addressing deeply held values, beliefs and attitudes.

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In deciding which knowledge system corresponds to the desired business outcome, one can follow some simple guidelines.

Bureaucratic Efficiency may be optimal for business outcomes where efficiency is a high priority and new knowledge production a low priority. It is particularly relevant where predictable results are desired, or in any activity requiring adherence to established routines, such as maintenance accounting, data storage, ongoing quality verification and comparative testing.

Diversification seems optimal where new knowledge production is desirable and where variety is more important than standardisation. It is particularly relevant where 'originality' is crucial, as in the design of Executive Development programmes and company conferences, where the stimulus of a new experience enhances individual and group learning.

Technical Specialisation appears optimal where new knowledge production is desirable and in-depth expertise is a high priority. It is particularly relevant in mature scientific and technical disciplines in which the overall complexity of available information is beyond the capacity of an individual working in isolation. In addition, it is apt where human and environmental health are critical issues, as typified in core activities of medical, pharmaceutical, transport and energy industries.

Permanent Discovery is clearly optimal where collective learning and new knowledge production are of the essence. It is particularly relevant to activities requiring continuous innovation and where cost is not the number one concern. However, it is also pertinent in a situation where the intrinsic Uncertainty of the task is high and is accompanied by significant financial or other risk.

The model as outlined above can be used as the basis for a task-by-task organisational audit¹⁶. For each task, context and time, there are three steps:

1. Identify the desired knowledge system
2. Identify the knowledge system presently operating; if this does not match the desired knowledge system, one can expect it to manifest in its negative aspect as business ignorance.
3. Adjust Uncertainty and/or Interdependence to move the activity from business ignorance to the optimal knowledge system.

Managing Scarce Resources

¹⁶ The audit takes place through dialogue, with and among the employees concerned. The model is presented to the group or team, who are then guided in mapping the desired and present knowledge systems for each task, moment and context. Maps are built up which represent the business processes through time. These are used to guide and monitor organisational initiatives.

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Take the example of an advertising company, auditing the work of their creative division involved in new campaigns. Ten years ago, the division was known worldwide for the originality of its work. They could be relied upon to generate fresh ideas and designs that caught the public eye. The company had recruited a number of young artists and designers who were left much to their own devices in deciding how to work and what to do. There was ample funding for trying out new ideas and they took pride in themselves as artistic individuals. The business was expanding fast and entering unfamiliar markets as socio-economic changes presented new opportunities. One recognises here the low level of Interdependence and the high degree of Uncertainty that are characteristic of Diversification, the optimal knowledge system for this kind of work¹⁷.

By the early 1990's, everything had changed. Their new ideas failed to capture the public imagination and clients accused them of merely delivering 'more of the same'. What went wrong? The decline began in 1990, when a cost cutting programme was initiated by top management, meaning that designers had to compete for resources. In addition, management decided to introduce a team work structure and brought in a firm of consultants to effect the change. The consultancy advised them to analyse their competencies and to establish design principles based on their successes of the 1980's. The result was a pooling of expertise and the group began to work closely as a team, applying a standard creative procedure and focusing on core competencies. It was thought that creativity would increase through people sharing knowledge and learning from one another. However, one can easily recognise in this scenario the high Interdependence and low Uncertainty characteristic of Technical Specialisation.

The initial effect seemed to be positive. Delivery to the customer was faster, costs were reduced, budgets became easier to predict and the designers even seemed easier to communicate with as they began to see themselves less as artistic individualists and more as a professional team. The company established a 'look', which became their hallmark. Applying the model in retrospect, it is easy to see why this soon went wrong. Technical Specialisation is not the optimal knowledge system for a creative design team in the advertising industry. Within a few months, the business ignorance of Tunnel Vision became apparent. Customers became dissatisfied with the predictability of the 'look'; the customers' priority was to be one step ahead of their competition and for their campaigns to be highly diverse and clearly differentiated. As a result of the effects of Tunnel Vision, the advertising company lost key accounts and was forced to recognise that something else needed to be done.

At this point, the PRIME model was used to guide management decision making. It was decided that the high Interdependence inherent in competition for scarce resources should be treated as a given; in other words, cost minimisation would continue. However, other

¹⁷ Diversification may be the optimal knowledge system for creative endeavour in the arts. This indicates an argument for abundant arts funding; allocation of scarce resources increases Solidarity, as individuals depend on others' judgments to be able to conduct their work. It is interesting to note that the world's great artistic traditions involve a long training period of Technical Specialisation, during which technical mastery is achieved, followed by either Diversification (in the case of individual endeavour) or Permanent Discovery (for group creativity). Where technical mastery is followed by individuals working independently and to clear rules (Bureaucratic Efficiency), we tend to classify this as a craft or trade, rather than an art form.

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measures could be taken to move them from Tunnel Vision towards Diversification. The design team were brought together with management during a two-day event that presented the model. Together, managers and designers generated options for how to reduce Interdependence and increase Uncertainty, without increasing the design budget. The following solutions were selected and implemented:

- introduce extremely flexible working hours (some of the designers preferred to work from midday until late at night);
- initiate a work experience programme in which undergraduate art and design students joined the work group for a six week period;
- sponsor individual designers to attend off-site professional development courses in art schools;
- run an annual outdoor event focused on developing individual flexibility, creativity and innovation;
- challenge designers to use any process except what had worked in the past for generating designs;

For the company in question, these were appropriate and low cost initiatives. The revitalisation of the design group began as soon as they were shown the model and continued as they empowered themselves to work as individual contributors on an inherently ambiguous and changing task. The processes of Diversification are evident again, as they begin to generate original, surprising campaigns which are renewing customer confidence in their ability to be 'consistently different'.

This example has been given because it counters preconceived notions of the desirability of team work and shared practice¹⁸. For many managers, the biggest current challenge *is* to move core business processes towards Permanent Discovery. But Permanent Discovery applied as a panacea may manifest as Collective Caprice. It could be argued that the fads and fashions of the 'guru' approach to management thinking are instances of Collective Caprice.

Generating Permanent Discovery

Where appropriate, Permanent Discovery is the path to competitive advantage. By maximising both Interdependence and Uncertainty, one can create the conditions for the development of this knowledge system. To increase Interdependence, management can:

- initiate a structural change which increases the density and complexity of information flow, such as a move to matrix management or cross functional design teams;

¹⁸ Managers with strong shared goals and values (high Interdependence) and with a high level of perceived Uncertainty (as in the current business environment) are particularly susceptible to Collective Caprice in the form of management fads and fashions.

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- increase accountability for resources so that they need to be shared or competitively allocated by the work group;
- introduce a reward system based on 360 degree feedback, peer assessment, team performance or internal customer performance;
- initiate a culture change process which enhances identification with the company and shared values.

In order to increase Uncertainty, management can:

- recruit staff from a range of disciplines so that received knowledge is not uniform;
- recruit staff with a diversity of cognitive styles, so that perceptions and data interpretation are highly differentiated;
- actively encourage employees to question and challenge established procedures;
- empower staff to create and select their own operating procedures;
- require that a number of alternative interpretations of the same raw data are generated at each stage of a project. This may be called Multiple Description, in deference to the Gregory Bateson's seminal work in systems thinking¹⁹.

Managing Uncertainty

Uncertainty can be increased through these and other means; however, many managers already face high levels of Uncertainty. In dealing with high inherent Uncertainty, one needs to acknowledge this and work with it. In the petroleum industry, the model has been used to review the conditions in which giant oil fields have been discovered, comparing this with unsuccessful exploratory ventures. When entering a new region, knowledge of the subsurface is minimal and the level of Uncertainty very high. The analysis revealed that successful new region exploration has consistently occurred in the conditions of high Uncertainty and high Interdependence associated with Permanent Discovery.

By contrast, poor performance in exploration was revealed to be associated with either high Interdependence and artificially low Uncertainty, or high Uncertainty and low Interdependence, manifested respectively as Tunnel Vision and Fragmentation. If inherent Uncertainty is denied or ignored, people proceed as if Uncertainty levels are low. In this instance, through the business ignorance of Tunnel Vision, geoscientists failed to consider other interpretations of the raw data and for many years missed a giant oil field, spending millions of dollars in the process. Sometimes the major Uncertainty was acknowledged, but associated with low Interdependence. In such situations,

¹⁹ See e.g. the works collected in Bateson, Gregory, *Steps to an Ecology of Mind*. Ballantine Books, 1972.

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Fragmentation occurred; somebody had a 'hunch' that there could be a giant field in the region; the knowledge was in the system, but was not shared. Again, considerable resources were expended before the field was discovered.

Specific recommendations for the management of exploration are now being implemented to create the conditions for Permanent Discovery in relevant sites around the world. A key recommendation for maintaining an appropriately high level of Uncertainty was the requirement that Multiple Description be generated for raw data at each stage of the process.

In contrast, the exploitation stage has a much lower level of inherent Uncertainty and so demands a different management approach. The optimal knowledge system is Technical Specialisation. The business ignorance most likely to occur is Stagnation. Recommendations are then focused on increasing Interdependence, to enhance continued learning and the accumulation of expertise. Central to raising the Interdependence level was a recommendation that cross-functional communication be given priority over the exercise of centralised and hierarchical power in decision making²⁰.

It will be clear by now that any aspect of the model can act as a starting point in setting direction for management decisions. In assessing the impact of corporate culture on business results, existing levels of Interdependence and Uncertainty are examined, along with their effect on business outcomes. The next step is to evaluate which areas are susceptible to change and which need to be acknowledged and worked with as they are.

Similarly, national and regional cultures vary in their degree of inherent Interdependence. Research is now under way to explore the correlation between Interdependence as described here and other dimensions of culture.

New Product Development

The model has also been specifically applied to the management of new product development. In this field, the predictions made using the model seem to be supported by recent research, which develops and tests a contingency model based on resource dependency theory. Olson et al. empirically tested their model against 45 new products developed by 12 firms in widely varying industries²¹. Their findings indicate that performance outcomes in new product development are improved by a good fit between 'product innovativeness' and work coordination structure, in other words, that there is *not* a best, one-size-fits-all solution. Their model includes four structural variables and six process variables and combines these to make broad comparisons between organic,

²⁰ A general description of organisational structure and reporting procedures is not adequate to predict the level of Interdependence in a given context. This recalls our earlier remarks on the preference for subjective assessment within a particular context over forced measurement. In the example in question, Interdependence was low due to a history of employees guarding knowledge in an effort to gain individual recognition and reward. Basing individual reward on team, division or company performance can effectively support initiatives to increase Interdependence.

²¹ Olson, Eric M., Walker, Orville C., Jr. & Ruekert, Robert W. 1995. "Organizing for Effective New Product Development: The Moderating Role of Product Innovativeness" *Journal of Marketing* Vol. 59: 48-62.

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participative structures on the one hand and bureaucratic structures on the other. Their description of the decision making, conflict resolution, information flow and work flow in each of these indicates that they correspond to high and low levels of Interdependence, respectively. Some of the variables also overlap with respectively high and low levels of Uncertainty.

Performance measures in terms of product quality, financial outcomes, efficiency and employee satisfaction, were found to be high when the organic structures were used for projects in which the company had little prior knowledge of the product; this corresponds to high Uncertainty in the model. In other words, where Uncertainty is high because the product is unfamiliar, high Interdependence correlates with high performance. This is exactly what one would expect, due to the importance of innovation in this kind of new product development. Conversely, bureaucratic structures were associated with high performance in developing an existing product line. Again, this is what one would predict using the model, as innovation would be less important and efficiency of the essence. In such instances, the company's familiarity with the product suggests a low level of Uncertainty, in which case low Interdependence is compatible with bringing the product to market in the shortest possible time.

Optimisation through Time

The model can be further applied to optimise work organisation through time. Projects and programmes differ from one another, but they all have life cycles, with business priorities changing from one stage to the next. In innovative new product development, one typically sees a progression through all four knowledge systems (Fig. 3).

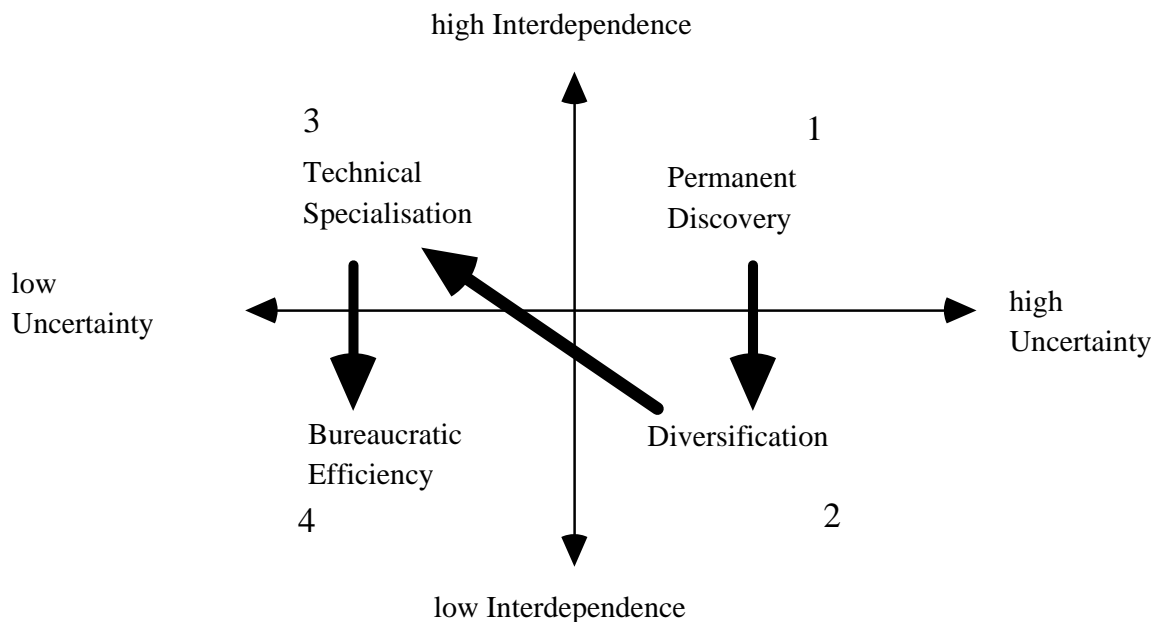


Fig. 3

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1. Permanent Discovery: new ideas are generated which are radically different from what has gone before and which represent genuine invention or discovery. These enter the dense communication networks of this type of knowledge system and a development process is initiated.
2. Diversification: multiple possible applications and developments of the invention or discovery are generated; scenario planning is used to forecast futures as a basis for project selection.
3. Technical Specialisation: projects are selected and developed in accordance with established quality and value criteria; there are clear shared goals, defined problems and guidelines for comparing and evaluating solutions.
4. Bureaucratic Efficiency: the agreed product is manufactured and brought to the market place.

This is a much simplified version of the new product development cycle. An example will serve to illustrate its application. An automobile company with global operations was experiencing frustration in new model development. In spite of a rigorous forward planning process and the creation of dedicated engineering teams, new models were failing to achieve competitive edge. The PRIME model was presented to one of these engineering teams as a basis for dialogue on how to improve performance.

By auditing their existing process and comparing it to the cycle represented above, the team were enabled to agree actions which would enhance their success. The process in place involved a team of engineers agreeing criteria for the car of the future and then using a sophisticated form of benchmarking as the basis for new model development. From start to finish, Interdependence was high, due to team members' shared engineering background and the early consensus on criteria. Uncertainty was minimised throughout, by using competitors' existing models for benchmarking, and by creating a single scenario of the future.

It became apparent that the process was typified by Technical Specialisation, which was manifesting as Tunnel Vision during most stages of new model development. The effect of this was lack of innovation and designs which lagged behind the competition. Using the model as a guide, the team were facilitated in reinventing this key business process. They have made a number of significant changes.

To begin the renewed process, multiple future scenarios are posited, which increase Uncertainty about the criteria for the car of the future. These include imagining socio-economic constraints for specific markets, such as "private cars have been banned in all cities", "there are no speed limits on motorways", "inner city traffic must always give way to pedestrians", "petroleum is extremely cheap" and "petroleum use is severely restricted by environmental legislation". The team work closely together, producing a wealth of new ideas in response to diverse and sometimes bizarre scenarios. This, of course, is the Permanent discovery stage.

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At the next stage, each team member works with an individual from another function (such as marketing) to develop selected design concepts from stage one. The effect of this is to reduce Interdependence while maintaining high Uncertainty, resulting in Diversification. The results are even more varied than at the first stage, some ideas being taken to unwieldy extremes, others being creatively developed into the seed of competitive advantage. There is lively discussion and disagreement about which proposals should be retained for further development.

At this stage, criteria are agreed within the larger cross-functional group. The engineers then work with selected concepts to develop and quantify their value, incorporating the existing benchmarking process. This core team share an understanding of costs and benefits and base their assessments on defined measures; this is clearly Technical Specialisation.

This prepares the way for Bureaucratic Efficiency; prototypes are made and tested and (via further feedback loops) new model manufacture is instigated.

The results so far indicate enhanced performance in new model design. The process takes slightly longer than before and involves a wider cross-functional group, with only the core team intact throughout. The high levels of Uncertainty during the first two stages are uncomfortable for certain individuals. Some of the early ideas generated are unusable. However, the process is proving to be cost-effective and to have broken through the barrier of Tunnel Vision. The group have generated a few significant design breakthroughs which can help to situate the company at the forefront of the industry.

The central message here is that the optimal levels of Uncertainty and Interdependence vary across moments in time. Sensitive use of the model can radically improve business performance.

Conclusions

The details of these and other applications of the model continue to be refined as it is used to guide organisational transformation and project management in a range of industries. The model is now in effect in facing diverse challenges, such as developing transcultural competence, enhancing corporate creativity under pressure, guiding innovative development projects through their life cycle and managing major risk and uncertainty.

To sum up, the central messages embodied in the PRIME model are already quite clear:

- Qualitative and quantitative variations in collective learning and knowledge production are correlated to four types of knowledge system: Bureaucratic Efficiency, Diversification, Technical Specialisation and Permanent Discovery.
- The knowledge systems are the result of the interaction of two organisational variables: Uncertainty and Interdependence.

Permanent Discovery or Collective Caprice?

- The currently fashionable image of the learning organisation corresponds to only one type of knowledge system, Permanent Discovery.
- A broader view of high performing learning organisations includes all four types of knowledge system.
- Which knowledge system is optimal is contingent upon the specific task, socio-economic context and moment in time.
- While the current challenge for the majority of companies may be to create the conditions for Permanent Discovery to emerge, the other knowledge systems give rise to higher performance for some tasks, contexts and moments.
- Organisational decisions create the conditions for a given knowledge system, by influencing the levels of Uncertainty and Interdependence.
- Matching knowledge system to task, context and moment enhances employee satisfaction and business performance.
- Knowledge systems which are not matched to task, context and moment manifest as the four forms of business ignorance: Stagnation, Fragmentation, Tunnel Vision and Collective Caprice.

All of this can be summarised by reiterating one of the elementary principles of true systems thinking: "**Don't maximise, optimise!**"