

# World view

## THE CONUNDRUMS OF INNOVATION

*Professor Ron Johnston, FTSE,  
Executive Director,  
Australian Centre for Innovation and  
International Competitiveness,  
University of Sydney, Australia*

**M**any countries are placing increasing emphasis on innovation as a key to economic prosperity or just economic salvation. The word 'innovation' has become a catch-all definition for a multitude of activities in diverse economic sectors. In this article Ron Johnston discusses the meanings of innovation and explores some of the assumptions underlying its use.

*Authors selected by the Science Policy Support Group and Science, Technology and Innovation review current research on science and technology policy and report on how related issues are dealt with in different countries. The views expressed do not necessarily reflect those of the British Library or the Science Policy Support Group.*

## Progress in innovation

Much has been said and written about innovation in recent years. This once unfamiliar word has entered the common language and is regularly used to advertise products, companies and trends. How do we account for this strong growth of interest in something as apparently 'soft' and nebulous as innovation?

One apparent reason is a growing conviction that it is 'soft' processes like innovation and learning which underpin economic competitiveness, whether at the firm level or that of the nation:

...Innovation systems are now acknowledged to lie at the heart of economic development and determine the technological competitiveness of nations. The systems are built on national combinations of such factors as research capacity, industrial organisation, professional skills and financial resources, all of which are heavily influenced by national characteristics<sup>1</sup>.

The analytical history of the concept of innovation has two distinct roots<sup>2</sup>. The first, with the oldest antecedents, is that of technological innovation. This rested on the view that the major source of substantial change was new technology. It carried with it until recently the assumption that innovation was a matter for engineers and scientists. The business manager only needed to ensure that some resources were dedicated to this objective, and to await the flowering of its market potential; only then would real management be required.

The second root of the contemporary focus on innovation comes from the management literature. With barely a mention of the phrase 'innovation', there has been a major thrust to improve the effectiveness of business processes, particularly through 'quality assurance' (QA) and 'total quality management' (TQM). The advances in business process management have delivered considerable efficiencies, and are considered in some cases to be responsible for three-quarters of improvements in business productivity over the past decade<sup>3</sup>. Much of

TQM relies on the capture of incremental improvements in routine procedures, particularly and most effectively when applied to manufacturing processes.

Now these two paths have joined, with a remarkable broadening of the concept and use of the term innovation from an emphasis primarily on technological innovation, which encompassed new product and process development, to the much broader term of 'business innovation'. The latter encompasses changes in business practice and management, including marketing, financial management, distribution and packaging, as well as new products.

In parallel, understanding of the innovation process, its critical role in the competitive economy and firm, and its changing nature has been advanced considerably in the past few years. Thus, Dodgson has noted that 'analysis of the innovation process has moved well beyond simplistic technology push-demand pull models, and progressed from seeing innovation as an activity which occurs within the boundaries of individual firms to understanding that numerous organisations acting in concert contribute to the generation and success of new products, processes and services'<sup>4</sup>. In this view, the definition of innovation reaches its widest scope: 'something that is new or significantly improved, done by an enterprise to create added value either directly for the enterprise or indirectly for its customers'<sup>5</sup>.

The competitive firm depends far less on the strategic breakthrough than on fostering an innovative culture. Such a culture both supports continuous incremental improvement, and recognises and builds upon opportunities for discontinuous changes such as new services, new customer linkages or new supply processes. Indeed, it is the conscious pursuit of synergy between these various innovations that marks the highly successful organisation.

This wider view of innovation has also shifted the locus of interest, and action, away from product development in a particular firm and towards a systems-based analysis of the innovation process. Thus innovating firms are viewed as operating within an environment made up of competitors, suppliers, customers, regulators, government policies, social and cultural practices and value systems which shape the range of opportunities for successful change and for failure.

For firms to operate effectively as they move towards a more creative, learning-based approach, they must develop complementary strong external alliances with customers, suppliers and joint venture partners. Innovation needs to be directed to all components of the value chain of an industry, regardless of whether the component sits within an organisation's perceived boundaries.

This has led to an emphasis, at the policy level, on the make-up and strength of national innovation systems composed of elements and relationships which interact in the production, diffusion and use of knowledge. These have been described by Christopher Freeman as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies'<sup>6</sup>. The range of institutions which play a role in a national innovation system is very broad – not just the research and educational institutions and the companies which use their output, but also financial, regulatory and infrastructure institutions. It also includes the range of mechanisms established by private decision and public policy to promote (or hinder) all aspects of innovation.

However, in the face of this recognition of innovation as a dominant factor in competitiveness, economic growth and world trade, a number of significant conundrums are emerging about an innovation-based economy and society.

## Some conundrums of innovation

The first conundrum is associated precisely with the breadth of our definition of innovation. There has been a rightful recognition that an advance in financial control procedures, or in badging a company for public presentation, or in the effectiveness of packaging, or in the way finance is raised, may generate as much revenue to a company as a new product or process. However, this very generality, rather than providing benefits of synergy, as often as not serves to confuse and dilute the meaning of innovation to such an extent that individuals, managers and policy-makers are no longer certain how to go about making sensible decisions. To introduce a 'total quality management' system and approach is a difficult but manageable task. To be charged, as a manager, with continuously reinventing not only yourself but also your organisation and to continually change, in a

purposeful manner, every aspect of familiar practices and values, is beyond human capacity.

A second conundrum of innovation might be labelled 'the Red Queen effect'. In a global economy, where much (but not all) information can be rapidly accessed, where competition appears to grow ever harder and faster, where the lifetime of products is shortened to such an extent that it is difficult to recover the investment in its development, and where today's competitive advantage is tomorrow's millstone, there is evidence that organisations, and particularly individuals, have a limited ability to sustain such an agenda of endless change. As the Red Queen said in *Alice in Wonderland*, 'you have to run faster and faster to stay in the same place'.

Economists espouse this as the 'race that never ends'. The model is the arms race, in which each side escalates their investment in greater power in response to actual or, more commonly, perceived capabilities of the opposition. The race is seemingly endless, in pursuit of the elusive goal of permanent advantage. The driving force is the threat of destruction, should either party fall below parity.

But societies, organisations and individuals are not capable of continuous change on all fronts simultaneously. In order to reinvent in one area, it is necessary to build on a foundation that has some stability. One is reminded of the laboratory story of the rat faced with six equidistant sources of food, who starves to death because of the inability to make a choice. Rather, companies and individuals develop strategies that restrict the competitive battle to a number of carefully targeted arenas. In recent years, there has been abundant evidence, particularly in the fastest moving high technology industries, of cooperative behaviour, commonly in the form of strategic alliances. This is designed to allow all players (or at least the big ones) to survive through sharing the costs of expensive technology development.

This raises the question of what will hold an organisation together if it is in a state of constant change. What glue could be effective when all the components are subject to change, and the glue itself may need to be constantly reinvented? It may be that a relatively stable culture is necessary to sustain a climate of change. As Dodgson<sup>7</sup> has noted with regard to that most innovative of industrial nations,

Japan: continuous adaptation and change in the industrial system appears to occur most consistently in an environment where people are comfortable in the knowledge of racial homogeneity, employment security, trust, fine gradations of hierarchy, stable community values, continuing increases in self-esteem reflecting income and deference to age, and adherence to principles of fairness. Where this is true, it is probably so because in this context change in technology or work process represents little threat.

A third conundrum points to the limitations of economic rationalism. This view, resting essentially on the views of classical economics, regards human transactions as operating most efficiently where a market exists, players have perfect knowledge and prices are set by the dynamic interplay of demand and supply. Hence competition becomes the most effective means of supplying human needs. The philosophies and policies of economic rationalism have dominated economic and social thinking and planning over the past 25 years, at least in the Western industrial nations. This dominance is being challenged from several directions. One challenge is being posed by the success of the East Asian national economies, which are based on quite different models of government-industry relationships, including the responsibility of the state to provide worthwhile employment for its citizens. Nor is there a single model of Asian development. Hobday<sup>8</sup> has demonstrated that, in addition to the by now well characterised approach of Japan, distinctly different but successful models (from Japan and each other) have been followed by South Korea, Taiwan, Hong Kong and Singapore, each producing effective economic and industrial development.

Another challenging stance is that emerging from the assumptions of modernism, as highlighted by its critics. The essence of modernism is a commitment to the rational, humanly improved world. Thus tradition is displaced by reason, nature by technology, and culture by goods. Modernist assumptions underpin our sense of progress and of improvement. However, if the world is not simply a malleable object on which to operate, if rationality is limited, if nature has ways of adjusting to human intervention, such an approach may, by itself, be ultimately self-defeating. 'When policy-makers try to steer research and profit from knowledge production in a modernist way, their problems are exacerbated.

They treat knowledge as a commodity, and because of that, will not get what they want. The aimed for commodity slips through their fingers, while interesting knowledge is produced and used elsewhere<sup>9</sup>.

Yet another challenge is the emergence of a deeply alienated youth, who see no place for themselves and their aspirations in a world that is governed solely by economic rationalist criteria. As Maslow<sup>10</sup> wrote in the context of his hierarchy of human needs, 'We must say harshly of the "science" of economics that it is generally the skilled, exact, technological application of a totally false theory of human needs and values. A theory which recognises only the existence of material needs. How could young people not be disillusioned! What else could be the result of getting all the material and animal gratifications and then not being happy as they were led to expect.'

But perhaps the greatest conundrums and challenges to the establishment of effective innovation are the characteristics of the emerging knowledge economy, and the central role of social capital.

## The knowledge economy

Knowledge, in the form of technology and market information, has become the principal resource in the world economy, especially knowledge in its dynamic form as the capacity to generate new technologies and to market new products<sup>11</sup>. In the terms of the knowledge economy, innovation had been redefined as 'the creative process through which additional economic value is extracted from the stock of knowledge'<sup>12</sup>. Under these circumstances we need to develop a conceptual framework which can provide knowledge and learning with the central roles that they deserve in the analysis of economic change. The neo-classical tradition focuses on the allocation of scarce resources. It does not address institutional, organisational and technological learning.

'Information flows are becoming so rich that the main problem has become how, where and when to dip into these flows. Knowledge is abundant, but the ability to use it is scarce. One consequence is that knowing how to do things in isolation is not the decisive type of knowledge anymore. Knowing how to communicate and cooperate becomes much more

important than before'<sup>13</sup>. The characteristics of the knowledge economy shift the focus of attention from competition to cooperation: 'the overall innovation performance of an economy depends not so much on how specific formal institutions (firms, research institutes, universities, etc.) perform, but on how they interact with each other as elements of a collective system of knowledge creation and use, and on their interplay with special institutions'<sup>14</sup>.

In the learning economy all the different categories of knowledge are combined in the innovation process. Entrepreneurial knowledge consists of know-what, know-how and, to a considerable extent, of know-who, -when and -where. Since all these forms of knowledge have transactional peculiarities, the pure market does not constitute a proper institutional set-up<sup>15</sup>.

Yet another approach rests on the concept of the 'knowledge system' and focuses on learning systems for scientific and technological knowledge. David and Foray have developed the concept of 'knowledge-product space', which is essentially a way of categorising different forms of knowledge by placing them with respect to three different dimensions: from completely tacit to fully modifiable, from fully disclosed to fully restricted; and from privately owned to publicly available<sup>16</sup>.

This differentiation of knowledge types provides a basis for analysing the characteristics of 'effective' knowledge, and the conditions for its effective application, which is very different from the perspective offered by neo-classical economics: 'within this complex structure of differentiated knowledges, what determines performance is not so much knowledge creation as the "distribution power" of the system: the system's capability to ensure timely access by innovators to the relevant stacks of knowledge'<sup>17</sup>.

This evolutionary view of technological knowledge and innovation provides the basis for a quite different consideration of the justification, and appropriate form of, government intervention. Whereas policies based on neo-classical economics emphasise support for knowledge creation, the evolutionary model places an emphasis on coordination across all components of the system. The most appropriate place for intervention, and public support, may be in providing mechanisms to assist in knowledge identification, location and

distribution. The role of government in the knowledge economy becomes one of supporting learning processes.

This provides a much broader justification for government support of public sector knowledge organisations than does the neo-classical view, which points mainly to spillovers from public good research. Such organisations are not simply engaged in the uncertain practice of research in support of national objectives. Rather, they provide the central core of the knowledge infrastructure of the nation, assembling and disseminating relevant knowledge throughout the economy and social structure. Parts of this infrastructure exist within, and can be provided by, the private sector. But the non-market nature of many of the transactions indicates the extent of a continuing role for public sector involvement.

As a consequence, it is: 'knowledge of how to develop new knowledge, how to locate and acquire rapidly knowledge generated elsewhere, how to diffuse knowledge throughout an organisation, how to recognise possible inter-connections between two distinct pieces of knowledge, how to embody knowledge in products and services, how to obtain access to the learning experiences of customers – all of these are the challenge for the modern manager, and for those who would make science policy'<sup>18</sup>.

## The role of social capital

The central role of social capital has been championed by Fukuyama<sup>19</sup>, who has suggested that prosperity depends more on shared values and sociability than rational self-interest. It is trust – not arms-length contracts – which forms the basis of effective relationships between firms and maintains an innovative capability within firms. The speed with which markets and technologies change, access to vast stores of information and the 'leanness' of modern organisations have undermined the traditional rationally-based 'command-control' management system. This system, most highly developed in military command (at least in previous times), relies on the exclusive location of decision-making at the top of the organisation, and instructions for action being passed down the line to those whose job it is to carry out the delegated task. However, the aforementioned conditions of the modern organisation require that all its members,

and not just those at the top, be able to access, evaluate and apply knowledge, in pursuing the company's goals. It is the shared values of the members, and the trust that exists between them, that will maintain the organisation on an appropriate course, as a consequence of a myriad of functionally independent decisions.

Fukuyama addresses what he calls the '20% solution', on the basis that neo-classical economics is 80% correct: 'it has uncovered important truths about the nature of money and markets because its fundamental model of rational, self-interested human behaviour is correct about eighty percent of the time'<sup>20</sup>. I think he may be putting this figure a bit high; something more like 60% is correct, which leaves us with a 40% problem that is not being addressed.

There is also evidence that economists have become a dangerously exclusive, inward-looking group, whose beliefs are either shaped by the assumptions of neo-classical economics, or who choose this career because it fits their beliefs. In a social experiment at a US university, a large group of people were given tokens that they could exchange for money. They could take the money for themselves or for the group to share. Between 40% and 60% of those in the experiment contributed altruistically to the group. The only specific exception was a group of entering graduate students in economics!

The circularity and self-referential nature of the beliefs exposed here perhaps indicates why what non-economists consider rational arguments have so little influence on policy-makers. It also indicates the extent of the challenge in reducing the grip of the 60% solution.

However, Fukuyama points to the beginnings of an effective response, and an important means of forcing economists to face up to the 40% they ignore. He notes that in post-industrial society, social and economic progress can no longer be achieved, or even attempted, through ambitious social engineering. Therefore the future of political and economic institutions depends on a healthy and dynamic civil society – that 'complex welter of intermediate institutions, including businesses, voluntary associations, educational institutions, clubs, unions, media, charities, and churches – builds, in turn, on the family...A thriving civil society depends on a people's habits, customs and ethics'<sup>21</sup>.

Trust within the community is the expectation that arises of regular, honest and cooperative behaviour (based on commonly shared norms) on the part of other members of that community. Social capital is the capability that arises from the prevalence of trust in a society or certain parts of it. Through a wide range of historical examples, Fukuyama demonstrates that social capital is at least as important a determinant of economic performance as the economists' version of capital.

Social capital, according to Fukuyama, is a measure of the ability of people to work together for common purposes in groups and organisations. In addition to the familiar knowledge and skills component of human capital there is an element arising from people's ability to join in association to pursue a common cause. The level of social capital in an economy or society arises from the extent to which trust, as opposed to formal contracts, governs and drives behaviour. In the absence of an adequate level of social capital, economic capital cannot be effectively generated.

Moreover, social capital cannot be developed through individual or corporate decisions to invest. Rather it requires 'habituation to the moral norms of the community, and, in its context, the acquisition of virtues like loyalty, honesty and dependability'<sup>22</sup>. In a high-trust society, the costs of doing business are reduced. In contrast, in a low-trust society, the production and enforcement of rules and regulations entail very high costs.

Thus, Fukuyama identifies a relationship between social capital and firm size. In countries with high trust and social capital, there are many large, private business organisations. In contrast, low-trust societies like Taiwan, France and Italy have traditionally been populated by family businesses. Trust confined to the family provides advantage within the business, but considerable disadvantages in dealing with non-family trade. Similar arguments are used to explain the long term differences in economic performance between Northern and Southern Italy, the lack of development of many Latin American countries, and the low level of small business ownership by African-Americans in the US inner-cities

In the information age, libraries are major repositories of, and investments in, social capital. They are characterised as a 'safe space' in which citizens can explore and seek knowledge and

interpretations of their past, and their future. In a society increasingly marked by isolation and alienation, the commercial experiences they often provide are a contracting 'social glue'. Those with responsibilities for social capital – museums, libraries, universities, community organisations, etc – need to develop mechanisms to join in championing the crucial importance of the national investment in social capital, and to make the contribution more evident to the community and to the decision-makers in government and industry.

## People and processes

Senge<sup>23</sup> has outlined a framework for the 'learning organisation' which he sees as the appropriate structure to address the challenges of innovation in a competitive knowledge economy. These are organisations 'where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together'. This requires the development of a new organisational infrastructure to enhance learning. Traditional mechanisms need to be reinvented to address the emphasis on learning. Thus, planning is no longer primarily a senior staff mechanism for setting the future direction of the corporation, but a process whereby all members of the organisation change their shared mental models of their company, their competitors, their markets and their futures.

People are the key generators of innovation. For many, however, the experience of analysis-dominated learning, and of authority structures, has reduced their ability and willingness to innovate. This represents a serious challenge to all our educational institutions, from primary school onwards. In an innovative society, it is the capacity for purposeful creativity, for synthesis beyond analysis, for design and for imagination, which are crucial. Within organisations, it is processes which foster and reward innovative behaviour that will create the most propitious environment. Despite the rhetoric of innovation, many firms and public sector organisations still carry a formal and informal culture which values meeting objectives in approved ways and avoiding failure. The very drive for greater accountability, appropriate in its own terms, can generate an extreme fear of failure, a culture of 'bury your mistakes at midnight'. Attachment to hierarchy and formal authority runs very deep.

In assessing the conditions which support effective change management, perhaps the most important lesson for innovation is that it is not the preserve of the economists, of market forces or of narrow preoccupations with R&D expenditures, technology transfer or intellectual property management. The broader challenge is to develop a stable and dynamic culture which can support and sustain change without loss of order. In this sense, innovation may represent a central element in the make-up of a national identity and of society. Innovation is much more than a means to redress problems with balance of payments.

## Notes and references

1. *STI Review* No. 14, Introduction, p.7, Organisation for Economic Cooperation and Development (OECD), Paris (1994)
2. However, it is interesting to note that Schumpeter in his ground-breaking but much neglected exposition of 1934 emphasised the importance of both product innovation and business process innovation.
3. Business Council of Australia *Managing the innovative enterprise* The Business Library, B.C.A. 45 Flinders Lane, Victoria 3000, Melbourne (1993)
4. Dodgson, M. 'Technology and innovation: strategy, learning and trust' in Sheehan, P. *et al.* (eds), *Dialogues on Australia's future* p.216, Centre for Strategic Economic Studies, Melbourne (1996)
5. Business Council of Australia, *op.cit.*
6. Freeman, C. *Technology policy and economic performance: lessons from Japan* Francis Pinter, London (1987)
7. Dodgson, M. quoted in Johnston, R., 'The challenge of technology and innovation' in Sheehan, P. *et al.* (eds) (1996), see ref. 4
8. Hobday, M. *Innovation in East Asia* Edward Elgar, Aldershot (1995)
9. A. Rip, personal communication (1996)
10. Maslow, A. H. *A theory of metamotivation: the biological rooting of the value-life*, quoted in Chiang and Maslow *The healthy personality* Van Nostrand, New York (1969)
11. Cox, R. *Production, power and world order* Columbia University Press, New York (1987)
12. Organisation for Economic Cooperation and Development *Conference on Creativity, Innovation and Job Creation* background paper, OECD, Paris (25 July 1995)
13. Lundvall, B. and Johnson, B. 'Learning economy' *Journal of Industry Studies* 1(2) p.25 (1995)
14. Organisation for Economic Cooperation and Development *Interactions in knowledge systems: foundation, policy implications and empirical methods* DSTI/STP/TIP (94)15, OECD, Paris (1994)
15. *Ibid.* ref. 14, p.30
16. Organisation for Economic Cooperation and Development *Assessing and Expanding the Science and Technology Base* DSTI/STP/TIP (94)4, OECD, Paris (1994)
17. *Ibid.* ref. 15
18. *Ibid.* ref. 17
19. Fukuyama, F. *Trust: the social virtues and the creation of prosperity* Free Press, New York (1995)
20. *Ibid.* ref. 20
21. *Ibid.* ref. 20
22. *Ibid.* ref 19, p.27
23. Senge, P. *The fifth discipline; the art and practice of learning organization* Random House, Sydney (1992)