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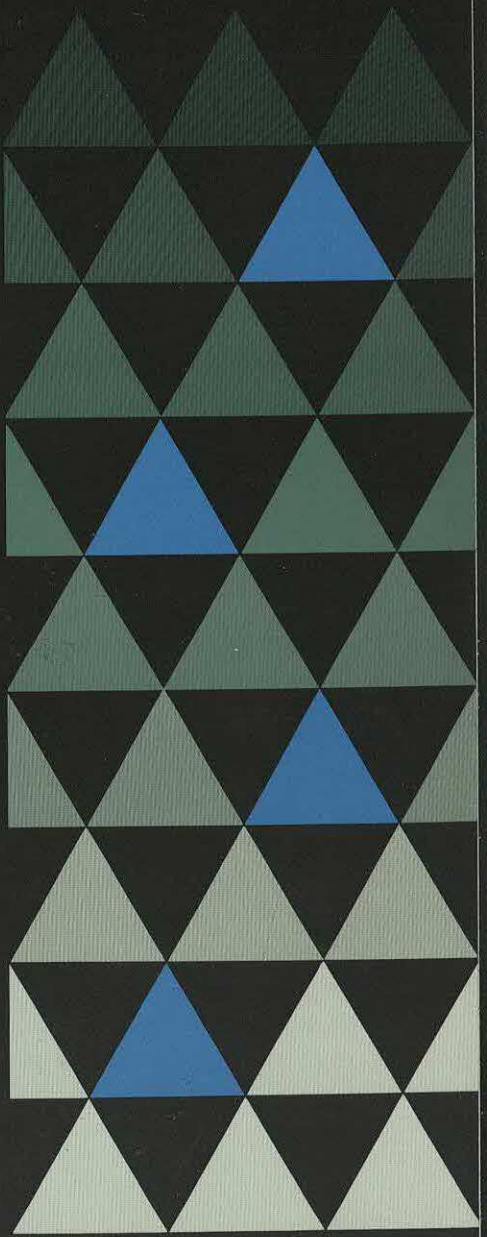
Innovation: The Challenge in Exploiting Technology



A Directors' Briefing

May 1992

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Innovation: The Challenge in Exploiting Technology

by Tony Brewer

This Directors' Briefing is based closely on the opening presentation given by Professor Juan Rada at the Foundation's 1991 International Conference. At the time, Professor Rada was General Director of the International Institute for Management Development, Lausanne, but is now Director of Strategy and New Initiatives with Digital Equipment Corporation International (Europe). The title of Professor Rada's presentation was *Getting More from Technology*. In it, he argued that inventing technology is not a constraint; innovating to apply existing technology is the challenge facing organisations today.

Directors' Briefings are published by the Foundation and provide directors and senior general managers with practical guidance on the effective exploitation of information technology within their enterprises.

Further information about the Foundation can be found inside the back cover of this paper.

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A Directors' Briefing

Innovation: The Challenge in Exploiting Technology

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According to Professor Rada, the challenge to managers today, in exploiting technology, is not to invent new technology-based products or services, most of which will make little contribution to commercial results, but to innovate, by applying existing knowledge to new situations. Creating the right environment for innovation is a management task, and one that is becoming increasingly demanding. While technology has an important part to play in innovation, it is, nevertheless, only one of many enabling factors.

The challenge of technology is to innovate rather than invent

Professor Rada referred to the distinction between invention and innovation drawn by Joseph Schumpeter, a leading member of the Austrian School of economics and a contemporary of Maynard Keynes. Invention is about new ideas, new laws of nature, new products and processes. Currently, it is very much about new characteristics and applications of technology. Typically, it is the concern of aspiring Nobel prize winners. Innovation, by contrast, is concerned with transforming new ideas into benefits – either commercial benefits, such as profit or market share, or social benefits, such as greater personal mobility or more democratic institutions.

Most businesses are drowning in more good ideas than they can implement. Their problem lies in converting these ideas into profit. Schumpeter's research suggested that 98 per cent of all inventions were wasted, and more recent research has confirmed the continuing validity of this figure.

Innovations often require little new technology

Innovations are frequently conceptual, although their realisation often depends on technology. Professor Rada quoted self-service and container transportation as good examples. Probably the biggest increase in productivity since World War II has been achieved by transferring transaction costs from the service supplier to the customer. This innovation, as seen in self-service petrol stations and restaurants, and on pick-your-own fruit farms, required little new technology, although advanced technology has now enabled the idea to be exploited much further in banking and food retailing. The point is that the customer is working free of charge for the oil company, the restaurateur or the farmer. Container transportation, introduced in the 1960s, is based on the idea that a multitude of goods, in a variety of shapes, sizes and weights, can be carried more easily in standard-sized containers than as individual pieces. Again, little new technology was required to implement the concept.

Given this emphasis on concepts and results, rather than on technology and invention, innovation is clearly a general management, rather than a specialist, responsibility.

Current trends will require innovative responses

Professor Rada picked out several important trends that will require innovative responses. The first is the growing social, political and commercial concern with the environment. Until recently, environmentalists have been concerned primarily with production processes – reducing toxic emissions, ensuring cleaner and safer working conditions, and cutting energy consumption. While these concerns will not diminish, they will be reinforced by a growing concern with the disposal of used products. There are currently some 500 million automobiles in the world, for example. By the year 2010, there will be close to two billion, produced in perfectly clean factories, with practically no emissions. The problem will be how to dispose of 250,000 used cars each day. A similar problem will arise with the disposal of environmentally hazardous products, such as refrigerators, chemical weapons, de-commissioned nuclear power stations and even PCs.

Disposing of used products will be a growing problem

It is likely that governments will make producers responsible for disposing of their products at the ends of their useful lives. (An excerpt from the environmental policy in the Netherlands is shown below).

Governments will increasingly force manufacturers to take responsibility for disposing of their products

"Manufacturers will be made responsible for products at the waste stage. This will be done by requiring manufacturers to accept the return of goods when they become waste, which will be linked to a regulation on reprocessing. This mainly concerns batteries, packaging and durable consumer goods such as fridges, televisions and computers. Regulation on return premiums or deposits will be introduced to achieve this."

(Source: Environmental policy in the Netherlands, April 1991)

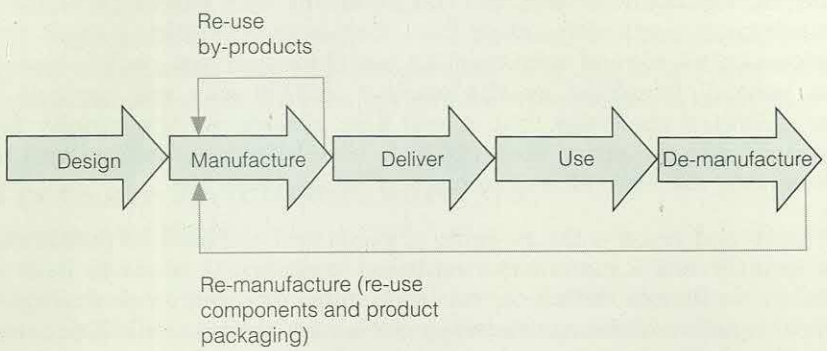
This requirement leads to the concepts of de-manufacturing and re-manufacturing. Products will be designed not only to be manufactured, but also to be taken apart and recycled (see diagram at the top of page 3). At present, for example, it takes 18 times more resources to take apart a PC than to assemble it.

Products will be designed to be recycled

The first two examples of this concept being applied in practice are the new Opel Astra, from General Motors Europe, and the new Volkswagen Polo. In both cases, the manufacturer will take the car back for de-manufacturing and recycling. Although this sounds like a costly operation for the producer, it does have some compensating commercial benefits. The logistical problems of tracking and receiving back used products create a significant entry barrier against imported products. Moreover, gaining control of the product from cradle to grave creates new profit opportunities. Mercedes Benz claims that its practice of buying used parts from scrap dealers for recycling has largely eliminated the market in second-hand parts for its cars, and has enlarged the market for official spare parts.

The need for producers to take on a cradle-to-grave responsibility for their products will lead to a new manufacturing model, which Professor

Products will be designed to be recycled



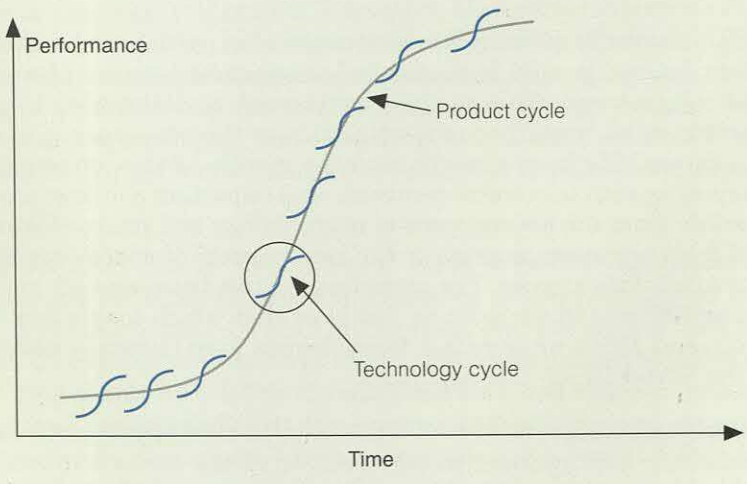
(Source: International Institute for Management Development)

New information infrastructures will be required to track products throughout their lives

Rada called the 'model of reconsumption'. It will require producers to reduce the amount of material that they use, to use it for longer, and to re-use component parts and packaging. Within this model, logistics will become one of the most significant cost components. Much more complex information networks will be required to track products throughout their lives. This contrasts sharply with the current manufacturing model, where goods are produced and then transferred to become the customer's responsibility. The reconsumption model places much greater emphasis on modularity, repair and services, all of which will require information infrastructures that have not, hitherto, been necessary.

The reconsumption model will also lead to a breaking of the traditionally close correlation between the technology cycle and the product life cycle. This break implies a need to find a way of combining long product cycles with short technology cycles (see diagram below).

Short technology cycles will have to be reconciled with long product cycles



(Source: International Institute for Management Development)

Quoting the example of the personal computer, Professor Rada suggested that those parts of the machine with a long life – perhaps the casing, the keyboard, and the power supply – will be purchased, while those parts with a short life – such as the operating system, the processor boards and main memory, and the disc drives – will be leased or rented. Breaking up the product in this way will present a complicated challenge, but it will also provide an opportunity for suppliers to reposition their products from being commodity items to becoming the focus of continuing service relationships.

The second trend is the merging of goods and services. At present, if a country has a manufacturing-based economy, it tends to have a balance-of-trade deficit in services, and *vice versa*. Increasingly, however, the distinction between goods and services will disappear. On the one hand, goods will be substituted for person-to-person services, as the electric razor has been substituted for the barber. On the other, services, particularly those based on the provision of information, will add value and differentiation to commodity goods, as lifetime warranties and driver insurance have to car sales. Future innovations will be complex and creative combinations of what today are classified separately as goods and services.

The distinction between goods and services will increasingly disappear

It is clear that pressure for environmental conformance, and the merging of goods and services, will create opportunities for those businesses that are alert enough to recognise them and that are properly equipped to take advantage of those opportunities in innovative ways.

Professor Rada pointed out that certain technology trends are also important because of the opportunities that they create for profitable innovation. The first is the rapid acceleration that is taking place in technological development. This results from the rapid increase in the number of scientists and engineers available for commercial technology. This increase arises partly from the transfer of many of the brightest and best scientists and engineers in western countries from defence projects to commercial work, and partly from access by companies in the west to scientists and engineers from eastern Europe. Many of these were working on state-sponsored high-technology projects, such as titanium metallurgy, that would not have been economically viable in non-communist economies, so they possess knowledge and skills that may be in short supply in the west.

Many scientists and engineers are being transferred from defence to commercial work

This infusion of talent with new areas of expertise and a different scientific background is particularly important because of a second technology trend. This is the replacement of discoveries in single disciplines by breakthroughs arising from the convergence of many disciplines. We have already seen the results of the convergence of computing with telecommunications, and important achievements are possible from the convergence of microbiology and micro-electronics, and from 'nano-engineering' – the convergence of micro-engineering and solid-state physics. The cross-fertilisation between east and west in the 1990s is likely to be as fertile as that which took place in the 1940s and 1950s when rocket technologists from Germany emigrated to the Soviet Union and America.

Breakthroughs arise from the convergence of different technologies

A third technology trend that will create further opportunities is the continuing improvement in performance in the various information technologies. Nearly all these technologies are still far from their theoretical performance limits. The theoretical performance of silicon

chip technology, for example, is still around 100 times greater than current performance, and the theoretical performance of optical fibre is assumed to be at least 1,000 times better than current performance. The implication is that applications of technology will be limited more by our imagination than by technical capability. It will be a long time before the limitations of technology constrain the process of innovation.

There are formidable barriers to innovation

Although there are both commercial and technical opportunities for profitable innovation, there are also several barriers that often inhibit progress. These barriers arise from various aspects of the working culture within which invention or innovation occur. It is well known, said Professor Rada, that certain companies, and also some countries, have a reputation for inventiveness – one thinks of the United Kingdom as an inventive country, and of such companies as AT&T and Xerox – but invention and innovation rarely go together. These same countries and companies frequently fail to exploit their inventions or derive any lasting benefit from them. Obvious examples are the transputer (which was invented by an Englishman) and the stream of new inventions from Xerox's Palo Alto Research Center. Professor Rada suggested that if a company has a high tolerance of individual flair, and even of eccentricity, it will be good at inventing. By contrast, if it places greater emphasis on the creation and support of multidisciplinary teams, it is more likely to be good at innovating. The logic of inventing and the logic of innovating are very different, and they rarely thrive together in the same culture.

Particular cultures tend to foster either invention or innovation

Professor Rada argued that, generally speaking, the existence of a short-term capital market tends to be hostile to an innovative culture. It places an emphasis on share prices and dividends (rather than on capital growth) and on strict accounting and disclosure rules. It therefore tends to lead to unstable equity ownership. In response, managers focus on short-term results, and on the controls and accountability needed to achieve them. These features are all characteristic of Anglo-Saxon business cultures which, he suggested, tend to be inventive rather than innovative. By contrast, countries that have less-active equity markets, and that rely for investment finance on long-term relationships between shareholders and management, create a business culture that encourages synergy rather than individual responsibility, and flexibility rather than control. These features encourage innovation and are found in Germany and Japan, for example.

The investment climate is particularly important in encouraging innovation

The conclusion drawn by Professor Rada was that an essential requirement for innovation is the existence of good horizontal and vertical communications within an organisation. Businesses that are poor at innovating tend to have highly departmentalised structures, which keep people with different skills separated, and which emphasise control and accountability at the expense of flexibility and synergy. Such companies also tend to have an extensive management hierarchy, which inhibits the communication of the company's vision and objectives to its operating staff.

A prescription for success

What, then, can we conclude from Professor Rada's analysis of the characteristics of innovation? Our prescriptions for creating an environment for successful innovation apply at three levels – national, corporate and information systems.

The most relevant national characteristic, in terms of innovation, is the structure of capital markets. It seems very unlikely that the Anglo-Saxon countries will abandon short-term equity markets, but their impact on innovation must be recognised, and shareholders should be encouraged to value innovation, and to support those companies that are prepared to invest in creating an innovative culture.

Shareholders in short-term equity markets should be encouraged to value innovation

At the corporate level, several useful actions can be taken to encourage innovation:

- *Communicate the business vision and the consequent commercial objectives*. Innovation comes from the profitable application of new ideas to commercial objectives. The first step, therefore, must be to ensure that these objectives are well understood by the people with the ideas – that is, by everybody.
- *Create a climate of idea-generation and idea-sharing*. Encourage everyone in the organisation to reflect on the way the business works, in the light of its commercial objectives, to generate and share ideas for improvement, and to be valued for doing so.
- *Organise for synergy and flexibility*. Set up formal and informal networks of people from different functions, or business units, or countries. Reduce the number of organisational levels in the management hierarchy. Design the organisation structure in terms of sets of overlapping teams, but do not overlook the need for strong leadership.
- *Create a learning culture*. Make the enterprise not only responsive to customer requirements, but also to changing itself. Tolerate risk taking, and learn from both successes and failures. Aspire to continuous improvement.

Finally, there are four messages for the systems director. They are, first, that innovation requires the application of IT to facilitate the generation, communication and review of ideas, through applications such as electronic mail, voice mail, computer conferencing and groupware. Second, that the role of information systems departments will increasingly be to support the creation of flexible structures, to encourage synergy between groups of different workers, and certainly to avoid inflexibility. Third, that environmental concerns and the merging of goods and services will create opportunities for new kinds of IT application. Last, and perhaps most important, that companies require profitable innovations, rather than amazing inventions, from their systems departments.

The Foundation

The Foundation is a service for senior managers responsible for information management in major enterprises. It provides insight and guidance to help them to manage information systems and technology more effectively for the benefit of their organisations.

The Foundation carries out a programme of syndicated research that focuses on the business implications of information systems, and on the management of the information systems function, rather than on the technology itself. It distributes a range of publications to its sponsors that includes research reports, management summaries, directors' briefings and position papers. It also arranges events at which sponsors can meet and exchange views, such as conferences, management briefings, research reviews and study tours.

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