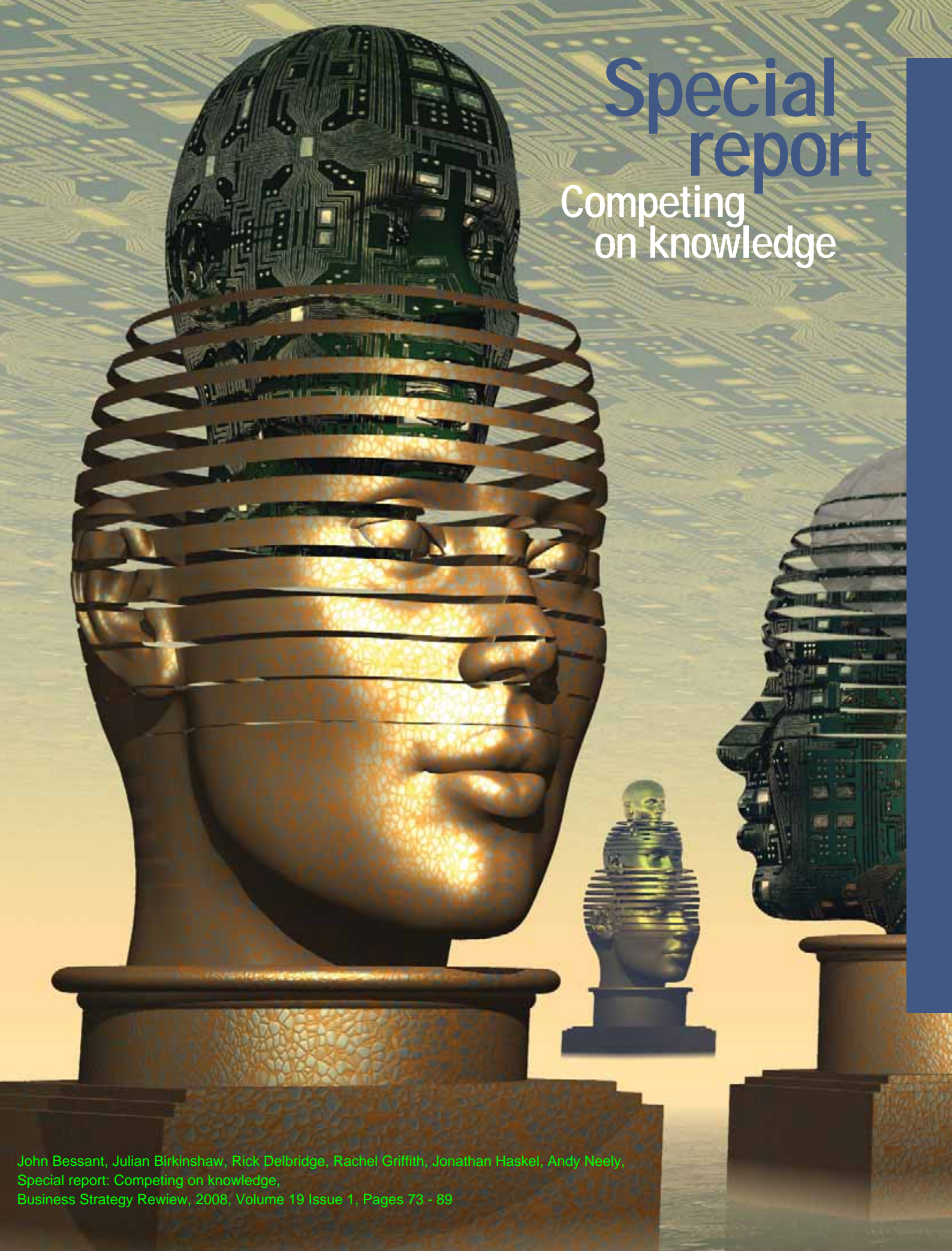


# Special report

Competing  
on knowledge



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## Competing on knowledge

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Traditionally, the UK has been regarded as good at innovation – with many inventions and scientific breakthroughs. So, can this nation rest easy? No. Based on extensive research by the Advanced Institute of Management Research (AIM), it would appear that the agenda for keeping Britain competitive is a demanding one. Six AIM authors report on what the UK needs to know. And do.

Is the UK an innovative country? Sad to say (and for many years), the UK economy has underperformed in terms of innovation. Research shows that Denmark, Finland, France, Germany, Japan, Singapore, South Korea, Sweden, Switzerland and the US all spend more than the UK on Research and Development as a percentage of GDP. The Competitiveness Index, produced by the World Economic Forum, ranks the UK sixth on a more general measure of innovativeness.

The Advanced Institute of Management Research (AIM: [www.aimresearch.org](http://www.aimresearch.org)) came into existence in 2002 to sustain, among other goals, a rigorous watch on UK's innovation performance. This led to research projects looking at innovation from a number of different perspectives and at different levels of activity. In particular, AIM researchers tried to understand UK's innovation performance within the context of a changing business world. From all its work, AIM has pinpointed four key ways that Britain could overtake its global competitors and achieve higher ranking. Quickly, Britain must become far better than it is at:

- **Opening up innovation** The country has to boost collaboration across organizations and national borders. Britain already has one of the highest levels of international flows of investment; but, in other areas, such as collaboration between universities and the private sector – or with India and China, the UK has further to go.
- **Mastering higher-order innovation** Britain needs a better understanding of the different forms of innovation (especially higher-order innovations, such as management innovations). Business leaders need fresh ways of looking at innovation in order to move their companies up the value chain. In particular, UK firms need to adopt smarter innovation practices, leading to novel business models and better ways of working.
- **Developing innovation networks** To capitalize on its strong science base, the UK should develop innovation networks around its leading research centres, which would thus become innovation hubs. These innovation networks should also reach beyond the UK. In this way, the UK could position itself at the centre of a global innovation web. UK firms already invest heavily in R&D in other countries, especially the US. Rather than worrying about this practice, policymakers should

recognize the important role it plays in technology transfer and knowledge spillovers into the UK.

- **Making the most of international firms in the UK** Foreign multinationals own large parts of the UK economy (40 per cent of private sector companies), and the trend toward foreign ownership is continuing. Concerns have been raised about the “hollowing out” of the UK economy, especially the ability of these foreign-controlled businesses to be innovative and entrepreneurial. AIM research suggests this concern is unfounded. There is evidence that foreign-owned companies are at least as innovative as locally owned companies. There is also evidence that UK firms can use the local presence of foreign firms to learn from their superior technology.

### Competing on knowledge

There is a thread that links the four measures advocated above. AIM research suggests that one of the main drivers of differences in productivity is tied to knowledge. Learning is a competitive weapon. That is, both in terms of individual skills and competencies and in terms of the knowledge-based capabilities of firms, the UK needs to shift away from competing via lower costs to competing via adding value. Put even more simply, Britain and its businesses need to expand their knowledge base.

The challenge now facing the UK is not simply to create more knowledge but to capture it in ways that have a positive economic and social impact. Primarily, this means converting our knowledge base into economic value through commercial innovation. It also means recognizing the changing nature of the global knowledge economy.

Attention is shifting from knowledge creation to knowledge flows, with the implication that trading knowledge may become as important in the 21st century as trading physical goods was in previous centuries. This requires the UK's innovation infrastructure to become more effective at identifying and capturing useful know-how. In more ways than most people can imagine, the fate of the UK hinges on its ability to learn how to compete on the basis of knowledge. That's why, for each of the four major AIM recommendations, leaders need to understand the actions that people in the UK can take, now, to accelerate the nation's speed on the path to becoming boldly innovative. ❖

Innovation has been traditionally viewed by large companies as a closed process. Whether it was innovation involving the source code for a new software product, the formula for a new drug or the designs for a radically different motor car, the watchwords were caution and secrecy. With large financial investments and future profits at stake, commercial innovation, in particular, typically occurred behind closed doors.

This made sense in a world where competitive advantage was seen to reside in proprietary R&D, protected by patents and intellectual property law. Consequently, the exchange of ideas remained in-house. Over the last decade, however, this situation has started to change. One major catalyst has been the success of the open source software movement, which freely publishes the source code for new software projects on the Internet. Open source collaboration can, and does, work. For example, the Linux computer operating system, invented by Linus Torvalds and developed through the open source model, now offers an alternative to Microsoft's Windows.

The open source approach is now being applied not only to the development of software but to an increasingly wide range of products. Increasingly, firms are adopting the collaborative principles of what is called open innovation. As the head of innovation at the US consumer goods company Procter & Gamble recently explained: "We have a broad programme we call 'connect and develop'. In the academic world, they call it open innovation. We want to connect internally – move technologies and ideas across our business units internally – but we also want to connect externally. This has been a real source of innovation for us." Open innovation at P&G now accounts for 35 per cent of the company's total innovations and millions of dollars in revenue.

#### Exchanging knowledge

The potential of the Internet as a knowledge resource is huge. →

In an increasingly competitive world, no single organization has all the answers. In the future, innovations involving collaboration across organizations and national borders will play a critical role in competitive positioning. A growing number of firms (including BT in the UK, Lego in Denmark and Procter & Gamble in the US) have begun to emphasize this approach. The UK has one of the most open innovation systems in the world in terms of cross-border flows, but more needs to be done to encourage collaboration between businesses and universities, for example. The UK's strong science base offers enormous opportunities. UK firms, research centres and universities are also well placed to collaborate with upcoming countries such as India and China. It is vital that these opportunities are grasped.



→ In 2001, for example, Eli Lilly and Company set up InnoCentive as a matchmaking tool, connecting those with scientific problems to those able to offer solutions. Its stated aim is to “use the power of the Internet to create and enhance open-source scientific research and development (R&D).” There are now multiple sites offering a brokering service, linking needs and means to create a global

Another increasingly common strategy involves companies seeing users not as passive consumers of innovations, but rather as active players in the process. Their ideas and insights can provide the starting point for very new directions and create new markets, products and services. For example, the Danish toy company Lego has set up the Lego Factory website: users can design their own models online and then

complex aerodynamic and other engineering products. And a growing set of tools – such as rapid prototyping, simulation and computer-aided design – help users interact with professional designers.

Of course, innovation is not confined to manufactured products. It also encompasses the huge range of service activities in both public and private sectors. Service businesses may not have a formal

Of course, innovation is not confined to manufactured products. It also encompasses the huge range of service activities in both public and private sectors.

marketplace for sharing ideas. InnoCentive CEO Darrel Carroll explains: “Lilly hires a large number of extremely talented scientists from around the world, but like every company in its position, it can never hire all the scientists it needs. No company can.”

have the ready-to-assemble sets sent to them. Lego’s website is an effective way to capture ideas from its most advanced users that can then be incorporated into mainstream products. Such a collaborative approach is now used for everything from T-shirts and surfboards to

R&D department, but they do undertake related activities in order to deliver a stream of innovations. Importantly, the knowledge sets with which they work involve a much higher level of user insight and experience – and thus their continuing competitiveness, especially in those

## Open innovation at BT

Telecommunications company BT has a long history of technological innovations with a total worldwide portfolio of 7,700 patents and applications. Deregulation, convergence and fierce competition made BT rethink its research and development (R&D) strategy by “innovating the way it innovates”, in the words of BT’s group chief technology officer, Matt Bross.

Bross believed that the company’s innovation efforts had to be more commercially – rather than

technologically – driven, with the entire research portfolio structured around business needs. With that purpose in mind, BT adopted an open innovation model based mainly on two pillars.

First, BT is actively managing its patent portfolio (for example, licensing and spinning out new businesses) through NVP Brightstar, a firm that specializes in taking technology projects out of BT as new ventures. Second, BT is moving toward a model where it

leverages the power and speed of external partners to accelerate the creation of new services. Bross reorganized BT’s R&D function to enhance its ability to identify, understand, select from and connect to the wealth of available external knowledge. In November 2006, BT had scouting units in Silicon Valley, China and Japan, with the objective of identifying global sources of innovation (product, service, process, social) and seeding them into the lines of business.

sectors which are internationally traded, will depend on taking an open approach to innovation.

### Opening minds

Underpinning the move to open innovation is a growing recognition that no single country or organization can corner the market in new ideas. The effect of open innovation is a fundamental change in the way that organizations create value. It involves a willingness to seek out leading-edge research wherever it occurs and an acceptance that home-grown knowledge is less proprietary than was once the case.

This favours the UK, which already has one of the most open innovation systems in the world. UK firms, for example, are big investors in R&D overseas, especially in the US. In the past, this has been viewed negatively, with calls for UK firms to invest their R&D budgets mainly within the UK. But in the context of a global innovation system, investing in R&D outside the UK offers important benefits in terms of technology transfer and importing leading edge ideas.

Similarly, the fact that R&D carried out by foreign-owned multinationals represents almost a third of all R&D in the UK suggests that the UK is a

good innovation system to invest in. This also points to the openness of the UK’s innovation infrastructure.

At the level of the UK economy as a whole, AIM research has shown that the large-scale market liberalization undertaken as part of EU integration and other pro-competitive reforms has had a positive effect on innovative activity and economic performance. More open markets encourage firms to innovate in order to “escape competition”.

At the level of the individual firm, AIM research has examined the strategic choices firms make to develop and commercialize new product ideas. This research emphasizes the importance of gaining access to external sources of ideas, but it also shows that such external sourcing works best when done in combination with a less proprietary attitude to knowledge protection. Open innovation relies on trust and reciprocity between partners. Unless a firm changes its mindset to reflect the need for such values, the necessary knowledge exchanges will not occur.

In terms of the UK science base, there is much more to be done to encourage collaboration among firms and across academic institutions. AIM research shows that the UK’s

share of internationally co-authored papers (an indication of scientific collaboration) with newcomer countries is relatively high, but well below US and Japanese levels. When it comes to collaboration with China and India, in particular, the trend from 1988 is downwards. In collaboration with China, for example, the UK has been overtaken by Germany and the group formed of South Korea, Taiwan and Singapore. Collaboration with India shows a similar pattern to that with China, but with a more pronounced drop of the UK’s share.

Another AIM study focuses on the commercial outputs from research-council funded projects. Projects that lead to spin-off companies, licensing, patenting or consulting activities are more likely to rise in higher-reputation universities; they are also more likely to be led by less experienced and more junior faculty. This study highlights the difficulty of trying to steer established research-oriented faculty toward commercial projects and underlines the importance of developing a broader range of outlooks and capabilities among researchers if the twin objectives of high-quality research and commercial outcomes are to be obtained. ❖

There is an important distinction between the run-of-the-mill innovations in products and processes that all firms engage in and the higher order forms of innovation (such as business model innovation, discontinuous innovation and management innovation) that very few have mastered. UK firms need to find ways of understanding and managing these different forms of innovation. Many organizations around the world are currently experimenting with new innovation practices. There is a great opportunity for UK firms to learn from and adopt new practices in this area to develop more sustainable sources of advantage.

Critical to improving the UK's innovation performance is a better understanding of different types of innovation. For many firms, innovation is seen as applying narrowly to new product development or technological progress, but this is an unduly constraining point of view that restricts a firm's ability to generate new sources of competitive advantage.

Try to think of the different forms of innovation as a stack of approaches. At the bottom are relatively incremental innovations in products or processes. So, for example, the formulation of a product is altered slightly to create the new and improved version or a process is streamlined to enhance efficiency; but the fundamental approach and technology remain unchanged. These are the lower-order forms of innovation, also called "steady state" innovation. They are important; but because everyone is doing them and can copy each other's advances fairly quickly, they are never a lasting source of advantage.

At the top of the stack are the higher-order forms of innovation that can have a dramatic impact on a firm's competitiveness if they are effective. One of AIM's key contributions is to examine the nature of these higher-order innovations and the managerial challenges they present. Specifically, the research looked at *discontinuous innovation* and *management innovation*.

## Managing discontinuous innovation

Occasionally, a disruptive event occurs that changes markets, industries – even societies. A good example is the advent of the Internet. Such world-changing events give rise to a wave of discontinuous innovation across many industries. This has a destabilizing, or disruptive, effect for established firms.

Successful well-managed companies thrive in mature markets by focusing on doing what they do just a little bit better (steady state



innovation). Consequently, when a disruptive event comes along, such as new technology or a regulatory change, the successful company is often blindsided. It is just not very good at the “doing it different” type of innovation. The very attributes that make it successful in stable conditions hinder its ability to detect or exploit the change.

AIM research confirms that the ability to manage innovation well during steady-state periods and the types of routines employed can actually hinder a company's ability to deal with innovation during discontinuous change. The consequences of failing to take advantage of such disruptive change are often severe. Eastman Kodak, for example, struggled to cope with a shift to digital photography. Digital Equipment Corporation lost its way when the minicomputer was superseded by the personal computer (the company was ultimately sold to Compaq). Sectors that currently face disruptive change include:

- Pharmaceutical firms, in which the dominant model of high investment in R&D (15–20 per cent of turnover) linked to the quest for blockbuster drugs is giving way to uncertainty about new technological direction (the bio-pharma challenge). This involves “low end” disruption from generic drugs, future market growth in low-income countries and new business models around total healthcare services rather than product delivery.
- Telecoms firms, in which a combination of technologies around VOIP (Voice Over Internet Protocol), convergence within Information and Communication Technology (ICT) and market fragmentation challenges service and delivery models.
- Medical devices, in which producers are facing shifts as in pharmaceuticals from product development to service delivery.
- Engineering companies, in which companies are facing challenges around new business models that involve offering “total” solutions based on a wide range of services

wrapped around a core product. Rolls Royce, for example, now derives over 50% of its revenue from the services surrounding its aeronautical engines.

- Digital media and entertainment companies, in which firms are straining in a sector that is fragmenting rapidly, due to the emergence of Web 2.0. The boundaries between consumers and creators are disappearing (contrast YouTube with a traditional TV firm; recent data suggests that YouTube has 100 million viewings per day, with 65,000 new videos being uploaded daily).

How can established firms cope with and thrive on disruptive change? AIM research examined this issue from several different perspectives. One AIM study focused on the need for firms to adopt “smarter innovation practices”. Steady-state innovation practices are fine for equilibrium conditions or non-complex environments, but they break down when used to try and deal with high unpredictability (“the edge of chaos”). In fact, the approaches needed to cope with these two different types of conditions are different in almost every respect, as the related chart illustrates.

Through a detailed study of organizations such as BT, the BBC, Lego, and P&G, the research suggests a number of broad findings:

Type 1 Innovation organization for steady state	Type 2 Innovation organization for discontinuous conditions
Operates within a mental framework based on a clear and accepted set of rules of the game	No clear rules; these emerge over time High tolerance for ambiguity
Strategies path dependent	Path independent, emergent, probe and learn
Clear selection environment	Fuzzy, emergent selection environment
Selection and resource allocation linked to clear trajectories and criteria for fit	Risk taking, multiple parallel bets, tolerance of (fast) failure
Operating routines refined and stable	Operating patterns emergent and “fuzzy”
Strong ties and knowledge flows along clear channels	Weak ties and peripheral vision important

Figure 1.

First, not all firms “get it” as far as discontinuous innovation is concerned. Many still work inside a comfort zone, defining the “box” which they pretend to want to get out of. But, actually, the decision and resource allocation structures limit the exploration space and leave the firm vulnerable to new entrants rewriting the business model or opening up completely new markets created by radical technological shifts.

Second, UK firms need to develop new mechanisms to let go of the past, reframe the present and explore multiple rather than single futures. This requires them to find new ways to encourage (or at least tolerate) challenges to the industry orthodoxy, including the views held by senior management. The danger, otherwise, is that any radical alternative vision of the future will be killed by the corporate immune system. There is an important role here for input from outsiders with a different frame of reference.

Third, firms need access to “gatekeepers”, science partners such as universities, consultants and trade associations, who provide expertise and act as neutral knowledge brokers across the network. By collaborating with those at the forefront of new technologies, firms can better identify disruptive change and, crucially, use that knowledge to create commercial applications. →

→ One way of coming to grips with this challenge is for firms to learn together, sharing experiences and reflecting on what has and hasn't worked and looking at new ideas and models. This is the basic idea behind the AIM Discontinuous Innovation Laboratory ([www.innovation-lab.org](http://www.innovation-lab.org)) that involves networks of around 50 firms in the UK, Germany and Denmark.

Another AIM study focused on the structures firms put in place to handle discontinuous changes; this research suggests the goal is to become "ambidextrous". There are two major ways to do this:

### Underwrite corporate venturing

Corporate venture units exist to nurture and develop start-up businesses for their parent company. Many were established in the late 1990s, during the boom years of the technology bubble. Not only did these operations face all the classic challenges of start-ups – inexperienced management, securing access to funding, attracting customers – they also had to weather a meltdown in the technology sector that left most corporate parents wondering why they had got involved in corporate venturing in the first place.

So how has corporate venturing fared in the post-dotcom world? Is it still a viable and exciting approach to new business development in large corporations? Some venture units have been shut down, but many have survived the downturn – and a few new ones have been started up. More interestingly, the survivors have adapted their strategies and organizational models significantly to cope with the more risk-averse business environment we are now living in. AIM research shows that the survivors have:

- Created enough autonomy to make their own investment decisions rather than allowing corporate management to second-guess their decisions
- Made good use of external partners, especially venture capitalists, who can provide access to new ideas and help them learn how to develop new businesses

- Ensured top-level support at all times; it takes longer to make a venture unit successful than the typical tenure of a CEO, so it pays to have more than one highly placed ally
- Looked for ways of adding value back to the mainstream businesses, for example, by building new ventures that they can benefit from or that they see as strategically important

**Build an innovation culture** The second approach involves firms trying to foster a culture that is supportive of innovation. Specifically, this means wrestling with two diametrically opposed organizational qualities – adaptability and alignment. *Adaptability* is about focusing on the future. It is the ability to respond to change, to be nimble, to progress. *Alignment* is about maximizing the present, leveraging existing ideas and exploiting markets.

Organizations that successfully balance the two qualities are called *ambidextrous*. The key to success is to empower individuals to make the choices in their day-to-day work that allow them to find the balance. Car manufacturer Renault and software firm Oracle both rate high for ambidexterity. Renault achieved it by building a performance context around existing social support. Oracle built a performance context first, then looked for ways of building support and trust across the organization. Despite their differences, Renault and Oracle both have a clear and simple set of priorities. Oracle employees emphasized the role of goal setting, individual performance appraisal and risk management as key priorities. With Renault employees, capital allocation, recruiting and vision were important. Selecting focal elements is critical, as they have to fit the needs of the organization. However, the consistency with which they are applied, and the number of employees impacted, is even more important.

### Leveraging management innovation

A second key form of higher-order innovation is management

innovation, defined as a marked departure from traditional management principles, processes and practices or a departure from customary organizational forms that significantly alters the way the work of management is performed.

Management innovation has the power to transform the way organizations operate. For example, consider how our ability to manage the consistency of manufacturing processes has evolved: from Ford's introduction of the moving assembly line in 1913 and Western Electric's invention of statistical quality control in 1924; through the quality revolution begun by Toyota and other Japanese companies in the period following WWII; and on to more recent innovations such as the ISO quality standard and Motorola's Six Sigma methodology. These advances are as much about *innovations in the philosophy and tools* by which manufacturing processes are managed as the processes themselves.

"If you look over a hundred years of industrial history, typically it is management innovation that has allowed organizations to reach new performance thresholds – more than any other kind of innovation," observes Gary Hamel, visiting professor at London Business School, and co-founder of MLab (which received seed funding from AIM). "The challenge is to instill management innovation into organizations."

The trouble is that, while many firms have developed established processes for managing the lower-order forms of innovation, few (if any) have dedicated themselves to the pursuit of management innovation. Instead, when it occurs, management innovation is typically ad hoc and serendipitous rather than systematic and planned.

AIM researchers have undertaken three studies that begin to identify some of the key drivers of management innovation. The first study focused on ground-breaking innovations and the conditions that led to their emergence. Key factors included:



- *A questioning, problem-solving culture* Rather than adopt well-proven approaches, individuals in innovative companies sought to develop their own unique solutions.
- *Use of analogies from different environments* In order to get outside the box of traditional thinking, innovative companies imported ideas from entirely different places. The Danish hearing aid company, Oticon, for example, built its innovative “spaghetti organization” on the principles of the scouting movement.
- *A capacity for low-risk experimentation* Because management innovation is hard to prove in advance, it needs to be tested in low-cost experimental ways. P&G applies its standard testing process, used for new

detergents and foods, to its management innovations as well.

- *Selective use of external change agents to explore new ideas* Innovative firms make selective use of outsiders such as academics and consultants who fulfil three roles: providing a source of new ideas and analogies, acting as a sounding board for emerging innovations and helping to validate what is accomplished.

A second study focused on the conditions under which firms introduce management practices that are new to the firm (typically adapted from other settings). This study highlights the importance of a perceived crisis or “burning platform” around which people can be mobilized to seek out new practices

as well as the importance of insights from many different external sources to identify the appropriate solutions.

A third AIM study explored the relationship between management practices and competitiveness. Management practice data was collected from 732 medium-sized manufacturing firms in the US, France, Germany and the UK. These measures of managerial practice were linked with firm-level productivity, profitability, sales growth and survival rates. Management practices also display significant cross-country differences with US firms on average better managed than European firms. All three studies, if examined in detail, can help leaders focus on managerial innovation and ways to advance their organizations. ❖

The UK's science base could be better harnessed by developing innovation networks around the top research centres and universities. Importantly, such networks are not only about stimulating high tech start-ups but also about providing the space within which a variety of knowledge exchange activities can occur to support existing businesses. Clearly much effort has already gone into this but, as innovation opens up, the importance of networks will grow. Global innovation networks can also support knowledge transfer – but they depend critically on brokers and gatekeepers to enable the flow. UK firms already use their R&D investment in other countries, especially the US, as an important way to access new technology and import know-how into the UK. International links will be increasingly important to create networks that span the globe, including the rapidly developing economies of Brazil, Russia, India and China (BRIC).

To improve its innovation performance, the UK needs to get better at exploiting its knowledge base, especially its strong science base. AIM research confirms the importance of networks for exploiting know-how; they play a major role in the innovation process. Moreover, a certain type of high-value network is far more effective at sparking innovation. We call these Innovation Networks or I-Works, which have the following characteristics:

- **Highly diverse** Network partners are drawn from a wide variety of disciplines and backgrounds and encourage exchange across idea systems.
- **Third party “gatekeepers”** These include science partners such as universities, but also consultants and trade associations, which provide access to expertise and act as knowledge brokers across the network.
- **Financial leverage** Access to investors – via business angels, venture capital firms and corporate venturing – spreads the risk of innovation and provides market intelligence.
- **Proactively managed** Participants regard the network itself as a valuable asset and actively manage it to reap the innovation benefits.

For firms, access to I-Works offers a potent source of new ideas and competitive advantage. Fostering relationships with such networks should be seen by firms as a critical capability. Here's how to get started.

## Encourage clusters

AIM research also examined the role played by clusters – geographic concentrations of expertise and economic activity – in stimulating innovation.

At their most powerful, clusters – which consist of networks of specialized skills and knowledge – can dominate an entire global industry. The Hollywood film industry, Detroit automotive industry and the financial district in London's Square Mile are famous examples. But the economic role model in recent years has been the technology cluster of Silicon

Valley centred on Stanford University. It has been argued that creating clusters around leading UK research universities could improve the exploitation of the UK's science base.

## Create magnets for R&D

AIM research investigated the extent to which foreign business R&D activity in the UK was located close to high-quality university research departments. One study compared the concentration of R&D labs with the results of the 2001 Research Assessment Exercise (RAE). The findings show that R&D activity clusters around the more highly rated university research departments.

This is particularly strong in the pharmaceuticals and chemicals sectors. A postcode area with a chemistry department rated 5 or 5\* by the RAE has on average twice as many pharmaceutical R&D labs as an area with no chemistry department. The results are even stronger for foreign-owned labs, consistent with technology sourcing by foreign multinationals.

In some sectors, the results are not limited to highly rated research departments. Postcode areas with a materials science department rated 4 or below have on average more foreign-owned labs in machinery, aerospace and motor vehicles. These results confirm the role of world-class centres of research in attracting foreign R&D in some sectors. But they also point to the potential role of more applied research centres. The most pronounced effects were found in pharmaceuticals – where two-way flows of R&D investment and specialization were observed.

Successful networks or clusters include a wide variety of firms and research centres. AIM research on three UK biotech regions shows how research establishments, manufacturers and a variety of service providers each contribute in different ways to the innovative output of a cluster. It is important that the UK continues to encourage and develop both pure science and the commercial enterprises that bring these ideas to market.

Potentially, clusters are important pillars of UK competitiveness, yet they are still something of an enigma. Theoretically it should be possible to create conditions that encourage cluster development. Yet attempts to foster their formation have had mixed results. AIM research indicates that policy support should be tailored to the specific needs of individual clusters and be designed with the complexity and lifecycle stages of clusters in mind.

## Enable learning networks

Another area where networks can help is in diffusing existing knowledge – essentially reaching the long tail of less experienced firms with knowledge that, while not new to the world, is new to them and whose application can enhance productivity. One AIM study has been looking at how such mechanisms can accelerate the take-up of innovative practices, for example, in the use of new manufacturing techniques.

Work in South Africa, for example, indicates that collaboration in learning networks significantly enhanced the ability of automotive component manufacturers to absorb and deploy new manufacturing knowledge and catch up with the world frontier in terms of productivity indicators such as quality, cost and delivery performance.

Learning networks can be configured in a variety of ways. Another option is to organize across supply chains to provide the framework for sharing and transferring learning about innovative practices. A third option is to mobilize at sector level – as has been the case with the Industry Forum approach in the UK automotive sector.

## Build new networks

AIM research also examined the specific strategies firms can use to gain access to new networks of partners, customers and suppliers, especially when faced with disruptive threats of the type discussed earlier. This research makes a critical distinction between the strategies used to identify new partners and the strategies used to build relationships

with partners once they have been identified. It highlights a number of specific approaches that have been successful for such firms as BT, GlaxoSmithKline, the BBC, AstraZeneca, and Rio Tinto:

- Where the challenges in finding and forming relationships are relatively low, approach potential new partners directly, and structure the relationship to minimize whatever obstacles separate you
- Where the challenge is mostly around finding new partners, approach them through boundary spanners or scouts who specialize in such activities, and work hard at building the capability to absorb insights from these partners
- Where the challenge is mostly around forming new relationships with prospective partners, focus on the higher-order purpose that transcends ideological differences and try to identify crossover individuals who can link the different parties
- Where the challenge involves finding *and* forming new networks, be prepared to work with specialist and independent network builders to bridge the gap and look for ways of gradually breaking down barriers to enable the approaches identified above to work

Once new relationships have been formed, in order to turn them into high-performing networks, it is necessary to keep the network fresh and engaged, build trust and reciprocity across the network, understand your own position in the network and learn when to let go of old relationships.

Policy can also play an important role in encouraging the establishment and development of networks. AIM Research has explored innovations in design principles and build processes in the construction of luxury yachts. UK-based independent design houses have played a major role in these, but the majority of construction takes place elsewhere. The DTI and British Marine Federation have combined to establish the Superyacht UK initiative in order to promote UK producers internationally. ❖

Large parts of the UK economy are owned by foreign multinationals, and the trend towards foreign ownership is continuing. This has prompted concerns about the “hollowing out” of the UK economy and the ability of foreign-controlled businesses to be innovative and entrepreneurial. AIM research suggests this concern is not well founded: there is evidence that foreign-owned companies are at least as innovative as locally owned companies. Moreover, there are a number of clear strategies open to managers of foreign-owned businesses who want to chart their own destiny.

The challenge of increasing the innovative capacity of the UK is complicated by the fact that approximately 40 per cent of companies in the private sector have non-UK based parent companies. Major UK businesses such as Powergen, Thames Water and Nycomed Amersham are fully owned subsidiaries of foreign multinationals; and entire industry sectors, including car manufacturing and financial services, are dominated by foreign companies. Foreign ownership has obvious benefits: it provides UK companies with greater access to capital, cutting-edge technology and new managerial practices. However, foreign ownership comes at a price: a loss of autonomy and influence for senior executives and a concern that important decisions will not be made in the best interests of the UK economy.

AIM research has addressed these concerns in two very different ways. One study focused on the strategic issues facing subsidiary operations in the UK, with a view to understanding how much influence subsidiary managers have over their own destiny and the extent to which they are able to drive new ideas and innovation projects. The research confirmed that UK subsidiary managers typically have low degrees of autonomy (compared, for example, to subsidiary managers in Canada or Australia who are further away from their corporate headquarters). However, the research also indicated that low autonomy was not necessarily a bad thing. Rather, the key factors that made a difference in terms of upgrading the subsidiary's activities and influence were initiative-taking strategies aimed at acting on opportunities in the local market and profile-building strategies aimed at raising awareness back at the home office of what the subsidiary company was good at.

AIM researchers also looked at the benefits of innovation networks that cross national borders for foreign-owned companies. Research examined the effects of UK PLC investing in R&D in other countries. In particular, it considered the →

# Innovating in Britain: the way ahead

AIM's research on how to boost innovation in Britain was extensive; however, AIM's recommendations on how to start can be quickly summarized:

## Embrace open innovation

Globalization presents many new challenges. Policies that focus on increasing domestic activity, and particularly encouraging firms to relocate R&D away from international centres of excellence, may come at a cost of isolating these firms from international markets and knowledge systems. In addition, focusing policy on larger firms risks further strengthening the position of large dominant firms.

Changes in the economic environment now favour greater flexibility. It is important to focus on policies that facilitate entry-and-exit and experimentation – and allow successful entrants to grow and challenge the market position of incumbent firms. The sorts of institutional reforms that matter are complementary policies promoting flexibility, higher education, well-functioning financial markets, flexible labour markets that encourage the acquisition of general skills and greater cooperation between the science base and private sector.

At a national level, competition in R&D is not between countries; it is between research teams that operate within and across countries. It is vital, therefore, to ensure that conditions in the UK are conducive to research teams succeeding here and to UK firms succeeding in research that is carried out in other parts of the world. The UK government's anti-protectionist stance is clearly one that helps promote greater international collaboration.

**Make mastering higher-order innovation a priority** It is critical that UK firms prepare for discontinuous shifts. Specifically, UK managers need to find ways to:

- Broaden their vision to look out for possible discontinuity signals; this can be achieved by setting up networks and broadening the scope of research.
- Develop alternative strategic frames by using different business models to examine discontinuities. For example, Shell has built on its extensive scenario planning experience through a programme called Gamechanger, which seeks to identify forces that will change the rules of the game.
- Extend resource allocation, which is critical when a firm is experiencing discontinuities.

**Engage with international innovation networks, including clusters** AIM research suggests that policy makers should consider a range of measures to stimulate the formation of innovation networks. These include:

- Establishing centres for collaboration in priority areas
- Fostering the diversity of partners, for example, actively promoting local professional networking and pump-priming funding for foreign research collaboration
- Establishing more network intermediaries in universities and colleges
- Strengthening the role of business-angel networks on a local (sub-regional) level
- Encouraging syndicated investments to improve the quality and the quantity of investment in entrepreneurial firms

Policies in this area (to develop clusters, but also for innovation in general) need to have a long time frame (decades rather than years). Policy should be consistent and clear in its direction. There have been a lot of changes to policy recently, following various innovation reviews. An important principle in this (as in other) areas is that policy shouldn't change too frequently; too much change will lead to uncertainty and will mean that policy is less effective at encouraging firms to change their behaviour. (Investing in innovation is a long-term goal; if firms don't know what future policy will be, then they will be less likely to invest.)

Our research also indicates that firms should:

- Proactively manage their networks and networking activities
- Actively seek out and participate in I-Works
- Collaborate with third parties such as trade associations, consultants and science partners who can act as neutral network brokers
- Recognize that venture finance networks offer more than just funding

The first step, however, is for senior managers and policy makers in the UK to realize that networking is a critical capability for UK organizations and should be managed as such. Companies need to manage knowledge spillover, but they also need to recognize that, in the global economy, no company can afford to be an island. The failure to develop networking capability is a self-limiting strategy.

→ effects of technology transfer from the US into the UK, often referred to as technology sourcing or spillovers.

UK firms operating abroad access new ideas and technologies and can transmit these back to the UK. Previous research has emphasized the importance of technology sourcing as a method of gaining access to foreign know-how. Firms can tap into leading edge knowledge, for example, by setting up overseas R&D labs close to clusters of innovative activity and using this knowledge to improve productivity in their home operations. AIM research examined whether technology sourcing in the US had a beneficial impact on UK firms during the 1990s. The findings suggest that UK firms with R&D activity located in the US benefited more from US R&D spillovers than firms that were not located there.

Knowledge flows are clearly important to innovation, especially when they involve technology transfer from one country to another. Another AIM research project looked at how information and know-how flows around organizations. The study compared knowledge sharing in multinational companies and multi-plant firms. The findings suggest that multinationals are more likely to share information with other parts of the business than comparable multi-plant firms. These information flows are strongly correlated with reported innovation activity. This result supports the idea that knowledge transfer is an important factor in explaining the competitive advantage of multinationals.

Firms that export or, better still, are actually part of a multinational enterprise tend to have higher productivity than their purely domestic counterparts. Gaining a better understanding of this correlation is a very active area for current research. AIM research suggests that one of the main drivers of differences in productivity is differences in knowledge. The AIM research looked at several thousand UK firms covering all industries from 1994 through 2000. For each firm,

the study examined multiple detailed measures of knowledge outputs, knowledge investments and sources of existing knowledge. The findings indicate that globally engaged firms innovate more. But this is not simply because they use more researchers; it is also because they learn more from more suppliers and customers, universities and other network contacts. The relative importance of knowledge sources also appears to vary with the type of innovation.

There is also evidence that this sort of knowledge brought by multinational firms then spills over to local firms. This suggests that providing incentives to encourage multinationals to come to a host country (for example, by offering subsidies as many countries do) can be an effective strategy. But the research also suggests that the subsidies currently paid are, in some cases, too high.

### No time to run away

Since the 1980s, the UK economy has undergone a dramatic transformation. Huge swathes of industry have been stripped from the public sector and privatized. Trade union power has diminished, and previously protected industries have been deregulated. As a result, the UK is among the most market-oriented and business-friendly economies in the world.

These changes have successfully encouraged growth in the UK. Yet, despite the improvements, the UK economy continues to underperform relative to other developed nations on many key measures. National productivity and prosperity have improved in absolute terms but still obstinately lag those of direct rivals, especially the US.

The market reforms of the 1980s stimulated growth but were insufficient to close the productivity gap with other developed nations. Moreover, the world has now moved on. The rise of India and China and other lower-cost economies means that competing on cost is no longer a viable strategy for firms in the UK. Indeed, with the increasing

commitment by those countries to R&D investment and to education and training, the basis of international competition has shifted firmly to knowledge. Clearly, as globalization expands the competitive nature of the marketplace, learning how to innovate in new ways is central to national progress.

The UK's Chancellor of the Exchequer, Alistair Darling, put it this way in a 2007 speech: "The answer is not running away from globalization. It's investing in innovation, design and training to help our skilled workforces provide an unanswerable argument for continued investment in the UK." ❖

### Resources

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