Countess Markievicz Lecture 2007

BUILDING INNOVATION CAPABILITY: THE HUMAN ELEMENT

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It is an absolute delight to return to Ireland to present the Countess Markievicz annual lecture, after 16 months in my new role at the Macquarie Graduate School of Management in Sydney. I would like to thank Dr Noel Harvey of GMIT for inviting me, and both Medtronic and NUI Galway for making it possible. Previously, as many of you will know, I made a nuisance of myself for more years than anyone would care to remember as Head of the Department of Management and Dean of Commerce here at the National University of Ireland, Galway, where my colleagues and I established a new centre of excellence in innovation research, with funding from the Irish Government's Programme for Research in Third-Level Institutions (PRTLI), as well as the J E Cairnes Graduate School of Business & Public Policy, which resulted in a magnificent new building with generous private donor support from Atlantic Philanthropies and others. These were truly wonderful years not only for me, my wife Deirdre, returning to her Celtic ancestral roots after several generations, and for our family in the rural idyll of Oughterard – hopefully to remain so in the face of development proposals – but also for our University and the higher education sector in Ireland as a whole.

Why were these years so critical for Ireland? Because this was the moment of realisation that the riches promised by decades of investment in human capital were no mirage but a joyous reality, even if the riches were somewhat skewed towards those with the good fortune to hold a disproportionately large chunk of privatised state assets or with the opportunity to have family land rezoned within the expanding concentric circles of wealth generation. In Australia, we take our reliance on natural resources for granted, though it makes us vulnerable to sudden and unpredictable fluctuations in the global commodity cycle. Right now, China's dramatic entry into the world economy and its insatiable demand for raw materials have reversed the relentless deterioration in Australia's terms of trade – traditionally the textbook fate of a primary commodities exporter – providing windfall gains both to shareholders and taxpayers as well as a powerful new source of complacency for a mediocre, short-sighted government. Is this government sleepwalking its way towards an even worse fate, if not for itself then for everyone else in our supposedly lucky country? We shall return to this later.

Here in Ireland, by contrast, with no exportable natural resources to speak of – unless we count peat, still reassuringly firing a power station, waste materials from an increasingly consumerist society or, more recently, mineral sands products for electronics applications – competitive advantage in global markets is based primarily and indeed as a deliberate long-term strategy on knowledge and ingenuity. And you have a prime minister, the Taoiseach, who is not only prepared to go on the record to this effect, but does so on regular occasions – as by the way will his successor whomever he or she may be, whenever that moment may arrive. As the present Taoiseach put it a couple of years ago: 'Ireland's competitive advantage is no longer based on low labour costs but on the skills and ingenuity of people'. You may think this is just politicians' rhetoric, and not particularly significant, but how we wish we had a prime minister in Australia who believed in such a lofty description and destiny for his nation.

What does this destiny mean for Ireland? How can progress be made towards it, and is this progress sustainable in the context of huge external pressures, not just from other small countries and regions wishing to emulate Ireland's success but also from much larger, better resourced competitors such as China and India. This goes to the heart of my topic tonight, which is about the factors providing a small, marginal economy with the competitive edge and agility required to build a strong economy and fair society – together with environmentally sustainable outcomes – in fast-changing global markets. You may be familiar with Tom Friedman's book, *The World is Flat*, which catalogues the 'boundaryless' nature of wealth creation today and the interconnectedness of producers and consumers through developments in information and communications technology. However, in response to this argument, Richard Florida claimed in *Prospect* magazine that 'The world is spiky', because, as research and experience have shown since Alfred Marshall's early 20th century examination of the 'potteries' in the Midlands and north of England, geographically concentrated clusters with distinctive attributes may enable some regions and localities to achieve superior productive performance. No prizes for guessing the major attributes of 'spikiness' internationally – they are, of course, the types of innovation and learning being fostered right here in Ireland. As the Harvard economist Michael Porter put it, 'The enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match'.

The clearest evidence is in the flow patterns of people and skills. Whereas in the late 1980s, there was a net outflow from Ireland of around 50,000 people a year, many of them newly minted computer science and engineering graduates, now about the same number, net of departures, are migrating here every year – more if you count those in the country unofficially. As the newly arrived Irish ambassador to Australia put it at a St Patrick's Day function in Sydney recently, 'the population of Clonmel is arriving every month'. But just as significant as the people arriving are the people staying, in particular Ireland's burgeoning population of third level graduates who can find good jobs at home, with rewarding career choices, and who make a valuable contribution to the nation's growing prosperity.

I recall, not long after my arrival in Galway in 2000, a moving occasion where one of the more senior government ministers, at least in age, gave a short speech commemorating the first cohort of the Faculty's Masters of E-Commerce graduates. He shed a genuine, non-concocted tear as he reminded us that this was the first generation who could count on being snapped up by local employers, with a guaranteed future in their own country. I had never seen anything like this before, certainly not in Australia which was the beneficiary of so much Irish immigration – and where tears are shed only at major sporting fixtures – and it had a deep effect on the way I saw Ireland's place in the world.

Australia too has been conducting a debate about its highly educated and entrepreneurial but footloose diaspora, since a comprehensive study by geographer Graeme Hugo found that there were one million Australians working and living abroad – around one in 20 of the population. However, further research indicated that far from being lost to the country, a large proportion of these expatriates eventually chose to return home, on average within a period of six years, bringing with them new skills and valuable experience, including a greater understanding of other cultures and ways of doing business. In reality, this was not a 'lost generation' as the media portrayed them, but a highly mobile generation in a life transition, or at least a constant state of 'churn', replenishing the stock at home while simultaneously being augmented by successive waves of students, professionals and those who may best be described as 'adventurers'. We can expect to see this happening on an even bigger scale, as a proportion of the population, in Ireland. While the first phase of new entrants to the country is by no means at an end, it is about to be superseded. This phase comprised Irish expatriates from the less than halcyon days of the 1980s, who were forced to leave by the economic circumstances of the time and only now have the opportunity to return to senior positions in universities, public agencies and international firms, as well as professionals and skilled workers from a wide range of other countries, especially the new member states of the European Union, who also want to contribute to the Irish economic transformation and build a new life here for themselves and their families. With only a slight stretch of the imagination, you might say that London-born Constance Markievicz herself was an early prototype for this group, as were James Connolly, born in Scotland, and Eamon de Valera, late of New York City.

However, the next phase of entrants will be very different. Many will be the current and subsequent generations of Irish graduates who for a variety of reasons will decide to work and study abroad for some years, including backpacking in Australia, before returning as more mature and rounded individuals with an even greater capacity to add value to their firms and organisations and the wider community. You can anticipate the public consternation once the scale of the outflow becomes apparent from the demographic data, not to mention the private grief of families whose painful memories of emigration are hardwired into their DNA as a history of the finest, cleverest and most ambitious offspring seeking a better life elsewhere. Let me suggest to you that while this is an understandable reaction, it is the wrong one. Not only is it wrong but it will be decidedly counter-productive in addressing a new set of challenges for emerging

knowledge-based societies. These young people are your investment in the future, indeed in a richer, more sustainable and prosperous future for Ireland. Unlike Joyce, Beckett, Shaw and the Massachusetts Kennedy clan, whose life and work were conducted abroad, the new generation will be gone one day but back the next, as a sophisticated, Blackberry-wielding, Armani-suited and Prada-wearing globalised community which, according to A T Kearney's *Globalisation Index*, belongs to one of the most globalised economies in the world.

Indeed, the story of Ireland's transformation is one of increasing integration with European and global markets, along with economic as well as political emancipation from its colonial dependency on Britain. I should acknowledge at this point that using the 'c-word' still seems to make some in these islands feel uncomfortable, but my confidence in doing so has been reinforced by the recent publication of Terry McDonough's scholarly volume *Was Ireland a Colony?* It should not spoil your enjoyment of the book if I were to divulge that the answer is in the affirmative. In any case, Ireland's trade with the rest of the world has not only grown dramatically in recent years in absolute terms and as a proportion of output – with exports almost a third of GDP – but it has also diversified geographically and in its sectoral composition. Ireland is now a major European platform for the production and export of computer hardware and software, pharmaceuticals and medical devices, it has for its size a significant presence in financial services and it has the highest proportion of high-tech and medium to high-tech exports in its total manufactured exports of any country in the world. This is not to say that the ideas and technologies embodied in these exports originate in Ireland, because most of them don't. For better or worse, they have their source in the home base of the FDI companies that have come to drive and dominate Ireland's export performance. Does this mean we should start bracing ourselves for volume two of McDonough's study, with the title question rephrased in the present tense? Or has the question itself been superseded by changes in the nature of international competition and division of labour?

Certainly, policy-makers have demonstrated their concern over the years about Ireland's lagging performance in basic science, technology and innovation, and taken steps to address it. Almost every indicator has justified this concern, from A T Kearney's measures of technology innovation in the *Globalisation Index* to the OECD technology balance of payments data, which suggest that Ireland is an outstandingly effective and prodigious 'technology taker' rather than a 'technology maker'. Indeed, the high-level Enterprise Strategy Group recommended in their 2004 report *Ahead of the Curve* that, 'Whereas in the past, products manufactured in Ireland were designed elsewhere, in the future, more of the ideas, the designs and the technology must originate here. Companies in Ireland will have to innovate and gain leadership positions in their target markets'. Much earlier, in the *National Development Plan 2000-2006*, it was argued that, 'There is a strong link between investment in the research and innovation base of the economy and sustained economic growth… The accumulation of "knowledge capital" will facilitate the evolution of the knowledge-based economy'. During this period, the Irish

Government committed very substantial public resources to the task of building research and innovation capability, particularly through PRTLI, now in its fourth funding cycle, Science Foundation Ireland (SFI) and Enterprise Ireland.

I was privileged to have some involvement in these endeavours, and took the same pride that you did in the development of world-class research centres and research projects, and in the associated expansion of students undertaking postgraduate studies, including doctoral research. I saw our University achieve success in each of the competitively funded cycles of the PRTLI, including, as I mentioned earlier, our own Centre for Innovation & Structural Change (CISC). I was gratified that we also merited SFI support for two new Centres for Science, Engineering and Technology (CSETs) – first, the Digital Enterprise Research Institute (DERI), which has partnered with Hewlett-Packard and other leading companies to become a dynamic research 'hub' for the growing software cluster in the west of Ireland and, second, the Regenerative Medicine Institute (REMEDI), which in collaboration with Medtronic is part of what has become the largest concentration of medical technology employment in Europe. According to the *Financial Times*, the FDI companies in the emergent 'Atlantic Technology Corridor', with their local supply chains and linkages to universities and institutes of technology have made this region 'one of Europe's leading industrial clusters' (February 10 2005). Ironically, SFI's model was the US National Science Foundation, which in the 1950s and 60s pioneered this approach by identifying the world's best researchers in areas of strategic priority and relocating them along with their teams to the top US universities and research laboratories. Now the Irish are doing it for themselves. This is why a German research team was recruited to establish DERI, focusing on the 'semantic web', and REMEDI is led by Irish expatriates lured back from the Mayo Clinic to conduct stem cell research and build leading edge research capacity here in the west of Ireland. It is a tribute not only to the research institutes themselves but to NUI Galway's senior managers, that this latter objective is well on the way to being realized – as readers of the journal *Nature* will have noted from a laudatory article on Irish research a few months ago.

While SFI programs have attracted most of the attention, and are undoubtedly glamorous, the quietly industrious and influential mission of Enterprise Ireland should not be overlooked. From the 'National Linkage Programme' of the 1990s to support for business start-ups and 'Industry-Led Networks', the policy imagination of Enterprise Ireland has been central to the success of Irish companies, including the unique achievement, eluding most other countries, of 'embedding' FDI firms in the local economy through linkages to supply chains, graduate labour markets and the evolving infrastructure of research and innovation. It was with Ireland in mind that an OECD study drew the lesson that, 'The full benefit of the presence of foreign production firms depends on the extent to which they can be integrated into their environment'. In retrospect, I can attest that I found my role on the National Research Funding Support Board of Enterprise Ireland one of the most satisfying experiences of my time in Ireland. Some might say, and have said, 'How sad is that – I would rather watch grass grow', but in fact there are much worse things

than watching grass grow, which is not an entirely frivolous analogy with the strategy of Enterprise Ireland, with its formidable array of fertiliser, weed-killer where required and artificial sunlight. Indeed, this agency has done more than most to encourage not just the research effort itself but also the transfer of knowledge to the market through its sharply focused Commercialisation Scheme and 'Innovation Partnerships', linking industry to research institutions.

We might conclude at this point that Irish public policy is on the right lines with 'much done but more to do', as the slogan goes, to meet and even possibly exceed the Lisbon strategy target of R&D expenditure of 3 per cent of GDP. It will be recalled that the objective of the Lisbon strategy was to make Europe 'the most competitive and dynamic knowledge-based economy in the world by 2010', and while the mid-term review by Mr Wim Kok and his High-Level Group was sceptical, most observers would agree that progress towards the various Lisbon targets, including R&D, is now being made. The problem for the strategy, however, as it was originally conceived, is that recent developments in innovation research and practice have moved the goal-posts, and the narrow identification of R&D with innovation is increasingly acknowledged to have been superseded by a much broader, more holistic understanding of the process in firms and organisations. The research by Clayton Christensen, Henry Chesbrough, Erik von Hippel and others has generated the following five key findings:

- innovation is not simply scientific invention and may be as much about new processes, applications and business methods as about new products;
- innovation may be pursued as a linear evolution from research and technology development to a commercial outcome but in practice it is usually non-linear;
- innovation is less likely to be of a breakthrough or 'disruptive' character than in the form of incremental improvements to existing products and processes;
- innovation is not confined to high tech manufacturing but is often identified with product and process improvements in low and medium tech industries; and
- innovation is no longer pursued internally to the organisation but is increasingly an open and collaborative set of activities with suppliers and customers.

The main impact of these findings is that while science and technology remains an important component of innovation, and has been shown to contribute to productivity growth, it does not exhaust the scope of innovative activity in individual organisations and their external networks. Surprising as it will seem, this is an area where discussion and debate in Australia as well as in some other countries may have useful implications for current policy challenges in Ireland. Far be it for me to suggest that simple or straightforward answers may be found, but searching questions are being asked, most recently in a report published by the Business Council of Australia (BCA) and somewhat presumptuously titled *New Pathways to Prosperity: A National Innovation Framework for Australia*. However, the title reflects the deep frustration in the business and public

policy community about the failure of the present Australian government to look beyond the welcome but temporary impact of the mining boom to future, more sustainable sources of competitive advantage, and to address the underlying deterioration of Australia's productivity performance since the reform-driven growth of the 1990s. As I had only just returned to Australia to share this sense of frustration, and had not yet succumbed to the pervasive local cocktail of economic complacency and foreign policy paranoia, I was asked to prepare this report with a group of business leaders and academics.

The central argument of the BCA report is that economies need not position themselves, or allow themselves to be positioned, as either technology makers or technology takers, which is viewed in the report consistently with the research findings as a restrictive and unhelpful dichotomy, but they may in fact turn out to be very proficient 'technology integrators'. In other words, while paradigm-shifting research and technology development will continue to be an important element of innovation, so too is technology integration which adds value to existing products and services and creates new ones by linking technology adoption and 'absorption' to organisational and business transformation. The traditional view may be found in the Australian government's 2002 report on *Mapping Australian Science and Innovation* which restated 'the importance of strengthening our ability to generate ideas and undertake research, accelerating the commercial application of these ideas, and developing and retaining skills'. However, a recent Australian Bureau of Statistics (ABS) survey, *Patterns of Innovation in Australian Businesses*, found that non-R&D spending accounted for over two-thirds of total business expenditure on innovation. While most innovating firms reported changes which were 'new to the business' rather than 'new to the world', this new research indicates that organisational innovation can improve performance through structural flexibility in product and service development, new approaches to quality and supply chain management and implementation of high performance work practices. The innovation management challenge, identified in the literature, is how to do two things at once, how to be 'ambidextrous', by exploring and exploiting, being fluid and organic and structured and systematic.

Indeed, it is this increasing emphasis on technology integration, especially in mining, financial services, software and medical devices, that saw Australia improve its position in the *Globalisation Index* and various measures of global competitiveness, though the more recent lack of policy leadership, institutional support and best practice diffusion has placed this achievement in jeopardy. Internationally, IBM's 2006 global CEO survey *Expanding the Innovation Horizon* found that while CEOs continue to promote technological innovation, they now focus at least 30 per cent of their efforts on organisational innovation. According to the survey, 'companies that have grown their operating margins faster than their competitors were putting *twice* as much emphasis on business model innovation as underperformers', with CEOs identifying not only 'organisation structure changes' but also 'major strategic partnerships' as key features of this approach. Significantly, innovating firms, far from operating in isolation, benefit from structured collaboration, technology

spillovers, networking and knowledge diffusion, where the boundaries of the extended enterprise become less easy to draw, as well as 'open systems' approaches to customer engagement. In Australia, a recent analysis by the Federal Department of Industry on *Collaboration and Other Factors Influencing Innovation Novelty in Australian Businesses* found that firms which collaborated for innovation had a much greater chance of achieving a 'new to the world' degree of novelty, especially in technology intensive sectors. More widely, a Verizon/Microsoft research program on *The Impact of Collaboration on Business Performance* affirmed that 'collaboration works in conjunction with strategic orientation and opportunities inherent in the market environment… to improve business performance', and that collaboration was more than twice as significant for performance than these other factors.

The growing importance of the external environment of firms and organisations, as well as their internal capability requirements, have led to successful or emerging knowledge-based economies being typified as 'national innovation systems', first defined by economist Richard Nelson as a 'set of institutions whose interactions determine the innovative performance of… national firms'. These institutions, including public agencies and research and educational infrastructure, not only build the internal innovative capability of organisations, but facilitate linkage to the external networks and relationships that allow such capability to be used to its full productive potential. Indeed, international comparative studies by Michael Porter and others suggest that national innovation capacity is as important as internal technological capability in driving competitiveness. Australian innovation researchers Keith Smith and Jonathan West have argued that, 'The capacity to innovate is capability based, cumulative, collaborative in character, and highly uncertain. So any successful innovating economy needs mechanisms and institutions to provide sustained investment in capabilities to manage collaboration and cope with risk and uncertainty and their implications for business development. The "national innovation system" is the totality of these mechanisms and institutions: it is the overall context within which innovation occurs'. This is widely recognised in Ireland, and even in Australia the government's major statement on *Backing Australia's Ability* referred to 'the complex nature of innovation and the importance of the people, linkages and interactions between the different system elements'.

However, what Irish policy-makers grasp much better than their counterparts in Australia is that the development of world-class innovation capacity requires as its precondition a major national commitment to invest in human capital and infrastructure, including schools and universities, vocational education and training and provision for life-long learning. They know from research and observation on an international scale – including survey work at the Dublin-based European Foundation the Improvement of Living and Working Conditions as well as the Irish government's own National Centre for Partnership and Performance (NCPP) – that such an investment will ensure a skilled and adaptable workforce, ready to meet the challenge of organisational learning and innovation. As the Enterprise Strategy Group put it, 'Knowledge creation and diffusion are at the core of economic activity. Knowledge is embodied

in people, and it is the quality of the human resources that will determine the success or otherwise of firms and economies in the years ahead'. This is also well understood by Finland's innovation agency Tekes, which in its recent report on *Five Steps for Finland's Future* notes that 'renewal is always based on people, their knowledge, learning ability and motivation. Technology… has an integral role in the renewal process though it is seldom the key driver'. Tekes argues further that , 'Another crucial aspect is management in all organisations, because it is the facilitating factor that allows individual creativity, innovation and entrepreneurial inspiration to develop into a national economic and social resource'.

Similarly, the IBM global CEO survey focuses on the management of innovation, identifying employees as the main source of innovative ideas in organisations, followed closely by business partners and customers. This was also the central thrust of the report of the NCPP's 'Forum on Workplace of the Future', which was titled *Working to Our Advantage* and launched by the Taoiseach two years ago. In my role at the time as chair of the Private Sector Panel, I was uniquely placed to observe the profound commitment here in Ireland not only of policy-makers but also business leaders themselves to the development of human capital in their organisations and the community as a whole. The rationale for this commitment is given substance by the findings of academic research which, according to Benn Lawson and Danny Samson in a recent paper, views innovation management as 'a form of organisational capability'. Building on the resource-based theory of the firm, this research defines innovation capability as 'the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders'. It sees 'substantial investment in innovation capability as the primary engine for wealth creation, rather than the possession of physical assets', and uses dynamic capabilities analysis to identify seven key elements of innovation capability as follows: vision and strategy, harnessing the competence base, organisational intelligence, creativity and ideas management, organisational structures and systems, culture and climate and management of technology.

Ultimately, the success of national and regional innovation systems must depend on the development of innovation capability and performance at the organisational level. As workplaces become more flexible and responsive in a changing competitive environment, economic reform will need to evolve to a new stage in Ireland and Australia, with an emphasis on *building leadership and management capability*, as well as the educational infrastructure and programs needed to support the development of such capability in organisations. While CEOs in the IBM global survey claimed to 'view business and technology integration as integral to innovation', many were found to lack the capacity and skills to undertake it successfully. These skills are increasingly depicted in the academic and professional literature as 'knowledge management', which entails the development, tracking, measuring and sharing of intangible assets, particularly the knowledge and expertise employees may apply to products and services, and to the operations of the organisation itself. In line with much of the research, the IBM survey reported 'creativity cultures as highly collaborative, collegial and team-oriented – as opposed

to being focused on individuals or predominantly confined to specific sub-groups… Companies in which the CEO orchestrates a more team-oriented culture were decidedly more profitable than organizations with segregated pockets of innovators'. This conclusion is reinforced by current Fraunhofer Institute research in Germany, which indicates that in a number of areas, including medical devices, the presence of cross-functional teams is the most important influence on innovation. Yet here again the IBM survey questioned the ability of CEOs and managers to generate 'committed and effective teams' and to ensure 'structured opportunities' that would allow them to contribute to innovation performance.

More specifically, a recent OECD study on *The Significance of Knowledge Management in the Business Sector* elaborated the most salient knowledge management practices as creating a knowledge sharing culture, incentives policy to retain employees, alliances for acquiring knowledge and formal knowledge management policy. The study found that these practices were becoming more widespread internationally, and that a clear association could be observed between such practices and innovation and productivity, though not one which is well researched or understood. According to the study, 'knowledge management practices seem to have a far from negligible effect on innovation and other aspects of corporate performance. But there is little systematic evidence of just how great an effect... Among the various categories of knowledge-related investments… knowledge management is one of the areas about which little is known in terms of quality, quantity, costs and economic returns.' Nevertheless, in an important guide to future trends, evidence emerged in last year's Economist Intelligence Unit world-wide survey of executives and managers to indicate that most identified knowledge and innovation management, in preference to areas such as marketing and product development, as the source of the greatest anticipated productivity gains over the next 15 years.

Will managers take advantage of the opportunities opened up by the development of innovation capability in their firms and organisations? Disappointingly, in Australia, a survey of manufacturers conducted last year by Mark Dodgson and Peter Innes for the Australian Business Foundation found that 'while there is evidence of manufacturers engaging in some innovative business practices, especially towards achieving production efficiencies, they generally fail to appreciate and employ innovation as a decisive competitive strategy'. Again, by contrast, the policy and business environment in Ireland is more conducive to such a strategy, but this does not mean that we can point to widespread adoption, implementation or diffusion of the approach among firms and organisations. Indeed, the evidence here as well would suggest otherwise. This is a challenge which must be addressed at every stage of the process of life-long learning – from early childhood to the higher education system. Nor is it an issue of what people learn, but rather *how they learn*. My family and I have had an opportunity to compare high school education in Australia with the equivalent in Ireland through the progress of our boys in the two systems. Apart from the obvious infrastructure deficit, at last being tackled with public funding, Irish school education is still far too heavily reliant on rote learning rather than critical thinking,

which is surely the key to unlocking creative potential in the classroom and workplace.

A few days ago, I was at the Institute for Advanced Studies in Princeton, where Einstein proclaimed in the 1940s that 'imagination is more important than knowledge'. This became the much publicised ethos of the Institute, where my father was attracted at the time to a postdoctoral fellowship in theoretical physics, before taking up a post at the Institute for Advanced Studies in Merrion Square, which in turn was modelled on Princeton by none other than Eamon de Valera, himself an accomplished mathematician. (By the way, I can now reveal that this, and fact that my mother was able to join my father there from Holland, explains how I came to be born around the corner at the National Maternity Hospital in Holles Street.) In any case, as it is now widely acknowledged, a key factor in the success of these institutes was that research and education were characterised by a high degree of personal autonomy for the researchers in the context of open dialogue and collaboration, where hypotheses could be tested and validated, and additionally, by the opportunity to pose questions and make choices about research directions, coupled with a commitment to being accountable for such choices and their implications. What better way could there be, one might ask, to encourage critical thinking and to unlock the creative potential to which I was referring?

The same applies to business education, which is the point on which I will finish. You may recall I began this presentation by emphasising the role of knowledge and ingenuity in establishing competitive advantage for both national and regional economies, and I have returned to this theme via a broader understanding of innovation, going beyond a narrow identification with science and technology to encompass organisational innovation, the growth of innovation systems and networks and the integration of technology with new business models. This brings us back to the critical importance of business education in the development of value-adding innovative capability in firms and organisations. We took some initial steps at NUI Galway to develop a more wide-ranging and stimulating approach to the curriculum, and indeed we expanded programme choice significantly. However, there is still a long way to go in the direction of the new pedagogical approaches of business schools internationally, such as Stanford with its emphasis on customisation and flexibility and Yale's ambitious new MBA featuring an 'integrative', interdisciplinary approach, but this will of course depend not only on the expertise and motivation of business schools but also to a large degree on the resources available for higher education in the years ahead.

Finally, it is not only because business education and research is my personal interest – and some would say obsession – that I end my talk on this note. The truth is that business schools everywhere have assumed for themselves a major if not predominant role in preparing the next generation of leaders in our societies, through their management of organisations in both the public and private sectors, and that leadership in the future will no longer be about 'command and control', but releasing people's talent and creativity, more often than not in cross-functional, problem-solving teams, collaborative networks and 'communities of

knowledge'. This is the very essence of innovation as I have described it, and our policy actions in government, universities and business schools should be directed at building the capability on which such successful innovation ultimately depends. The importance of doing so was captured recently by Sweden's *Knowledge Foresight*, which concluded that, 'We cannot plan the future, but we can plan for the future', and much earlier by the legendary management theorist Peter Drucker, who said simply: 'The best way to predict the future is to create it'.