

**NATIONAL
STRATEGY FOR
HIGHER EDUCATION
- FORFÁS
SUBMISSION**

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Preface

Forfás welcomes this opportunity to provide a submission to the National Strategy for Higher Education Group. The submission is informed by a wide base of research and evidence on enterprise issues connected to the skills requirements of the Irish labour force and R&D capabilities in which Higher Education plays a central role.

In this context, the submission focuses primarily on the outcomes that Forfás believes will be most beneficial from Higher Education from an enterprise perspective and hopes the Strategy will reflect those as objectives. The submission does not attempt to address in detail the structural and systemic changes that are required for Higher Education to achieve these outcomes. Those involved more directly in the operation and administration of Higher Education are better placed to make these judgements and the *raison d'être* of higher education extends far beyond enterprise objectives. In this regard, we offer some general principles for how Higher Education can most effectively operate to serve the needs of a modern, dynamic economy. We hope the Steering Group will find this submission useful in providing some guidance as to what enterprises in Ireland require and expect from Higher Education in terms of skills and research. The submission is set out as follows:

- A summary of the main messages of this submission;
- The enterprise policy environment in Ireland and how it relates to the Higher Education sector;
- The skills and research requirements of enterprises in Ireland; and
- Forfás priorities for Higher Education.

Summary

The success of the enterprise sector and the higher education sector are mutually supporting. In order to maintain continued investment in higher education (HE), Ireland needs a productive and competitive enterprise base which contributes to the economy through taxes and provision of employment. In order to be competitive, the enterprise base needs access to a supply of well educated graduates and needs to draw on the knowledge base and intellectual property that exists within our universities and colleges. Forfás believes the goals of Higher Education can be summarised as:

- A quality mass higher education system that meets the needs of the individual;
- A higher education system that contributes to societal and cultural development and makes Ireland an attractive place to live and work; and
- A higher education system that supports the development of enterprise and the economy through the delivery of relevant skilled individuals and relevant quality research.

Against this backdrop, Forfás believes that the new National Strategy for Higher Education should make the relationship between the enterprise sector and the Higher Education system a central theme of the Strategy, one from which there are significant mutual benefits to be gained. Forfás would like to see the following principles and priorities underpin the development of the National Strategy for Higher Education.

1. General Principles

- 1.1. A clear and unambiguous higher education policy which is developed in a collaborative way and which is supported by all stakeholders is required.
- 1.2. The pursuit of excellence should underpin the future development of the Higher Education system in every facet of its operation. This includes excellence in the quality of teaching, in basic and applied research, in commercialisation, and in interacting with society and the economy. Quality assurance should be prioritised.
- 1.3. Ireland should operate a system of 'mass' higher education which is required to meet the needs of a knowledge economy. This does not mean that a homogenous offering is provided to all individuals or that all institutions have the same mission, funding or governance system. In addition, Ireland needs to develop a cadre of 'world class' graduates that can meet the needs of enterprise and help to drive economic and social development. Institutions' missions should be differentiated and within this Ireland needs a small number of 'world class' institutions that can compete internationally for the best talent.
- 1.4. A small number of coherent key metrics need to be agreed between policymakers and the Higher Education Institutions which relate to the key strategic objectives of Higher Education Policy. Specific targets around key deliverables should cascade from these metrics. The funding model should follow from and support the key metrics.
- 1.5. The Higher Education Strategy needs to consider how a future sustainable

funding model can be achieved and to ensure that funding is aligned with economic and social needs. The first step is to ensure that any inefficiency and duplication which exists is driven out of the system. That is not to imply that there should not be competition between institutions, rather that institutions should consolidate and build on their competitive, international and regional strengths where appropriate and avoid attempting to provide a homogenous offering.

- 1.6. Where public funding is provided, institutions should be accountable for ensuring value for money and that funding is best used to support public policy objectives. In addition, public funding should be more broadly based, reflecting the three pillars of Higher Education (teaching, research and innovation), allowing institutions to play to their strengths and not limited strictly by the funding on the basis of student participation, although the role of teaching should be paramount. There is a need to diversify the funding streams of universities. Potential funding streams which should be considered in terms of their potential to contribute and their alignment with policy objectives include: Public funding, philanthropy, fees earnings from Irish students, fee earnings from overseas students, international competitive research funding. The objective should be to try to reduce dependence on exchequer funding, while at the same time maintaining an appropriate level of State investment in education.
- 1.7. The independence and autonomy of higher education institutions is highly important, yet so too is accountability. According to the Glion Colloquium, in the long run, institutional autonomy rests primarily on the amount of trust that exists between state government and institutions of higher education. Forfás believes that higher education institutions should be entrusted with greater operational autonomy while in tandem working towards the goals of higher education from a public interest perspective. The challenge now is to find a way of increasing central coordination at policy level that is underpinned by the goals of the Strategy, while simultaneously increasing individual institutions autonomy to manage their own operations in the context of those goals. These two objectives are not incompatible. Increasing institutions' managerial autonomy should help drive efficiency in the use of available resources.
- 1.8. There needs to be a greater connection between research and teaching. Those engaged in world class research should pass on their knowledge and expertise through teaching in order to enhance the development of human capital. That is not to imply that quality of teaching is only linked to quality of research but that in institutes where research is conducted there should be greater employment of that research expertise in the delivery of taught education programmes.
- 1.9. Forfás believes that the National Strategy for Higher Education should explicitly recognise the role that all disciplines have in developing Ireland's innovation culture and that this principle should permeate the Strategy.
- 1.10. The Higher Education Strategy should also be outward looking and consider how the Irish HE system will be recognised internationally and how it will collaborate internationally, with particular reference to initiatives under the

European Higher Education Area (EHEA) and the European Research Area (ERA).

2. Human Capital

Skills and Human Capital Requirements of Enterprise

Increasing the educational attainment levels of the labour market is crucial for Ireland to compete in international markets, for attracting foreign direct investment, for growing the number of better quality and better paid jobs and for developing the knowledge economy. Higher Education graduates are at the forefront of making this happen.

Despite the major recent rise in unemployment, skills shortages continue to persist in the economy. Some of these are sector/occupation specific while others are more generic and required across sectors. Skills shortages span the Arts, Humanities and Social Sciences as well as the Science, Engineering and Technology disciplines.

Particular shortages have been identified for certain occupations in the areas of medical devices, pharmaceuticals, food, ICT, financial services, health and sales and marketing. Employers have also identified deficits in skills required across sectors such as mathematics, language skills, innovation, and management.

Higher Education has a central role to play in responding to the changing skills needs of the economy, both in terms of addressing specific sectoral/occupation skills demands and general enterprise skills.

Forfás believes that Higher Education should have a core objective of addressing the skills needs of enterprise in a responsive and flexible way.

Skills Alignment - The Higher Education system should foster education and skills of relevance to employers

- 2.1. Higher Education's most significant contribution to enterprise development is through the provision of graduate labour from 'taught' undergraduate and postgraduate programmes; the importance of these programmes should be recognised in the HE Strategy.
- 2.2. The Higher Education Strategy needs to consider how Higher Education Institutions (HEIs) should interact with enterprise bodies and agencies in addressing skills demands in a systematic and co-ordinated way.
- 2.3. Industry needs to have greater involvement in the development and revision of course curricula to ensure that graduates have the skills required upon entering the labour market. Courses that provide structured graduate placements and internships have been highlighted by employers as extremely valuable in helping graduates transit to the labour market and should be expanded across disciplines. Enterprises have also identified a need to place greater emphasis within taught courses on stimulating creativity and innovation in students. Key practices that should be promoted in this regard include widespread use of cross-disciplinary work, more project work and increased use of problem-based learning and inquiry-based learning approaches.
- 2.4. The Higher Education system needs to be flexible in responding to changing

global and national demands for jobs of a cyclical nature. The Higher Education Strategy should also consider how the HE sector can best attract students from overseas to Irish HEIs and the appropriate balance of “EEA” and “non-EEA” student places. A country's market share for overseas students is a strong indicator of quality internationally.

Up-skilling/Re-skilling - The Higher Education system should support and encourage up-skilling and re-skilling for both those in employment and those unemployed, through flexible provision

- 2.5. Addressing the skills needs of those in the labour market through more flexible provision should be a core goal the Higher Education system, for example, modularisation, distance learning and programmes for continuing professional development.
- 2.6. The Higher Education Strategy should consider how provision can be adapted to enable people within the labour market meet their skills needs.

3. Research, Development and Innovation

Research, Development and Innovation requirements of Enterprise

The research base in Ireland has developed significantly over the past decade and Ireland has succeeded in developing excellence in many areas of oriented basic research. The Higher Education system has been central to making this happen.

The availability of research capacity is an important factor in attracting foreign direct investment. This investment activity is growing as a proportion of total FDI activity. Enterprises with high R&D intensity are able to interact directly with the areas of academic research that have been developed in recent years.

The fruits of this strategy have only started to emerge. Ireland has a long way to go in order to realise the high number of intensive research linkages between academia and industry that are characteristic of the knowledge-intensive economies and regions to which Ireland aspires.

Forfás believes that public investment in Research and Development within the Higher Education system should have the objective of producing highly skilled human capital and excellent research and scholarship that is relevant to enterprise and economic growth.

HEI-Enterprise Collaboration - The Higher Education system should build world class capacity in basic and applied research that is aligned with the strategic needs of the economy

- 3.1. Higher Education Institutions should continue to develop capacity in world class basic research.
- 3.2. Concentration of resources is required to ensure excellence and relevance of research and scholarship across the disciplines of Arts, Humanities and Social Sciences and Science, Engineering, Technology and Mathematics.
- 3.3. A priority setting exercise for research at national level spanning all disciplines should be undertaken at regular intervals to basic research is

aligned with future economic opportunities.

- 3.4. Higher Education in Ireland should seek to become an exemplar in applied research activity in collaboration with enterprise.
- 3.5. Greater balance between funding of basic research and applied research will be required.
- 3.6. Funding for applied research should be directed towards institutions that demonstrate greatest capabilities to undertake this type of research.
- 3.7. Metrics such as granted patents, spin outs and level of private funding to higher education research should be used to benchmark progress.

Researcher Training and Development - The Higher Education system should continue to develop world class researcher skills that are broadly aligned with enterprise needs

- 3.8. PhD programmes need to be more structured, provide greater recognition of transferable skills acquired and have greater interaction with industry.
- 3.9. PhD programmes should also provide the support to researchers to pursue opportunities to commercialise their research.
- 3.10. Enterprise research requirements should be considered across undergraduate and postgraduate provision, especially those courses key to the supply of research assistants and technicians.

Commercialisation - The Higher Education system should drive innovation and maximise commercialisation of publicly funded Intellectual Property

- 3.11. In a knowledge society commercialisation and knowledge transfer is a core element of the HE sector and institutions should be incentivised to put in place the appropriate policies and arrangements that facilitates long-term collaborative relationships with clusters of enterprise. These arrangements need to be consistent across the sector to ensure easier access, particularly by SMEs.
- 3.12. A culture that supports commercialisation and knowledge transfer needs to be embedded in the institutions and knowledge transfer activities that lead to economic and social opportunities should be recognised and rewarded.
- 3.13. Technology Transfer Offices need to continue to provide support for researchers, both senior and early-stage, to commercialise their research and to be more proactive in identifying opportunities for commercialisation and knowledge transfer.

Introduction

Forfás is Ireland's national policy advisory body for enterprise and science.

Forfás welcomes this opportunity to provide a submission to the National Strategy for Higher Education Group. Education enables individuals to achieve their full potential, to participate fully as members of society, and to contribute to Ireland's social and cultural development. Ireland has long embraced a broad view of education, having as its primary purpose enabling people to meet their full potential, which has served us well.

A clear link has been demonstrated internationally between formal education levels and productivity and income growth within the economy. Education has a significant impact on individuals' ability to access the labour market, achieve well-paid jobs and ultimately on their (and their families) standard of living. Education has also been recognised as having a central influence on the interest, motivation and capacity of individuals to be entrepreneurs. People with higher level educational attainment tend to have higher participation rates in the labour market, tend to have higher earnings and tend to have lower rates of unemployment.

Forfás strongly supports the development of a new National Higher Education Strategy which is framed within the context of sustainable economic renewalⁱ. The mission of Forfás is:

"to contribute to the future success of Ireland's economy as an agency of the Department of Enterprise, Trade & Employment, by providing ambitious, coherent & widely understood enterprise & science policy advice that supports growth".

In this context, the Forfás submission relates primarily to its mandate, that is, the skills and research requirements of enterprise and the economy from the Higher Education system. Forfás recognises that the higher education system has much broader social and cultural dynamics apart from its relevance to enterprise. Forfás believes the goals of Higher Education can be summarised as:

- A quality mass higher education system that meets the needs of the individual;
- A higher education system that contributes to societal and cultural development and makes Ireland an attractive place to live and work; and
- A higher education system that supports the development of enterprise and the economy through the delivery of relevant skilled individuals and relevant quality research.

Forfás believes that these dynamics are not mutually exclusive from an enterprise perspective and contribute enormously to making Ireland a great place to live and work, adding to Ireland's value proposition as an excellent location to do business.

Equally, Forfás believes that all disciplines covered by the Higher Education system have a role to play. The Arts, Humanities and Social Sciences are not in competition with Science and Technology disciplines. They have a symbiotic nature that, if harnessed properly, provide the enterprise sector in Ireland with a rich variety of skills and expertise that supply the lifeblood for businesses that can compete in international markets and develop quality, sustainable employment.

The success of the enterprise sector and the higher education sector are mutually supporting. In order to maintain continued investment in higher education, Ireland needs a productive and competitive enterprise base which contributes to the economy through taxes and provision of employment. In order to be competitive, the enterprise base needs access to a

supply of well educated graduates and needs to draw on the knowledge bases that exist within our universities and colleges.

Against this backdrop, Forfás believes that the new National Strategy for Higher Education should make the relationship between the enterprise sector and the Higher Education system a central theme of the Strategy, one from which there are significant mutual benefits to be gained.

1. Policy Context

The policy context within which enterprise operates has been developed through a number of Government initiatives which are of relevance to the Higher Education system. The reports have a shared emphasis on the quality of human capital and research base in Ireland as pillars of Ireland's future competitiveness.

Building Ireland's Smart Economy

The Government framework document for economic recovery Building Ireland's Smart Economy states that:

*"Future economic growth will depend on re-orientating the economy towards exporting goods and services... The key objective of Ireland's Smart Economic Growth framework is to make Ireland the innovation and commercialisation capital of Europe - a country that combines the features of an attractive home for innovative multinationals while also being an incubation environment for the best entrepreneurs from Europe and further afield."*ⁱⁱ

According to the framework, the development of the Smart Economy depends on the "skills, knowledge, creativity and ingenuity of people".

National Skills Strategy

The National Skills Strategy proposes a vision of Ireland in 2020 in which a well-educated and highly skilled population contributes optimally to a competitive, innovation-driven, knowledge-based, participative and inclusive economy. The Strategy highlights how future economic growth will be largely dependent on the productivity of the Irish workforce, which in turn requires greater levels of educational attainment.

"In the years ahead, labour productivity will be the key determinant of economic growth in Ireland, and increasing productivity will depend to a large extent on education and training. A workforce that is better educated and trained can produce higher value goods and services, and is more likely to be innovative."

The Strategy highlights how the skills requirements of enterprise are changing. Sectoral shifts in the economy point to increasing demand for those with high level skills and a relative decline in demand for those with low level skills. They show a continuing shift towards the services and high value added manufacturing sectors. They point to increasing employment in managerial, professional, associate professional, personal and service and sales related occupational groups and an increasing emphasis on generic skills including basic skills such as literacy, numeracy and using technology.

Strategy for Science, Technology and Innovation

The Strategy for Science Technology and Innovationⁱⁱⁱ (SSTI), launched in 2006, which constitutes one of the principal pillars of the NDP, strives towards the following vision:

"Ireland in 2013 will be internationally renowned for the excellence of its research and at the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture."

The strategy emphasises that success will be marked by increased participation in the sciences, increased numbers of people with advanced qualifications, enhanced contribution by research to economic and social development, transformational change in the quality and quantity of research, increased output of economically relevant knowledge, increased trans-national research activity, an international profile for Ireland and greater coherence and exploitation of synergies nationally and internationally. In summary, the strategy aims to deliver world class people and enterprises with the drive to succeed and the resources to do so.

The main objectives of the above Government enterprise policies can be summarised by the following points:

- Ireland's future economic development lies in re-orienting our economy towards our exporting sectors;
- The quality of Ireland's human capital is at the heart of making this happen;
- The skills needs of the economy have shifted and the future demand for high level skills will increase; and
- Ireland's strategy for science, technology and innovation has a primary objective of commercialising knowledge into jobs and growth.

In addition, there is a wide evidence base supporting these objectives available through research undertaken by Forfás, the Expert Group on Future Skills Needs, the National Competitiveness Council and the Advisory Science Council.^{iv}

The Higher Education system has a central role in the delivery of these policy aims through its graduate output and by its research capacity. There are specific quantitative targets within the National Skills Strategy and the Strategy for Science, Technology and Innovation which are relevant to the Higher Education sector:

National Skills Strategy 2007-2020

- By 2020, 48 percent of the Labour Force will have a third level qualification or above; and
- The progression rate to higher level education needs to increase to 72 percent.

Strategy for Science, Technology and Innovation 2006-2013

- GERD to increase from 1.48% of GNP in 2004 to 2.5% in 2013;
- Increase the number of PhDs - maintain quality;
- Add 40 Principal Investigators and teams per annum. (Total +350); and
- Measuring outputs - IP from system, spin-off firms etc.

These targets are aimed at making Ireland a leading country in terms of its quality of human capital and research, development and innovation activity. It is clear that these targets can only be reached if the enterprise sector and the HE sector work together in close partnership.

2. Skills and Research Requirements of the Economy and Enterprises

Both economic theory and empirical evidence emphasise the accumulation of R&D^v and human capital^{vi} for productivity growth. Investment in education and training improves the productivity of labour and capital - educated workers are more productive, can make better use of physical capital, and are better placed to contribute to innovation or R&D. Investment in innovation or R&D increases the stock of knowledge and the use of that knowledge for new applications.

This results in new goods, new processes and new knowledge and, therefore, is a major driver of technical change, productivity growth and overall economic progress. According to the OECD, "human capital, especially in science and technology, is of growing importance for innovation and technology-led economic growth. In the new economy where knowledge is the source of wealth creation, human capital becomes as important as financial capital."^{vii} The following sections outline the human capital and research requirements of the economy and enterprise that have been established through a significant research base and are relevant in the context of developing the Higher Education system.

Skills and Human Capital Requirements of Enterprise

Investment in human capital and increasing levels of educational attainment has demonstrated clear returns to the individual, the firm and the State (Kavanagh, 2006).^{viii} As a small, open economy, it is widely accepted that the only long term sustainable enterprise strategy for Ireland is through commercialising and exporting goods, services and ideas. While there is understandably a preoccupation with the pace of the deterioration in the current labour market, the long term development of the knowledge economy does not depend on shock labour market adjustments, but ensuring that the right infrastructure is in place to support increasingly higher skill level requirements of Ireland's enterprise base. Furthermore, competitor countries continue to develop policies aimed at improving their skills base as a source of competitive advantage for attracting inward investment and for developing indigenous industries.

The drivers of change that result in higher levels of skill requirements for enterprise identified in the National Skills Strategy have not dissipated in the current recession. The National Skills Strategy highlighted how virtually all occupations are becoming more knowledge-based, requiring an increasing breadth of knowledge, rising technical, qualification, and regulatory requirements and continual learning. Globalisation is continuing apace, human capital has become highly mobile and world competition for skills in areas such as ICT and Life Sciences remains fierce despite the downturn. The proliferation of new and emerging technologies requires continuous responsiveness to capitalise on their potential. The ability to respond and manage these drivers of change becomes important in order for Ireland to compete at the highest levels when global economic growth resumes. Indeed, in the *Recovery Scenarios for Ireland* (2009), the ESRI recommended that recovery would benefit from increased policy attention to enhancing productivity and innovation in the tradable sector of the economy.^{ix}

Future foreign direct investment and resulting job creation in Ireland will depend increasingly on the quality of our workforce. This is evidenced by IDA announcements in 2008/2009 which

show a distinct shift in the nature of FDI towards Research, Development and Innovation activities, Global Business Services, and expanding investments by existing multinationals in higher value added activities, for example:

- IBM announced the establishment of a Global Centre of Excellence for Water Management through the development of green data-centre technologies;
- AON, a provider of risk management services, insurance and reinsurance brokerage chose Dublin as its location for a global Innovation Centre with the creation of 100 jobs;
- Facebook, the world's leading social network site, established its international headquarters in Dublin;
- Alcon, a leading eye care company announced a €21.14 million expansion at its Cork operation increasing employment by 186 jobs;
- Microsoft expanded its Irish operations with a €360 million investment in a strategic data centre;
- PayPal announced €15m investment in a new European Centre for Operational Excellence to create business processes and regional intelligence positions such as business analytics, product design, risk management, information technology, operations and merchant services;
- Hewlett Packard announced €18m expansion of Global Service Desk Operation (500-1000 jobs);
- Big Fish Games Inc established its European Headquarters in Cork (100 jobs).

Ireland has made significant strides in recent years in increasing the stock of people in the workforce with higher levels of education. From Q4 2002 to Q1 2009, the number of people with third level education and above in the labour market increased from 531,000 to 797,000, an increase of 50 percent. As the knowledge economy develops, the quality of Ireland's workforce highly depends on the quality, relevance and responsiveness of our education and research system, particularly at higher education levels. More third and fourth level graduates are essential to:

- Providing a workforce capable of dealing with the increasingly complex demands of the global economy, including the proliferation of technologies and growth of internationally traded services and manufacturing services;
- Attracting high value added investment and highly skilled job creation, which has significant beneficial impacts on the wider economy;
- Developing the research base which provides opportunities for the development of new products, services and ideas; and
- Growing the number of better quality and better paid jobs in the economy which improve living standards.

Despite the major recent rise in unemployment, skills shortages continue to persist in the economy. The Expert Group on Future Skills needs has identified a range of current and likely future skills shortages. Some of these are sector/occupation specific while others are more generic and required across sectors. Skills shortages span the Arts, Humanities and Social Sciences as well as the Science, Engineering and Technology disciplines. The 2009 National Skills Bulletin highlights that current skills demand is confined to those with third level qualifications and with specific expertise and experience.^x

Sector/Occupation specific skills shortages (See Appendix I for further detail)

A number of Expert Group on Future Skills Needs (EGFSN) reports have pointed to the importance of the Science, Engineering and Technology sectors to future economic prospects, and to the need to address relevant future skills requirements. Research undertaken for the by the EGFSN on the Medical Devices sector indicates that there are skills and researcher shortages for those with an understanding of design engineering, good management practices, quality assurance, and understanding of regulatory affairs.^{xi} In the Bio-pharmaceutical sector, there is a shortage of organic chemists and those that can combine business, clinical and engineering skills. In a number of manufacturing sectors (e.g. food or medical devices), there is a shortage of process diagnostic and control engineers and technicians who can implement lean manufacturing/Six Sigma principles to production processes. The field of bio-convergence is growing, which is likely to result in a demand for hybrid technologists with backgrounds in science, IT and nanotechnology.

The EGFSN report on future skills requirements for high level ICT Skills shows that the ICT sector in Ireland has moved to higher value activities, and that there is a shortage of software engineers and computer analysts and programmers.^{xii} The EGFSN report Future Skills and Research Needs of the International Financial Services Industry shows a long term need to develop people with very high level mathematical skills for areas such as actuarial science and quantitative finance, which will need years to achieve and so requires active interventions now, in addition to other specialist and technical skills in areas such as regulation, compliance and risk management.

Both science graduates and engineers will be increasingly in demand in the energy sector, particularly renewable energy which is set to become one of the key growth sectors of the economy. Demand is likely to increase at both technician and professional level, combining new technologies, interdisciplinary backgrounds (e.g. science/engineering/business). Advances in areas such as renewable energy, water treatment and waste may require wholly new skills and expertise from research through to operation/production functions. In addition, with the commitment to the development of the Green Economy, there may also be opportunities for workers that relied on the traditional Construction sector for many years towards areas of the Green Economy such as, for example, in energy efficient systems design, installation, repair and maintenance.

In the Healthcare sector, there are a wide range of skills shortages including general practitioners and consultants, registered general nurses and some specialised nurses (e.g. oncology, theatre, intensive care), dentists and veterinaries.

Recruiters continue to report difficulties in sourcing experienced sales representatives with specific product or technical knowledge (e.g. medical sales or technical sales) and/or foreign languages. Experienced marketing managers are also difficult to source and demand is likely to remain strong in the future as marketing experts are expected to be important in increasing Ireland's market share of demand for global products and services. Online sales, marketing and advertising are expected to be strong growth areas in the coming years for individuals who can combine strong sales skills with competencies in other areas (e.g. foreign languages, online media, global markets and international business).

Enterprise Development Skills Needs

The Expert Group has also identified skills deficits that apply across sectors and occupations.

Mathematics

The current level of mathematical achievement is of serious concern to employers. Mathematical concepts, models and techniques are central to working in all sectors of employment and are equally important to service jobs as to manufacturing jobs. The proficiency level of students in mathematics is a key factor influencing the domestic supply of graduates for sectors with growth potential such as ICT, Life Sciences and Business, Financial and Professional Services. Boosting the level of our mathematical capability would help ensure opportunities for employment growth could be fully realised.

Language Skills

The Enterprise Strategy Group's report stressed the importance of greater understanding of international markets. In this context the ability of Irish-based enterprises to communicate effectively with other nationalities and cultures can enhance their success. International business relationships will be crucial to indigenous enterprise in the future. Success in marketing and selling Irish goods and services will be contingent on the ability of the indigenous sector to establish and maintain close relationships with customers in global markets. In addition, partnerships and collaborations with foreign enterprises will be key drivers of innovation and growth.

Language skills are complementary to other skills such as business, science, engineering and technology and are not in competition with them, nor are these skills mutually exclusive. Owing mainly to historical factors, throughout the education system the provision of languages education is concentrated in a limited number of foreign languages. The Expert Group on Future Skills Needs has recommended that further consideration is required in how current provision of foreign languages and cultures education relates to enterprise needs and how they could be enhanced in order that enterprises can maximise opportunities in foreign-language markets^{xiii}.

Skills for Creativity, Design and Innovation^{xiv}

Skills required for creativity, design and innovation, are needed in all industries and in all occupations. While there is some variation between occupations and across industries, some universal points emerge.

- Depth of skill and knowledge is important to creativity and innovation;
- Creativity relies heavily on finding new ways to combine existing ideas. In skills terms, this means that the capability to work well with people whose deep skills lie in other areas is critical;
- All other capabilities have to be underpinned by strong generic skills in areas including communication skills, team-working and problem solving; and
- Creativity and innovation are influenced heavily by the culture of the organisation, and how innovation is managed and led.

Management Skills

In 2006, the EGFSN report SME Management Development in Ireland highlighted deficits across a range of management capabilities including general management such as HR, marketing and finance skills, strategic management skills such as inability to plan ahead, product management skills, and functional management skills (sales, training, marketing, supply chain management, IT and R&D). In response to this report and subsequent endorsement by the Small Business Forum report, the Management Development Council (MDC) was established.

The MDC has found that most participation in management development education/training is in short compliance type courses, and that more emphasis needs to be placed on transformational change, competencies, and leadership.

In summary:

- Increasing the educational attainment levels of the labour market is crucial for Ireland to compete in international markets, for attracting foreign direct investment, for growing the number of better quality and better paid jobs and for developing the knowledge economy. Higher Education graduates are at the forefront of making this happen.
- Despite the major recent rise in unemployment, skills shortages continue to persist in the economy. Some of these are sector/occupation specific while others are more generic and required across sectors. Skills shortages span the Arts, Humanities and Social Sciences as well as the Science, Engineering and Technology disciplines.
- Particular skills shortages have been identified for certain occupations in the areas of medical devices, pharmaceuticals, food, ICT, financial services, health and sales and marketing. Employers have also identified deficits in skills required across sectors such as mathematics, language skills, innovation, and management.
- The Higher Education system has a central role to play in responding to the changing skills needs of the economy, both in terms of addressing specific sectoral/occupation skills shortages and general enterprise skills. Some actions that could help improve this role that could be considered in the development of the Higher Education Strategy are identified later in the document.

Research, Development and Innovation requirements of Enterprise

High quality innovative research can result in economic and social benefits for the country as a whole. These benefits can be considered along the lines of benefits traditionally seen as economic, such as creating employment in the production of ICT products, the creation of spin-off companies in the pharmaceuticals sector, or they can be more complex benefits related to a healthier workforce, an improvement in the environment, or further enhancement of Ireland's reputation, leading to increased foreign investment.

Research, Development and Innovation is at times associated only the Science and Technology disciplines. However, public policy in this area explicitly recognises the potential contribution of all disciplines to developing our innovation culture. The Strategy for Science, Technology and Innovation targets increasing research across all disciplines: both the physical sciences and the humanities and social sciences. This approach is founded in a belief in the intrinsic value of scholarship, both to democratic society and to the effective functioning of universities as communities of knowledge and discourse. It underscores the importance of scholarship and research in the formation of postgraduates, but also in its impact on the quality of undergraduate teaching. In addition, there are compelling social and economic reasons to further develop our capabilities in the Humanities and Social Sciences. These include: better understanding of the very rapid changes taking place in the Irish economy and society; the importance of that knowledge and understanding in better informing public policy making; and developing creative and analytical skills in the context of a global economy which is becoming increasingly dominated by knowledge based services.

Empirical evidence shows a clear link between investment in Research and Development by enterprises, productivity and economic growth.^{xv} Czarnitzki and O'Byrnes (2007) show that firms and, in turn, sectors and countries seem to exhibit higher productivity when they engage in R&D. Internal R&D spurs productivity through new products being introduced in the market that increase firms' revenue or through the implementation of new processes in production that lower cost or increase quality. Second, firms may benefit from spillovers of knowledge that others generated. In order to absorb such spillover effects, scholars have pointed out that a certain level of own R&D is required for building the capacity to benefit from knowledge generated elsewhere. Without the capability to understand such newly generated knowledge, firms (or indeed countries) may not be able to utilise information for their own benefit.

Public investment in Research and Development is also demonstrated to have significant impacts on the economy. The OECD has shown that in countries where substantial public funding of R&D has been made in parallel with high levels of spending by firms on R&D, there are significant productivity gains to be achieved. In addition, there are many spillovers that can be realised from publicly funded R&D. By ensuring a supply of skilled graduates and trained researchers, public research underpins the capabilities of the private sector. The Building Ireland's Knowledge Economy strategy identified a number of potential economic benefits that can be derived from public investment in R&D^{xvi}. A vibrant research activity in our higher education and public research system attracts high quality researchers, develops research excellence and can provide the research support needed by enterprise. It is important for increasing scientific and technological problem solving and can also lead to technology transfer to enterprise and new start-ups based on the commercialisation of research.

Ireland has made significant strides in developing its R&D infrastructure in recent years. Gross R&D spending in the government, higher education and business sectors of the economy has tripled since 1998. The overall R&D intensity ratio reached 1.68% of GNP (€2.6bn) in 2008 up from 1.41% (€972m) in 1998. This increase in the R&D intensity ratio brings Ireland closer to the OECD and the EU27 averages.

Business sector performed R&D (BERD) expenditure is estimated to have risen to €1.7 billion in 2008 with the BERD intensity ratio growing to 1.09% of GNP in 2008 from 0.96% in 2006 bringing it close to the EU27 average of 1.12%. The business sectors performing the largest percentage of R&D are the computer and related sectors and the chemicals sector with 24.5% and 20% respectively of the total.

Expenditure on R&D in the higher education sector (HERD) rose to an estimated €713 million in 2008. The HERD intensity ratio (HERD as a % of GNP) at 0.46% is above the OECD and EU 27 averages of 0.39%. The total number of researchers engaged in R&D in all sectors in 2007 was 19,915 with the number of support staff and technicians totalling 11,777. The number of full-time equivalent (FTE) researchers employed per thousand population in Ireland in 2007 was 6.4, slightly above the EU-27 average of 6, although behind the OECD average of 7.3.^{xvii} Half of all research personnel employed since 2001 were PhD qualified researchers.

The table below provides a breakdown of public R&D funding by the main administering government departments and offices. A detailed profile of these actors and their relevant schemes is available in the Forfás Science Budget Survey (2008).

Government Departments and Agencies Funding R&D activities (2008)

	2008, €m	% of total
Higher Education Authority	354.3	34.4
Science Foundation Ireland	174.0	16.9
Teagasc	66.4	6.5
Enterprise Ireland	62.5	6.1
IDA Ireland	57.0	5.5
Health Research Board	49.2	4.8
Sustainable Energy Ireland	40.0	3.9
Department of Agriculture, Fisheries and Food	37.8	3.7
Department of Education and Science	34.8	3.4
Irish Research Council for Science, Engineering and Technology	26.3	2.6
Department of Communications, Energy and Natural Resources	19.6	1.9
Marine Institute	17.3	1.7
Irish Research Council for the Humanities and Social Sciences	12.5	1.2
Environmental Protection Agency	12.4	1.2
Others	64.5	6.3
Total	1028.6	100

Source: Forfás R&D Surveys - The Science Budget 2007/2008

The largest share of publicly funded R&D is allocated through the Higher Education Authority (HEA) which in 2008 is estimated to have been the source of funding programmes worth €354.3 million, 78% (€278 million) of which is funding through the HEA block grant and 22% (€76.4 million) through the Programme for Research in Third-Level Institutions. Science Foundation Ireland (SFI) is the next largest funding agency which in 2008 was responsible for the distribution of €174 million in research grants. Both SFI's funding programmes and the HEA's Programme for Research in Third Level Institutions are provided on a competitive basis. Two research councils, the Irish Research Council for Science, Engineering and Technology (IRCSET) and the Irish Research Council for the Humanities and Social Sciences (IRCHSS), fund research by individuals at pre and post-doctoral levels.

Enterprise Ireland provides a range of grant support to third level colleges including the provision of funding towards enhanced R&D infrastructure in the Institutes of Technology. Through IDA, a R&D capability assistance grant is available to support the establishment of new R&D functions. Research Technological Development and Innovation (RTDI) grant assistance is directed at established companies who are planning to undertake their first R&D project and those companies who intend to expand existing ones.

The increased investment in Research and Development is having direct impact on Ireland's enterprise base:

- In 2007, 40% of IDA "project approval" included a strong R&D dimension- 54 R&D investment projects with a value of almost €470m. In 2008, a similar picture emerged- 43% of projects - 55 in number - valued at €420m.
- Through its Commercialisation Fund, Enterprise Ireland supported 138 projects in 2008, facilitating 7 start-ups and 29 licences.
- Over the period 2000 to 2007, Enterprise Ireland supported 430 High Performance Start-Up companies, 40% of which were specifically R&D projects. This investment yielded sales of €638 million, exports of €344 million and generated employment for 5,500 people.
- From its Enterprise R&D Fund, Enterprise Ireland supported 110 companies to undertake 240 R&D projects in 2008. The latest data for Enterprise Ireland points to sharp increases in the number of firms performing significant R&D (>€2m), with 164 significant R&D performers in 2007 compared to 118 in 2005.
- In a recent independent survey of 203 companies that had received R&D support from Enterprise Ireland, on average 4 products were newly introduced or significantly improved as a result of R&D funding. Both productivity and sales increased for the majority as a direct result of the funding with average growth of 18% and 24% respectively and over 70% of companies employed new staff as a result of R&D funding.
- Overall improvements in R&D spending continue to be a strong driver of innovation performance in the business sector. Between 2004 and 2006 over 47.2% of firms were engaged in innovation activities, with 56.7% of industrial firms and 41.3% of service industry firms being active in innovation of some kind.

Notwithstanding the considerable progress that has been made to date, significant obstacles remain in terms of how enterprises in Ireland interact with the public research environment.

There are two main challenges facing Irish enterprise in relation to maximising the potential of R&D activity:

- Firstly, as a small country, Ireland needs to specialise in areas that give the economy global competitive advantages. Ireland should develop world-class research in those areas that are aligned with the strategic needs of the economy and new enterprise opportunities; and
- Secondly, since Ireland is coming from a relatively low base in terms of developing its R&D infrastructure, there will continue to be a time-lag before the spillovers from public R&D are fully realised.^{xviii}

In addition to these challenges, there are apparent differences between the R&D requirements of the R&D-intensive, high tech companies and companies with limited absorptive capacity.

The needs of enterprise can therefore be summarised under the following headings:

- HEI-Enterprise Collaborations;
- Researcher Training and Development; and
- Commercialisation and Knowledge Transfer.

HEI-Industry Collaboration

The Higher Education system has a distinct role in terms of providing enterprise with access to new knowledge, specialist expertise and new technologies. There are several different models of HEI-Industry collaboration in Ireland, funded primarily by SFI, Enterprise Ireland and IDA. The type of collaboration broadly depends on the R&D capability and the absorptive capacity of the company, and proximity to the market and covers the spectrum from oriented basic research, applied research and problem solving and innovation. The HEIs have responded well to the development a world class research infrastructure that is linked to industry, primarily through SFI-funded CSETs and SRCs. This research is broadly focused on the underpinning sciences of ICT and biotechnology. It is recognised that the relationship between basic research and enterprise and job opportunities is not always linear and, as pointed out previously, there tends to be a greater lag in economic return from basic research than commercial research. However excellent basic research concentrating on fundamental scientific principles is important not only from an FDI perspective but also in the development a high tech indigenous sector. The results of a survey of American multi-national corporations show that four factors stand out as important R&D investment decisions: market potential, quality of R&D personnel, university collaboration, and intellectual property protection.^{xix}

The HEI sector should continue to develop a world class research infrastructure that is broadly aligned with Ireland's future economic priorities and that is informed by enterprise needs.

There are several different programmes to fund applied research but the Enterprise Ireland/IDA Competence centres and Enterprise Ireland's Applied Research Enhancement programmes are focused at developing critical mass within institutions in the area of applied research. Increasingly enterprises also look to HEIs to collaborate on incremental technological development or problem solving. For the vast majority of enterprises, the availability of basic research infrastructure is of little direct relevance. For the most part, enterprises (both foreign-owned and indigenous) are interested mainly in incremental innovation, which demands an intimate knowledge of existing technologies and markets and which is based on applied science and technology. SMEs in particular have difficulties in getting access to this knowledge in an absorbable way that they can apply to products and processes and to accessing expertise in technology platforms relevant to their needs.

Product and process innovation is not something that can happen as a supplementary activity, but requires the whole-hearted commitment of time and intellectual energy of researchers and it can be difficult for HE researchers to prioritise while also seeking to excel in traditional academic pursuits. Similarly, HE institutions have traditionally found it difficult to develop appropriate structures to engage with enterprises and to contribute to economic development in that way.

A policy choice has been made in Ireland not to establish dedicated applied research institutes with a singular function of translating knowledge acquired from research discoveries into practical uses for enterprises or society. Accordingly, the Higher Education system is expected to proactively perform the applied research function through its funding. Although there has been some good progress to date, Forfás believes that greater emphasis still needs to be given to research of a more applied nature to ensure that the R&D requirements of all sectors can be met. Deficiencies in the absorptive capacity of the Irish SME sector is undoubtedly a major contributory factor but international experience suggests that this will only be solved in conjunction with a major programme to build world class applied research capability.^{xx} The Higher Education Institutes are expected to address this

function and this should be a central focus of the Higher Education Strategy. A mechanism for ensuring that applied research capacity is aligned with important economic sectors, including emerging sectors, should be introduced.

The HE sector should develop a world-class capacity in applied research that matches its achievements in the basic research area. The metrics for applied research and innovation should reflect the target outputs e.g. licences, collaborations, patents. The HEIs should recognise and reward achievements in applied research and ensure parity of esteem between basic and applied research.

Researcher Training and Development

Ultimately, the quality of research personnel is at the heart of Ireland's research and development capabilities. Industry is dependent on the Higher Education system for the supply of skilled researchers. The ASC's report "Towards a Framework for Researcher Careers" addresses this particular issue. Continuing to assure world-class research excellence requires an appropriate career structure enabling the professionalisation of researcher careers. The Council's report sets out how a major restructuring of researcher careers in Ireland could be carried out so that the best and brightest aspire to enter the researcher profession. A more defined career structure within the HEIs is required to ensure industry and academia can take full advantage of the talent that researchers offer. As previously mentioned, the quality of research personnel is also an important factor influencing FDI decisions.

The SSTI target to double the output of PhDs by 2013 over the 2005 base is advancing significantly. The most recent data show total outputs rising from 808 in 2005 to 1055 in 2007 ahead of target of 894 in the Strategy. The original goal was to exceed annual output of 1,300 by 2013. A key objective of the strategy is not only to increase the output of PhDs, but to maintain quality and see this knowledge intensive capacity spread through all sectors of the economy. Recently published BERD data also shows that there has been a significant increase in the number of PhD researchers employed in enterprise, up from 830 in 2005 to 1179 in 2007^{xxi}. While good progress has been made in increasing the numbers of PhDs is, it is important to ensure that the policy in this area prioritises Ireland's competitive offering in terms of quality and relevance of researchers rather than purely absolute numbers of PhDs.

In many instances, PhDs who embark on a career in industry can bring with them not only the knowledge they acquired directly through their research but also skills, working methods and a network of relationships, to whom they can turn for support in their professional lives.^{xxii} PhDs' knowledge about recent research and, more importantly, a capacity to solve complex problems, conduct research and develop new ideas makes them especially valuable to innovative firms.^{xxiii}

Good scientific training can endow individuals with a tacit ability to acquire and utilise knowledge and apply it in new ways, which may generate a particular attitude of the mind that can be an important contribution to innovative activities.^{xxiv} Young scientists can also bring enthusiasm and a critical approach that stimulates others and raises standards.

Highly skilled personnel play an important part in developing firms' absorptive capacity. They can fulfil a "gate keeping" role^{xxv} - that is, "monitoring technological information external to the firm, identifying which is useful and making it available to other members of the organisation, in a form that they understand"^{xxvi}. This is a critical role when the internal knowledge base differs substantially from that of the external actors who supply relevant information, a situation that is frequent when a firm embarks on processes of change.^{xxvii} In

such circumstances, it is also vital that to have "knowledge of knowledge"^{xxviii}, i.e., to know where useful knowledge is located.

The growing availability of high technology capital has created new products and production systems that will require workers to have greater cognitive skills and to be more adaptable and efficient learners.^{xxix} In addition, the globalisation of research and business activities means the ability to act in an internationally networked environment will assume ever greater importance. This makes PhD skills and attributes increasingly relevant. The 2007 Forfás Business Expenditure on Research and Development Survey identified the most important factors for enterprise when employing PhD researchers:

- Broad understanding of discipline and of fundamental and underpinning technologies;
- Knowledge of research approach, techniques and methods; and
- Relevance of a research topic (specialist expertise).

A forthcoming publication from the Advisory Science Council identifies some shortcomings in current 4th level provision from an enterprise perspective.^{xxx} These include:

- A need for PhD programmes to be more broadly aligned with demand from enterprise;
- A lack of mobility of research personnel between industry and academia;
- A lack of formal recognition within PhD programmes of the transferable skills (project management, communication skills etc.) acquired which are relevant to enterprise;
- More structured PhD programmes are required to ensure that researchers gain commercial insights and experience in order to enhance mobility and develop business and management skills of researchers;
- A need to encourage more researchers to commercialise their research; and
- The need to ensure that research undertaken in higher education is more aligned with enterprise research requirements is not limited to the development of PhD programmes. Research assistants and technicians are required to support principal investigators in their roles. In this context, it is important that enterprise research requirements are considered across undergraduate and postgraduate provision.

Commercialisation and Technology Transfer

Building on the need to develop a much more coherent applied research function that is close to market, Higher Education Institutes also need to develop and strengthen their commercialisation functions. In itself, funding research within Higher Education at comparable levels to Ireland's competitors is not sufficient to ensure that Ireland develops as a knowledge economy. A key feature of the Smart Economy approach is to "build the innovation or ideas component of the economy through the utilisation of human capital - the knowledge skills and creativity of people - and its ability and effectiveness in translating ideas into valuable processes, products and services"^{xxxii}. The challenge remains in terms of not just generating new knowledge that addresses economic and social challenges but also to ensure that that knowledge is transferred and applied for economic or social benefit. The Advisory Science Council has recently acknowledged that significant progress has been achieved in building excellence in Ireland's research capacity, however, increasing emphasis is needed on the commercialisation potential of publicly funded research discoveries.^{xxxii}

Higher Education Institutes need to fully embrace their role as central to the commercialisation of knowledge, both in terms of supporting researchers to commercialise

their research and through engaging with the market to identify opportunities. Significant resources are now devoted through Enterprise Ireland's science and technology funding to assist HEIs to realise the goal of making IP management a central part of their mission and the 2008 Forfás Commercialisation Survey reported that there were positive trends in commercialisation metrics emerging from publicly-funded research.

The Technology Transfer Offices that have been established with this funding are responsible for the four key stages of IP management: generating, capturing, protecting and exploiting intellectual property. While significant progress has been made in a relatively short space of time, it is important to ensure that IP policies and arrangements at the institutional level facilitate the development of long term collaborations with clusters of enterprise that can help to sustain long term economic value. With that objective in mind it is important that agreements are negotiated in a timeframe that reflects the business environment. Also, while it is difficult to value IP, and companies must be prepared to recognise its commercial value, it is important that revenue from IP is not seen as a new source of income for the institutions. IP activities should be self-financing to ensure sustainability - the volume of commercialisation activity (in 2007, for example there were 13 reported spin-out companies from the HE sector) and internationally comparable data would suggest that this will never be a significant funding stream for the HE sector. Therefore Institutions should be incentivised to build long-term relationships rather than focus primarily on the revenue potential, particularly when negotiating with start-up companies. The HE sector should also adopt a consistent and coordinated approach to IP to ensure easier access, particularly by SMEs.

While TTO offices will lead the commercialisation activity it is important that commercialisation is embedded across the institution and that Principal Investigators in particular are committed, where appropriate, to the transfer of knowledge and technology for economic and social benefit. Knowledge transfer activities should be recognised and rewarded within the Institution. Early-stage researchers, including PhD students and postdoctoral researchers should be regarded as a potential pool of entrepreneurs and their PhD education should build business and transferable skills that would enable them to translate their research into economic or social opportunities. This would also help to embed a commercialisation culture within the institutions and ensure that commercialisation and knowledge transfer becomes a core activity of the HE sector.

The Higher Education system has a central role to play in addressing these issues.

In summary:

- The research base in Ireland has developed significantly over the past decade and Ireland has succeeded in developing excellence in many areas of oriented basic research. The Higher Education system has been central to making this happen.
- The availability of research capacity is an important factor in attracting foreign direct investment. This investment activity is growing as a proportion of total FDI activity. Enterprises with high R&D intensity are able to interact directly with the areas of academic research that have been developed in recent years.
- The fruits of this strategy have only started to emerge. Ireland has a long way to go in order to realise the high number of intensive research linkages between academia and industry that are characteristic of the knowledge-intensive economies and regions to which Ireland aspires.
- The majority of enterprises rely on product and process innovation developed through applied research that is not necessarily of a ground-breaking variety. The Higher

Education sector needs to address both basic research and applied research in order to maximise the contribution of research to economic development.

- PhD programmes need to be adapted to ensure they encourage mobility between enterprise and academia, have greater recognition of transferable skills acquired, provide more opportunities for engagement with industry, and offer opportunities for commercialisation of research. HEI researcher career structures need to be restructured to ensure the professionalization of the career and promotion of mobility between academia and enterprise.

3. Forfás priorities for the Higher Education System

Informed by a range of studies and consultations on enterprise skills and research requirements, the following section presents the principles and priorities underpinning the development of the Higher Education Strategy from a Forfás perspective.

It should be emphasised that Forfás is putting forward these priorities in the context of its mandate as Ireland's enterprise and science policy advisory board and recognises that broader cultural and social dynamics of Higher Education will also be addressed in the development of the Strategy.

General Principles

The Strategy for Higher Education is likely to result in significant reform of the Higher Education system. A clear and unambiguous higher education policy which is developed in a collaborative way and which is supported by all stakeholders is required.

Ireland has built a strong reputation internationally for the quality of its workforce and is making significant strides in developing its research and development base. The pursuit of excellence should underpin the future development of the Higher Education system in every facet of its operation. This includes excellence in the quality of teaching, in basic and applied research, in commercialisation, and in interacting with society and the economy. Quality assurance should be prioritised.

Ireland should operate a system of 'mass' higher education which is required to meet the needs of a knowledge economy. This does not mean that a homogenous offering is provided to all individuals or that all institutions have the same mission, funding or governance system. In addition, Ireland needs to develop a cadre of 'world class' graduates that can meet the needs of enterprise and help to drive economic and social development. Institutions' missions should be differentiated and within this Ireland needs a small number of 'world class' institutions that can compete internationally for the best talent.

A small number of coherent key metrics need to be agreed between policymakers and the Higher Education Institutions which relate to the key strategic objectives of Higher Education Policy. Specific targets around key deliverables should cascade from these metrics. The funding model should follow from and support the key metrics.

The Higher Education Strategy needs to consider how a future sustainable funding model can be achieved and to ensure that funding is aligned with economic and social needs. The first step is to ensure that any inefficiency and duplication which exists is driven out of the system. Where public funding is provided institutions should be accountable for ensuring value for money and that funding is best used to support public policy objectives. There is a need to diversify the funding streams of universities. Potential funding streams which should be considered in terms of their potential to contribute and their alignment with policy objectives include: Public funding, philanthropy, fees earnings from Irish students, fee earnings from overseas students, international competitive research funding. The objective should be to try to reduce dependence on exchequer funding.

In Ireland, as in many other European countries, the State has a significant stake in the funding of higher education. However, there needs to be a balance between what serves the national interest in terms of higher education policy and the capacity of institutions to manage their own affairs. The independence and autonomy of higher education institutions is

highly important, yet so too is accountability. According to the Glion Colloquium, in the long run, institutional autonomy rests primarily on the amount of trust that exists between state government and institutions of higher education.^{xxxiii} Forfás believes that higher education institutions should be entrusted with greater operational autonomy while in tandem working towards the goals of higher education from a public interest perspective. The challenge now is to find a way of increasing central coordination at policy level that is underpinned by the goals of the Strategy, while simultaneously increasing individual institutions' autonomy to manage their own operations in the context of those goals. These two objectives are not incompatible. Increasing institutions' managerial autonomy should help drive efficiency in the use of available resources.

There needs to be a greater connection between research and teaching. Those engaged in world class research should pass on their knowledge and expertise through teaching in order to enhance the development of human capital. That is not to imply that quality of teaching is only linked to quality of research but that in institutes where research is conducted there should be greater employment of that research expertise in the delivery of taught programmes.

All disciplines have the potential to contribute to Ireland's economic and social development. Just as manufacturing sectors are not in competition with services sectors, the Arts, Humanities and Social Sciences are not in competition with Science and Technology disciplines. The innovation culture that will underpin Ireland's future competitiveness is about finding new or improved products and processes in both manufacturing and internationally traded services and is dependent on all disciplines to develop. Forfás believes that the National Strategy for Higher Education should explicitly recognise the role that all disciplines have in developing Ireland's innovation culture and that this principle should permeate the Strategy.

The Higher Education Strategy should also be outward looking and consider how the Irish HE system will be recognised internationally and how it will collaborate internationally. This includes highlighting where Ireland has competitive strengths in areas such as quality of graduates, teaching, infrastructure and research and striving to reflect and improve those strengths in international rankings. It also includes making strategic choices in areas with opportunity for collaboration with international HEIs, for example, under the European Framework Programme, the European Institute of Innovation and Technology (EIT) and in terms of shared approaches to the development of specialist research infrastructures.

Priorities

- A clear and unambiguous higher education policy which is developed in a collaborative way and which is supported by all stakeholders is required.
- The pursuit of excellence should underpin the future development of the Higher Education system in every facet of its operation. This includes excellence in the quality of teaching, in basic and applied research, in commercialisation, and in interacting with society and the economy. Quality assurance should be prioritised.
- Ireland should operate a system of 'mass' higher education which is required to meet the needs of a knowledge economy. In addition, Ireland needs to develop a cadre of 'world class' graduates that can meet the needs of enterprise and help to drive economic and social development. Institutions' missions should be differentiated and within this Ireland needs a small number of 'world class' institutions that can compete

internationally for the best talent.

- A small number of coherent key metrics need to be agreed between policymakers and the Higher Education Institutions which relate to the key strategic objectives of Higher Education Policy. Specific targets around key deliverables should cascade from these metrics.
- The Higher Education Strategy needs to consider how a future sustainable funding model can be achieved and to ensure that funding is aligned with economic and social needs. The first step is to ensure that any inefficiency and duplication which exists is driven out of the system. Where public funding is provided institutions should be accountable for ensuring value for money and that funding is best used to support public policy objectives.
- There is a need to diversify the funding streams of universities. Potential funding streams which should be considered in terms of their potential to contribute and their alignment with policy objectives include: Public funding, philanthropy, fees earnings from Irish students, fee earnings from overseas students, international competitive research funding. The objective should be to try to reduce dependence on exchequer funding.
- Forfás believes that higher education institutions should be entrusted with greater operational autonomy while in tandem working towards the goals of higher education from a public interest perspective. The challenge now is to find a way of increasing central coordination at policy level that is underpinned by the goals of the Strategy while simultaneously increasing individual institutions autonomy to manage their own operations, in the context of those goals. These two objectives are not incompatible. Increasing institutions' managerial autonomy should help drive efficiency in the use of available resources.
- There needs to be a greater connection between research and teaching. Those engaged in world class research should pass on their knowledge and expertise through teaching in order to enhance the development of human capital. That is not to imply that quality of teaching is only linked to quality of research but that in institutes where research is conducted there should be greater employment of that research expertise in the delivery of taught programmes.
- Forfás believes that the National Strategy for Higher Education should explicitly recognise the role that all disciplines have in developing Ireland's innovation culture and that this principle should permeate the Strategy.
- The Higher Education Strategy should also be outward looking and consider how the Irish HE system will be recognised internationally and how it will collaborate internationally, with particular reference to initiatives under the European Higher Education Area (EHEA) and the European Research Area (ERA).

Skills Alignment and Quality

Higher Education's most significant contribution to enterprise development is through the provision of graduate labour from 'taught' undergraduate and postgraduate programmes; the importance of these programmes should be recognised in the HE Strategy. As pointed to previously, skills shortages exist in a number of sectors in the economy. There are also skills

shortages that cut across sectors and occupations that are required by virtually all enterprises. Furthermore, a joint survey by the Higher Education Authority, Forfás and the Expert Group on Future Skills Needs of multinational employers' perceptions of Irish graduates found that, compared to non-Irish graduates, Irish graduates were relatively underprepared for the realities of the workplace and that courses needed to place more emphasis on workplace skills such as teambuilding and project management skills.^{xxxiv}

It is vital for future economic development that the Higher Education system is producing skilled graduates that provide enterprises with what they need. Ireland has had to rely on immigration to fulfil skills shortages over the past decade. This cannot be relied upon as a solution in the long term. Forfás believes that there is currently a weakness in the linkage in terms of how the skills needs of the economy permeate the Higher Education system. In addition, there are inconsistencies between HEIs in terms of their willingness to engage in meeting skills shortages. As a starting point, the Higher Education Strategy needs to consider how HEIs should interact with enterprise bodies and agencies, including the Expert Group on Future Skills Needs, in addressing skills shortages in a systematic and co-ordinated way.

All disciplines and courses have distinct learning outcomes which develop the skills and competencies of the individual and which are valuable to enterprises. However, Forfás believes that, particularly within the Arts, Humanities and Social Science, that these skills are not fully clarified systematically in all HEIs in terms of how they can contribute to a person's ability in the labour market. Forfás considers that HEIs should as a matter of course map out and communicate the competencies developed in all disciplines/courses to undergraduates, including those identified in the National Framework of Qualifications, so that they can better translate them in a practical sense in the labour market.

Furthermore, Forfás believes that there should be greater linkages between the Arts, Humanities and Social Sciences and Science, Engineering and Technology disciplines in order to harness their potential in the workplace. While enterprises may be categorised within a certain sector, they are not limited to specific disciplines and they require a combination of skills and knowledge. In this context, the arts, humanities and social sciences have enormous potential in contributing to enterprise in Ireland, not only in their more obvious guises such as finance, business, legal, cultural and education services, but also in a much more pervasive way that enables innovation, creativity and design, and facilitates technological and scientific based sectors to maximise their potential. There should be greater co-ordination between education providers and industry to ensure business, entrepreneurial, and other relevant AHSS content is integrated in to course curricula in science, engineering and technology based disciplines.

Additionally, Forfás believes that where courses have a distinct role in preparing students with specific skills and qualifications for industry (e.g. finance, science, engineering, technology etc.), a highly responsive system is required to ensure relevance in teaching and outcomes for enterprise. Concerns have been raised by employers over the quality domain specific and theoretical knowledge compared to graduates from Eastern Europe, who have longer undergraduate level programmes that are viewed as more practical.^{xxxv} In addressing these issues, industry needs to have greater involvement in the development and revision of course curricula to ensure that graduates are more relevant to enterprise needs upon entering the labour market. Courses that provide structured graduate placements and internships have also been highlighted by employers as extremely valuable in helping graduates transit to the labour market and should be expanded across disciplines. Enterprises have also identified a need to place greater emphasis within taught courses on stimulating

creativity and innovation in students. Key practices that should be promoted in this regard include widespread use of cross-disciplinary work, more project work and increased use of problem-based learning and inquiry-based learning approaches. Teaching knowledge and experience can also be enhanced by a number of ways such as looking to international best practice in course provision, by using business representatives to deliver guest lectures, encouraging high mobility of lecturers to and from industry and overseas, and providing access to students to resources and learning benefits that derive from research investments from SFI/PRTL and other R&D streams.

The Higher Education system also needs to be flexible in responding to changing global and national demands for jobs of a cyclical nature, for example, in the provision of nursing places and apprenticeships. This requires a national foresight approach to examine the appropriateness of levels of provision in certain disciplines and should involve representatives of HEIs and the Expert Group on Future Skills Needs.

The Higher Education Strategy should also consider how the HE sector can best attract students from overseas to Irish HEIs and develop the Irish Higher Education Market. A country's market share for overseas students is a strong indicator of quality internationally. There are also significant potential benefits for the Exchequer from which the HE system stands to gain. This should be considered in the context of the priority of the Higher Education system to serve the needs of the national population first and foremost. As a principle, places for non-Irish nationals should be additional to those for Irish students.

Priorities

- Higher Education's most significant contribution to enterprise development is through the provision of graduate labour from 'taught' undergraduate and postgraduate programmes; the importance of these programmes should be recognised in the HE Strategy.
- The Higher Education Strategy needs to consider how Higher Education Institutions (HEIs) should interact with enterprise bodies and agencies in addressing skills demands in a systematic and co-ordinated way.
- Industry needs to have greater involvement in the development and revision of course curricula to ensure that graduates have the skills required upon entering the labour market. Courses that provide structured graduate placements and internships have been highlighted by employers as extremely valuable in helping graduates transit to the labour market and should be expanded across disciplines. Enterprises have also identified a need to place greater emphasis within taught courses on stimulating creativity and innovation in students. Key practices that should be promoted in this regard include widespread use of cross-disciplinary work, more project work and increased use of problem-based learning and inquiry-based learning approaches.
- The Higher Education system needs to be flexible in responding to changing global and national demands for jobs of a cyclical nature. The Higher Education Strategy should also consider how the HE sector can best attract students from overseas to Irish HEIs and the appropriate balance of "EEA" and "non-EEA" student places. A country's market share for overseas students is a strong indicator of quality internationally.

Up-skilling/Re-skilling the Labour Force

The National Skills Strategy highlights that virtually all occupations in the future (even those considered relatively low skilled) will require continual learning, up-skilling and/or re-skilling. The Higher Education system needs to be accessible to people as these needs arise. This might take the form of full qualifications or shorter modules to develop specific expertise.

At present, Forfás believes that Higher Education provision does not respond with flexibility to labour market needs and is skewed heavily in favour of fulltime students with provision available only at certain times. Furthermore, given that the funding system is prioritised in this manner, this acts as an additional barrier to enabling those within the labour market fulfil their skills needs.

Addressing the skills needs of those in the labour market through more flexible provision should be a core function provided by the Higher Education system. In doing so, the Higher Education Strategy needs to consider factors such as:

- The timing of course delivery;
- The introduction of modularisation, distance learning and continuing professional development programmes;
- The availability of modules to those that require specific learning (for example, software engineers that require entrepreneurship skills);
- The availability of part-time and evening learning that enables the individual to up-skill or re-skill at a time and pace that fits their needs;
- Recognition of Prior Learning of skills and competencies already developed and considered in identifying additional learning needs of the individual; and
- How funding might be adapted to facilitate those within the labour market to participate more in Higher Education.

Priorities

- Addressing the skills needs of those in the labour market through more flexible provision should be a core goal of the Higher Education system, for example, modularisation, distance learning and programmes for continuing professional development.
- The Higher Education Strategy should consider how provision can be adapted to enable people within the labour market meet their skills needs.

HEI-Enterprise Collaboration

As discussed, Forfás recognises that public investment in basic research is fundamental to the development of the knowledge economy. It is also highly important in the attraction of FDI and in the development of R&D intensive companies. Furthermore, it is acknowledged that the relationship between the basic research and the enterprise base is not simply linear and that the benefits of basic research discoveries can materialise in a variety of ways. Finally, it is recognised that there can be a time lag in realising a return on investment from basic research undertaken by research institutions compared to R&D performed by firms.

The Higher Education system is to be commended for its pivotal role to date in developing the basic research environment in Ireland from a low base and for ensuring that excellence has been the underpinning principle in its development.

Due to Ireland's size, it is widely accepted that Ireland cannot achieve excellence and critical mass in all areas of research. The Higher Education system needs to prioritise its research agenda with reference to the future needs of the economy. In addition, the principles of concentration, consolidation and coherence should underpin research funding to the HE sector to ensure research of the highest quality is undertaken and to maximise return on investment.

The Higher Education Strategy should consider how future arrangements for funding basic research in Higher Education institutions align with the long term research interests of the industries that will drive long term economic growth. The Technology Foresight Exercise in 1998 established important national priorities for research investment that would underpin economic development. A research priority setting exercise at national level should be repeated at regular intervals in which the Higher Education sector has a significant role. This priority setting exercise should not be limited to Science and Technology disciplines, but also the Arts, Humanities and Social Sciences that underpin Ireland's competitiveness in Internationally Traded Services, which will account for an increasing proportion of exports from Ireland and provide key growth and employment opportunities for the future.

Higher Education should strive to support both excellence in basic research and excellence in applied research and to be an international model of best practice in terms of interaction with enterprise.

Forfás believes that greater emphasis still needs to be given to research of a more applied nature to ensure that the R&D requirements of all sectors can be met. Higher Education funding of industry-led initiatives represents a relatively low proportion of total public investment in research compared to most other European countries. The Higher Education system should seek to develop suitable metrics to measure the progress and intensity of applied research. Metrics traditionally associated with basic research (e.g. citations) may not be the most appropriate in this regards. Other metrics such as granted patents, spin outs and level of private funding to higher education research are needed to track the impact of this type of research investment. A mechanism for ensuring applied research capacity is aligned with important economic sectors, including emerging sectors, should be introduced.

The applied research system should be developed in collaboration with basic research in order to leverage the underpinning scientific knowledge and expertise. Greater equilibrium is required in the balance of funding towards applied research. In line with concentrating resources in the area of basic research, funding for applied research should be directed towards institutions that demonstrate best capabilities to undertake this type of research.

Priorities

- Higher Education Institutions should continue to develop capacity in world class basic research.
- Concentration of resources is required to ensure excellence and relevance of research and scholarship across the disciplines of Arts, Humanities and Social Sciences and Science, Engineering, Technology and Mathematics.
- A priority setting exercise for research at national level spanning all disciplines should be undertaken at regular intervals to basic research is aligned with future economic

opportunities.

- Higher Education in Ireland should seek to become an exemplar in applied research activity in collaboration with enterprise.
- Greater balance between funding of basic research and applied research will be required.
- Funding for applied research should be directed towards institutions that demonstrate greatest capabilities to undertake this type of research.
- Metrics such as granted patents, spin outs and level of private funding to higher education research should be used to benchmark progress.

Researcher Training and Development

The primary objective of the SSTI target of increasing the number of PhDs should be to ensure relevance, quality, employability of researchers that will be Ireland's future innovators and knowledge entrepreneurs. More structured PhD programmes that include industry placements are required to ensure that researchers gain commercial insights and experience in order to enhance mobility and develop business and management skills of researchers. 'Industrial' PhD programmes should also be considered in which research undertaken for the PhD programme is conducted directly with industry. PhD programmes should also provide the support to researchers to pursue opportunities to commercialise their research. Furthermore, the SSTI also has targets to increase the number of research assistants and technicians to support the work of principal investigators. In this context, closer interaction with industry is required at both undergraduate and postgraduate levels.

Priorities

- PhD programmes need to be more structured, provide greater recognition of transferable skills acquired and have greater interaction with industry.
- PhD programmes should also provide the support to researchers to pursue opportunities to commercialise their research.
- Enterprise research requirements should be considered across undergraduate and postgraduate provision, especially those courses key to the supply of research assistants and technicians.

Commercialisation and Knowledge Transfer

In a knowledge society, knowledge and technology transfer is a core activity of the HE sector. While the mobility of human capital will continue to be the key channel for the transfer of knowledge between the sectors, commercialisation and knowledge transfer activity will play an important role in driving innovation in companies based in Ireland and the development of a high tech sector in new and emerging areas. While this is a highly collaborative activity, Higher Education has a central role to play.

The opportunities for commercialisation can come from two main sources - from within HEIs or from the market place. Technology Transfer Offices, strongly supported at an institutional level, need to be active in both of these spheres, through continuing to provide support for researchers, both senior and early-stage, to commercialise their research and through getting

closer to the marketplace and more proactive in identifying opportunities for commercialisation with enterprises. While significant progress has been made in a relatively short space of time, it is important to ensure that IP policies and arrangements at the institutional level facilitate the development of long term collaborations with clusters of enterprise that can help to sustain long term economic value. A centralised TTO support system is required to ensure efficiency and avoid duplication of activities.

Priorities

- In a knowledge society commercialisation and knowledge transfer is a core element of the HE sector and institutions should be incentivised to put in place the appropriate policies and arrangements that facilitates long-term collaborative relationships with clusters of enterprise. These arrangements need to be consistent across the sector to ensure easier access, particularly by SMEs.
- A culture that supports commercialisation and knowledge transfer needs to be embedded in the institutions and knowledge transfer activities that lead to economic and social opportunities should be recognised and rewarded.
- Technology Transfer Offices need to continue to provide support for researchers, both senior and early-stage, to commercialise their research and to be more proactive in identifying opportunities for commercialisation with enterprises.

Issues for consideration

In enabling the Higher Education sector to achieve the objectives set out in this submission, Forfás believes there are currently a number of operational issues within the Higher Education system that need to be considered:

- The National Competitiveness Council recently identified that at undergraduate level, there are high levels of similarity between the courses offered by many higher education institutes and little evidence of significant inter-institutional cooperation in programme delivery. All institutions should build on their strengths and, where appropriate, differentiate their activities on the basis of national, regional and sectoral needs.
- Greater specialisation, amalgamation of courses and programmes among Irish institutions and greater cooperation both locally and internationally will be required if Irish HEIs are to reach critical mass and attain a level of performance that is comparable with leading institutions overseas. Greater planning and co-ordination is required at a national level to ensure unnecessary duplication between HEIs is avoided.
- Similarly, greater co-ordination is required between the national education policy system and higher education institutes to improve communication and feedback in terms of how HEIs are addressing enterprise needs at a local level.
- The lack of parity between full-time and part-time students is a serious hindrance to the Higher Education sector fulfilling its role in lifelong learning and upskilling the labour force. Forfás would concur with the OECD recommendation in its Review of Higher Education in Ireland (2004) that “every effort be made to increase part-time student numbers as a proportion of total numbers in higher education and to this end distinctions between part-time and full-time student be removed”.

- Related to this is the barrier that most employee contracts within the HEI sector are structured around traditional term time provision and lack the flexibility to respond to learner needs that are outside the full-time provision model.
- In terms of governance, Forfás believes that enterprise is underrepresented on the governing authorities of Higher Education Institutes. Enterprise needs a stronger voice in governing structures to ensure that the economic objectives of Higher Education remain central.

Appendix I Current and Future Skills Shortages

Sector/ Occupation	Current/Likely future skills shortage
Information Technology	<p>While there has been a decline in the manufacturing side of the IT sector in Ireland recently, skills shortages persist in areas related to other aspects of the IT industry. The demand is still strong for individuals who not only have the advanced IT skills to install systems, but who can also customise and adapt those systems to a business's individual needs. In particular, there is a shortage of: experienced computer systems managers; IT professionals with business knowledge and managerial skills; programmers in specific software applications with substantial experience (e.g. Oracle, Java, web animation); experienced professionals with advanced software architecture skills; networking experts (SharePoint, VMware, etc.); telecommunications experts; IT security experts; research and design professionals, especially in electronics/ICT design and electronics hardware and semiconductor research.</p> <p>Online sales, marketing, entertainment and social networking are also expected to continue to grow strongly in the coming years and drive the demand for creative and highly skilled web developers.</p> <p>An increase in the demand for hybrid technologists is likely in the future as interdisciplinary activities expand in importance; ICT skills feature in most interdisciplinary convergence processes (e.g. business and IT; finance and IT; biotechnology, nanotechnology and IT)</p>
Science	<p>Despite the overall decline in employment, some science related areas (e.g. pharmaceuticals, medical devices and diagnostics, and biotechnology) have been performing comparatively well and shortages still exist for highly qualified and experienced individuals with specific skills, both at professional level (fourth level research and development scientists, clinical trials managers, regulation compliance staff) and technician level (e.g. lab technicians, junior chemists, development/prototyping technicians).</p> <p>A strategy launched by Science Foundation Ireland in March 2009, entitled 'Powering the Smart Economy', highlights the Government's commitment to the establishment of a critical mass of internationally competitive research teams in science and engineering. Such investment, aimed at advancing enterprise in biotechnology, ICT and energy, is expected to build on Ireland's reputation as a location of excellent research, thereby further expanding demand for people with advanced skills in these areas.</p> <p>Energy, particularly renewable energy, is set to become one of the key growth sectors of the economy, and the demand for skills, at both technician and professional level, combining new technologies, interdisciplinary backgrounds (e.g. engineering/science/business) and innovation, is likely to expand in the future.</p> <p>As the importance of ecology and environmental protection increases, along with EU regulation for this sector, new career opportunities will emerge for those with expertise in the natural sciences (e.g. impact assessment on flora and fauna in the context of major infrastructural projects).</p> <p>The field of bio-convergence is growing, which is likely to result in a demand for hybrid technologists with backgrounds in science, IT and nanotechnology.</p>
Engineering	<p>Despite the current economic pressures, design engineers, particularly in research and development in the medical devices sector, are in short supply; the demand pertains to individuals with experience and/or industry specific knowledge (e.g. process automation design).</p> <p>In a number of manufacturing sub-sectors (e.g. food processing, medical devices, etc.), there is a</p>

	<p>shortage of process diagnostic and control engineers and technicians who can implement lean manufacturing/Six Sigma principles to production processes.</p> <p>As is the case for science graduates, engineers, especially electronic, electrical, quality control, and design and development, will be in demand in the renewable energy sector (e.g. wind, wave and tidal), which is expected to be one of the drivers of future growth.</p> <p>Ecology and environmental protection are becoming increasingly important, creating new career opportunities for environmental engineers with expertise in the management of eco-systems.</p>
<p>Business and Financial Services</p>	<p>Despite the global and domestic financial crisis and the associated decline in employment, the demand for highly skilled financial professionals persists (e.g. chartered and certified accountants with expertise in project and system accounting, compliance experts, risk experts).</p> <p>Changes in the regulatory environment are expected to create demand for high level, up-to-date accounting skills (compliance, financial reporting, financial management) and risk management expertise. In addition, strong demand is expected to continue for experts in actuarial science and quantitative finance. These skills are expected to be critical in driving employment growth in the financial services industry in the recovery.</p>
<p>Sales and Marketing</p>	<p>Experienced marketing managers with product and market expertise and/or foreign language proficiency are difficult to source. Demand is likely to remain strong in the future as marketing experts are expected to be important to increasing Ireland's market share of the global demand for products and services.</p> <p>Despite a decline in employment for sales representatives overall, recruiters are continuing to report difficulties in sourcing experienced sales representatives with specific product or technical knowledge (e.g. medical sales, technical sales) and/or languages (e.g. telesales).</p> <p>Online sales, marketing and advertising are expected to be strong growth areas in the coming years creating opportunities for individuals who can combine sales skills with competencies in other areas (e.g. foreign languages, online media, global markets and international business).</p>
<p>Healthcare</p>	<p>There is a shortage of medical practitioners: the current shortage of general practitioners (GPs) is likely to persist in the future, especially if the trend towards an increased share of female and part-time GPs continues. There is a shortage of other specialist doctors required to meet the targets set out in the Report of the National Task Force on Medical Staffing.</p> <p>There is a shortage of registered general nurses, as well as nurses in some specialised areas (theatre, intensive care, cardiac, neonatal/paediatric critical care, and oncology/ cancer care). The shortage of general nurses is partly due to the fact that this segment of nursing is the main supply pool for most advanced nursing practitioners, as well as for most postgraduate courses (e.g. public health, children's nursing, etc.).</p> <p>The education and training output from dentistry has not kept pace with the growing demand for dental/orthodontic services, resulting in a shortage in this area. The shortage is likely to continue given that almost one in three dentists is older than 55, which is likely to create a higher than average replacement demand over the medium term.</p> <p>Although the number of vets in Ireland has been supplemented by a recent inflow of foreign-trained vets, there continues to be a shortage. The expansion demand arising from increasing food safety and traceability standards and the replacement demand arising from expected retirements (one in four vets is over 55) are likely to exceed existing graduate output in the short to medium term.</p>

<p>Education</p>	<p>Although there are no shortages at present, there are a number of factors which may create increased demand in future years:</p> <p>As outlined in the forthcoming EGFSN report increased fertility rates are expected to have an impact on junior infant enrolments from 2011, thus creating a future increased demand for primary teachers and subsequently secondary teachers.</p> <p>A greater demand for vocational trainers is likely to occur due to the training needs of an increasing unemployment stock</p> <p>The demand for education and training providers in the future is also likely to be driven by the fact that an increasing share of the workforce will have several different careers over the course of their working life.</p>
<p>Construction</p>	<p>Given the contraction in all segments of the construction industry in the short-term, shortages are not anticipated for any of the construction professional and associate professional occupations.</p> <p>The construction industry is contracting as well as undergoing a structural shift: the relative size of the new residential sub-sector is declining, resulting in a more even distribution of employment across sub-sectors. As a result, while further job losses are expected in the new residential sub-sector, in the medium term, job opportunities are most likely to arise for those who have expertise in the following areas: residential repair and maintenance; energy efficiency (e.g. retro-fitting, reduction of carbon dioxide emissions, renewable energy technologies); renewable energy infrastructure; management of construction and demolition waste; site assessment and water treatment; supply chain management in off-site construction methods; export of new building materials and processes.</p> <p>The extension of mandatory energy rating to the existing housing stock at the point of sale or rent from January 2009 under the Energy Performance of Buildings Directive (EPBD) and improved energy efficiency standards under Part L of the Building Regulations for new homes has the potential to create employment opportunities for craft-workers with the skills to install renewable energy heating systems, ventilation systems and insulation. While these skills have not been provided through the traditional apprenticeship system, an increasing number of upskilling programmes in these areas are becoming available.</p> <p>Driven by the sustainability agenda, there have been some employment opportunities for electricians in the installation of electrical services in SMART homes, electronic security systems and renewable energy technologies (e.g. wind turbines and solar-photo voltaic panels).</p>

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- A 1% increase in foreign R&D generates 0.46 per cent in productivity growth;
 - A 1% increase in public R&D generates 0.17 per cent in productivity growth; and
 - A 1% increase in BERD generates 0.13 per cent in productivity growth.
- These effects are larger in countries which are intensive in BERD. The long-term impact of R&D may be higher when it is performed by the public sector rather than by the business sector, probably because the former concentrates more on basic research, which is known to generate a higher social return.
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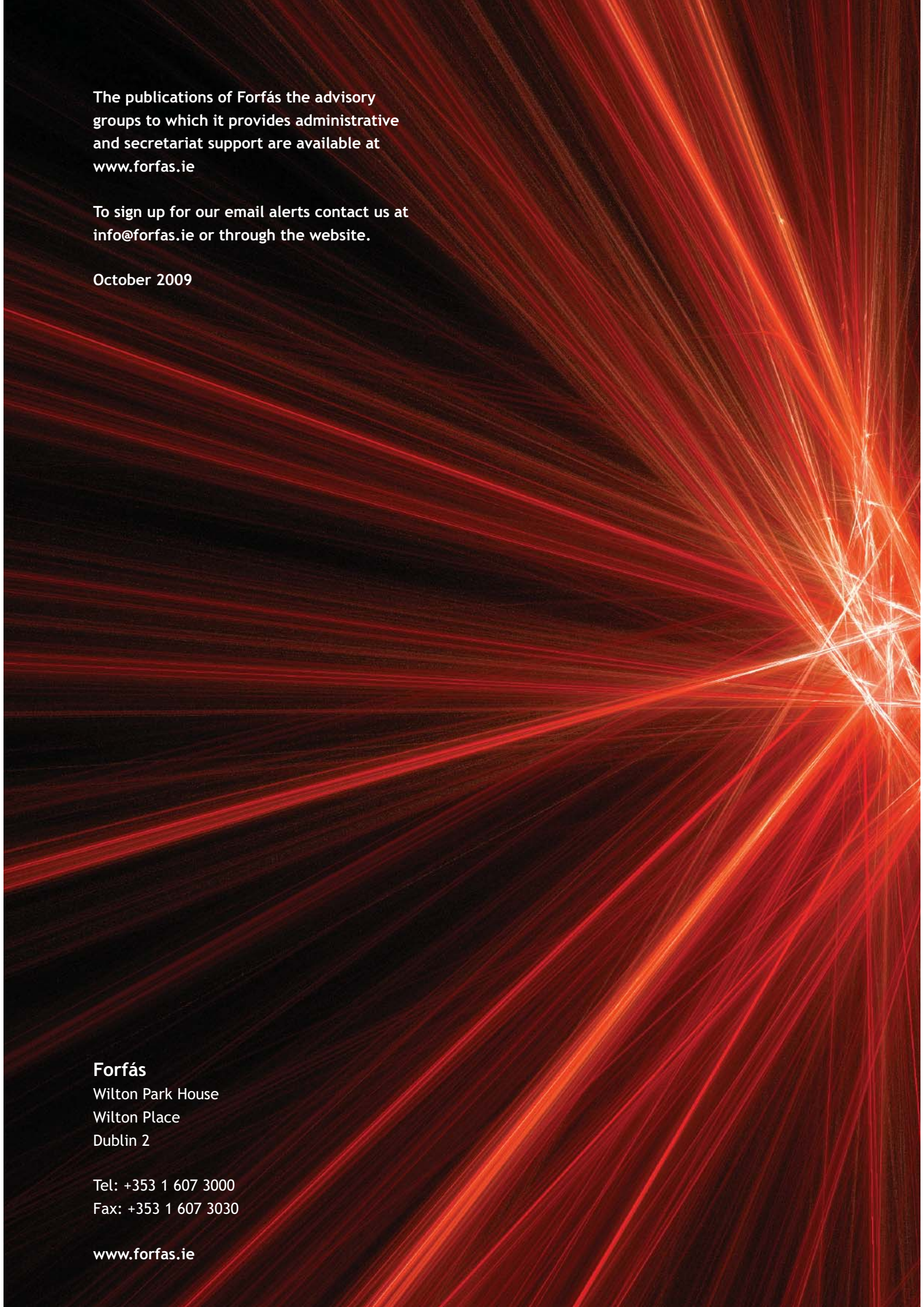
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