



**Report of the Consultative Forum  
on the Strategy for Science,  
Technology and Innovation**

**Farmleigh House, Dublin  
8<sup>th</sup> July 2015**

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Committee on Science, Technology and Innovation**

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**Report of the Consultative Forum on the Successor to the Strategy for Science, Technology and Innovation, Farmleigh House, Wednesday 8<sup>th</sup> July 2015.**

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## Executive Summary

A one day consultative forum was held on 8<sup>th</sup> July 2015, in Farmleigh House, Dublin as part of the preparation of a successor to the Strategy for Science, Technology & Innovation (STI). The strategy is being prepared by the Interdepartmental Committee on Science, Technology and Innovation (IDC), which is chaired by the Department of Jobs, Enterprise and Innovation. The purpose of the forum was to elicit views of stakeholders on a number of thematic areas that have emerged from discussion within the IDC and from inputs received by written consultation.

A total of approximately 120 invited participants were asked to discuss eight questions under four themes. The forum consisted of four parts and each part addressed two questions. Each part was closed by a plenary discussion. This report seeks to reflect the key messages and points of agreement and disagreement while recognising that the accuracy of statements made cannot be guaranteed.

Theme 1 (Supporting the Full Continuum of Research) first addressed the question of the appropriate balance between funding for basic and applied research and between core funding and competitive grants. Participants considered it difficult to distinguish between basic and applied research and while both are considered necessary, many considered the distinction to be somewhat artificial. No clear consensus emerged about an appropriate balance between the two. There is general agreement that excellence in research is an important criterion and that a complete move away from basic research would be self-defeating but there may be occasions when it is necessary to focus on applied research. The formulation of a clear vision is considered crucial and a distinction between short term and longer term objectives for research is considered relevant. It is also mentioned that an emphasis on Technology Readiness Levels (TRLs) may be more appropriate, although views differ on where funding should be targeted in terms of TRLs. Core funding for research institutes is considered necessary in order to create stability. Here also different views are expressed regarding the appropriate balance and the view is also given that competitive funding is the best way to increase excellence. There are still considerable barriers facing SMEs seeking to collaborate with Higher Education Institutes. Views are expressed both in favour of and against research prioritisation.

A second question asks to consider the appropriate balance between research for economic benefit, for societal benefit and to support policy and practice. How can we maximise the synergies between these and how should we measure success? The balance between economic and societal research leads to much discussion and it is generally felt that there is no clear dichotomy as much of the research for societal benefit is also important for economic development. The question of how to quantify impact is difficult but also considered necessary. A strategic approach is considered necessary where research is oriented around the problems relevant to broader society. An interdisciplinary approach is considered essential. The EU approach under Horizon 2020 is suggested as a good model of interdisciplinary research with both societal and economic outcomes.

Theme 2 (Enhancing Collaboration between Business and Academia) asks the question of how more collaboration between academia and enterprise can be encouraged. A strong view is expressed that it can be difficult for industry to know what services and supports are available. A greater regional focus is suggested as this would allow industry to be closer to the academic institutions. Also a brokerage service to help industry navigate the system is considered desirable. Communication is important in order to improve the understanding of what industry needs and what the higher education institutions (HEIs) can offer. Obstacles are mentioned and these include possible overlap between different institutions and problems with intellectual property rights. A number of

suggestions are made to achieve greater collaboration e.g. industry placements and employment of graduates. The needs of SMEs are different to those of the MNCs. It is suggested that the HEI sector needs to focus more on engineering and manufacturing. Institutional structures such as the Tyndall Institute and the German Fraunhofer model are held up as best practice examples to follow.

A second question asked how the impacts of research activity should be realised and measured. Measuring the impacts of research requires metrics and it is acknowledged that many metrics exist that can be used. However, concerns are expressed that more qualitative type metrics should be considered. These include: surveys (to measure impacts), case studies, and measuring impacts on skill levels. While the number of PhDs being awarded is relevant, it is observed that many PhDs and post-docs find it difficult to find employment. Teagasc is used as an example of transfer of knowledge from the advisory service to farmers and is seen as a good example of industry collaboration.

Theme 3 (Evolving the Research Landscape) first asks the question of how to ensure a sustainable research infrastructure to meet future needs regarding awareness, access and funding. The points are made that infrastructure is more than just buildings and equipment and that adequate technical support including adequate maintenance budgets, are important to ensure the continued availability of equipment. Potential duplication of equipment and adequate access to equipment are noted as issues of concern while a systematic approach in terms of collaboration with industry is lacking. The location of research centres in- or outside universities, is considered important. Facilities need to be accessible to business outside of academic hours and access charge models need to be simple. It is suggested that the support that is given to industry through the proposed knowledge development box model should be linked to support for research infrastructure. Data repositories and access to open data are seen as essential elements of the research infrastructure.

The second question asked under theme 3 is how the market focussed research centres landscape should evolve to support enhanced collaboration between enterprise and academia. Different views exist about the appropriate TRL levels. It is suggested that there is a gap at the high Technology Readiness Levels where the opportunity for industry engagement is highest. While there is agreement that a decision must be made on what model of research centre is best for Ireland and that this must be sufficiently market focused, different views are expressed about the relationship with HEIs. Two views are expressed in relation to how closely the centres should be linked to HEIs, one advocating independent stand-alone research centres while the other sees the link with HEIs as essential although with significant autonomy envisaged for the research centres.

Theme 4 (Delivering a Vision of Ireland as an Innovation Leader) first asks the question about prioritisation of STI investment across different areas. The clear view expressed is that the human capital is key as all other elements are dependent on the availability of human capital. It is considered that the attraction of high profile researchers to Ireland would be beneficial. The point is repeatedly made that a career structure for researchers is not well defined and that employment legislation leads to short term contracts being the norm for researchers. There is consensus that a model must be put in place to ensure researcher retention including career paths.

It is seen as important to be selective and to focus on Ireland's key strengths. Sectors such as food and agriculture, ICT and health are identified as areas of opportunity. Membership of international research organisations is considered important. There is also a need for consistent funding across a range of supports over a longer term planning basis. It is suggested that it may be necessary to prioritise international collaboration in order to achieve more with limited funding. The new strategy needs to be clear on what is meant by innovation. To be an innovation leader, we need to support

entrepreneurship, not just researchers. Business skills and scientific excellence must be combined to achieve results. The view was clearly expressed that we should not concentrate solely on growing higher TRL research at the expense of lower TRL research.

The final question asked is how we ensure that we have the people to deliver on a vision of becoming an innovation leader. In this regard the employment environment for researchers is considered very unstable. The current system tends to make career development difficult as the focus is on short term contracts. PhDs should be directed towards employment. Support for science at all levels is essential, from primary school level up. Multidisciplinary training is a key issue to consider in many sectors. Some views are expressed that planning and investment tend to be too short-term and not always consistent. A greater mobility (bi-directional) of researchers between industry and academia would be beneficial.

## 1 Introduction

The Interdepartmental Committee on Science, Technology and Innovation (IDC), chaired by the Department of Jobs, Enterprise and Innovation is developing a successor to the Strategy for Science, Technology & Innovation (STI). As part of the preparation of the strategy, a consultative forum took place which consisted of one day of workshops held to elicit views of stakeholders on a number of thematic areas that have emerged from IDC discussion on the development of the Strategy and from inputs received by written consultation.

The one day event took place on 8<sup>th</sup> July 2015, in Farmleigh House. It involved approximately 120 participants comprising of 10 tables with 12 participants at each. Each table included a mix of representatives from academia, public sector agencies and business. Each table had an IDC member to facilitate discussions and a Department official to act as a note taker.

The consultative forum event started with an introduction by the Moderator setting out the purpose of the Forum, followed by an opening address from the Minister for Skills, Research and Innovation and the Chairperson of the IDC. The consultative forum consisted of four parts and each part addressed two questions that correlate to the pillars of the consultation paper for STI which was issued to key stakeholders on 13<sup>th</sup> February<sup>1</sup>. Each part also included a twenty minute long plenary discussion and notes were taken of this as well.

This report of the forum is based on the notes that were prepared by the note takers at each table as well as the notes of the plenary discussions. The report seeks to reflect the key messages and points of agreement and disagreement. In preparation of the forum note takers were briefed on the process in advance and guidelines were issued. The structure of the report is based on the eight questions that were put to the participants.

The Consultative Forum was conducted on the basis that Chatham House rules were employed. The views in this report of the Forum do not necessarily reflect the views of the Interdepartmental Committee. This report reflects the sentiments of the attendees of the Forum, the Interdepartmental Committee cannot guarantee the accuracy of these statements.

Throughout this report best practice examples are highlighted as these were mentioned by participants of the forum. Statements that are considered noteworthy, although not claiming to be representative of the discussion, have been highlighted in single sentence form at the end of each section.

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<sup>1</sup> *Consultation Paper for Successor to Strategy for Science, Technology and Innovation*, Interdepartmental Committee on Science, Technology and Innovation, February 2015.

## 2 Forum Results

### Theme 1: Supporting the Full Continuum of Research

#### Question 1: What is the appropriate balance between funding for basic and applied research in Ireland and how should funding be distributed between core funding and competitive grants??

It is difficult to distinguish between basic and applied research. There is a need to ensure clarity on the definition of applied and basic before defining a target for a particular balance. The distinction between basic and applied research varies between sectors. One view is that basic research builds expertise and feeds the pipeline of applied research. Applied research is therefore dependent on basic research for a pipeline of ideas and people. There may also be a difference in culture, i.e. it is suggested that in basic research the allegiance of the researcher is to the discipline and the community of peer researchers whereas the culture is different in applied research.

In terms of the appropriate balance between the two, there is no black and white answer. It may depend on the sector. The balance is considered irrelevant by some without sufficient funding. There is a perceived need to maintain a balanced ecosystem of national research capability across the range of basic and applied research. In this ecosystem one needs both basic and applied research where basic research pays-off collectively and must therefore be an integral part of the research ecosystem.

The figures as presented during the workshop suggesting that currently there is a 50:50 split between basic and applied research are considered by some to be about right while others claim that they don't really give the full picture. One key message is not to reduce basic funding and instead work on the funding for applied research in order to maintain research capacity. Also, it is argued that official statistics on the breakdown between basic and applied may be misleading from the active scientist point of view as funding available for basic research has decreased drastically over recent years.

Despite the concerns about the relevance of the definitions it is stated that an excellent and sustainable applied research capacity must be underpinned by excellent basic research; otherwise applied capacity will wither in a matter of years and that Ireland's reputation as a location for science and innovation and the reputation of individual universities depends on a commitment to basic research. This is important for foreign direct investment and enterprise development generally. A move away from basic research is thus considered to be self-defeating, even from an enterprise perspective.

However, alternative views are also expressed in that because of our demographics and focus on our inward investment we need to focus on the applied side as we may never have the critical mass for international excellence. The example of the pharma sector is quoted. This sector has a particular interest in basic research and as a result Pfizer located a corporate lab in Cambridge because of the quality of basic research in that locale. More than the distinction between basic and applied research the need for all research to be excellent is emphasised. Needs driven basic research is dynamic whilst excellence is a cross-cutting factor.

Some argue that it is not really about basic and applied. Instead one should think of projects having different time horizons, we need science that is based both on the short term and the longer term. A balance must be achieved between near time imperatives and the longer term grand challenges. It is necessary to identify the emerging areas of the future and put sufficient funding into those. The current time horizon of looking forward by 5-10 years is not sufficient. What is missing from the current system is funding for research that is more exploratory, higher risk and further down the

road but which could have a significant impact. We have become more risk averse. Indeed, what we call basic may not be considered basic in other countries. Funding needs to be strategically aligned with the national interest and sectoral interests.

How can we answer the question of basic vs applied without discussion on the vision we are trying to achieve? What outcomes are we trying to achieve? We are not good at horizon scanning or having the detailed knowledge to inform what the next big area/sector of opportunity is and then to hone the skills necessary to service this new area.

Alternatives to the basic-applied criteria include a suggested emphasis on Technology Readiness Levels (TRLs), interdisciplinary research and excellence per se. The best researchers do both basic and applied research without categorising into one or the other. It is suggested that the data is telling us that we are quite strong at the lower TRL levels while SMEs are saying that that we need more funding for the closer-to-market research. (In a consultation with 60 MNCs in Ireland, it was found that they would see TRL level as a more accurate barometer than basic versus applied). Defining between basic and applied research does not help with cross TRL activity. The TRL graph demonstrates that there is a need to rebalance and put in new money for SMEs and MNCs to leverage higher TRL research activity. A key issue for business is the disproportionate level of funding going to lower TRLs. However, the question is posed as to whether HEIs have the ability to work across the TRLS.

It is suggested that public funding of applied research is necessary to entice MNCs to start research in Ireland. To achieve this one needs to invest more at the higher TRLs. However, this should not be done by replacing investment in lower TRLs – additional investment is required. International best practice suggests the one third rule (1/3 core, 1/3 industry & 1/3 competitive) for applied research. The view is expressed that there was also a need to focus on the high TRLs the same way that Europe is. The vision should be to have a flat TRL curve. However, there are contrasting views. high TRLs should not be the main focus of universities potentially replacing the lower TRLs. On the other hand surprise is expressed by some that there is not more funding going to the higher TRLs as this is seen as the area where one might get more funding from industry and ultimately this will drive more funding into the lower TRLs.

The nature of collaboration between researchers in research centres and researchers outside research centres is important and growing, e.g. in Tyndall. This has the potential to move things along the continuum. In some research centres one can observe a drift towards applied research as this is the better source of funding regardless of whether the initial intention was to work on basic research. It is suggested that collaboration between centres is required at a much higher level to induce better outcomes.

The barriers facing SMEs wanting to collaborate with Higher Education Institutes are considered considerable. Nevertheless, the strength in the Institutes of Technology in particular is that they have the industry expertise, especially in relation to engagement with SMEs, and this can apply right across the research continuum. There is also an opportunity for business to business networking at regional level. Companies want to use the Higher Education Institutes (HEIs) as a place to network, business to business. Support is expressed for the industry liaison function in our HEIs. It is suggested that currently companies in effect have to go knocking on the doors of the HEIs rather than the other way around.

There is a perceived deficit in the 'research ecosystem' particularly for indigenous companies in moving from early stage research to higher tiers. This gap needs to be bridged. Ireland could use the advantage of high MNC penetration to leverage this to build indigenous capacity around the MNC

sector; play to our strengths and have applied research that in turn informs basic research. Basic research should have a link to the commercial environment with the huge societal challenges that exist. It is suggested that - over time – the MNC applied research engagement will deepen to include basic research. It is considered significant that the doubling of PhDs under the previous strategy was instrumental in established MNCs being able to persuade corporate HQ to increase levels of investment here. Although industry PhDs and the employment based model could be considered good practice – they cannot and should not take the place of standard academic-based approaches to PhD education.

A key issue for the HEI sector is core funding versus competitive funding. The core grant is allocated by the number of students and the universities decide how to use it. The key contribution of the core grant is that it pays all the salaries of the researchers who can also be lecturers. Participants emphasise the need for long term core funding which should be at an adequate level to allow multi-year strategic planning cycles. This core funding should go beyond just covering salaries: institutions need some discretionary core funding in addition to the competitive funding in order to build & maintain capacity.

Some suggest that overall funding should be half and half core versus competitive but the view is also expressed that competitive funding is the best way to increase excellence and that even some of the core funding should be competitive. It was stated that 5% of the current core grant is competitive. It is considered important that institutes have enough resources to provide stability. The view is expressed that there needs to be a degree of stability and if it was all competitive it would create a lot of instability in the system.

It is pointed out that research in the IOT sector primarily has to come from external sources. To receive core funding is seen as the challenge for IoTs. HEA core funding has been greatly reduced in recent years. Core funding for research institutes is considered necessary to create stability.

It is considered essential that core funding is increased as the system is severely stretched at the moment. This is evident in teaching labs which need to be updated. The welcome increase in undergraduate numbers in certain disciplines has unfortunately been coupled with a decrease in postgraduate students who are an essential part of university teaching, particularly in relation to lab supervision. Another area of concern is the decrease in the number of technicians in universities - people leave/retire and are not replaced. However much of the research equipment depends on the expertise of technical staff in these labs. The lack of technical support will also constrain any efforts to widen the use of equipment for industry collaboration.

On the balance of core funding and competitive funding it is considered that competitive grants can only work properly if there is a sustainable (funded) base on which to build. A balance is therefore needed between core and competitive funding. A focus is needed on competitive funding for the purposes of international peer review.

It is considered important to understand what flexibility is present in the system. How much of the funding is really already tied up in block grants, teaching assignment etc? Only new money or a change to such structures could drive the flexibility the system needs to have in the medium term.

Alignment with research prioritisation is seen as a key issue by some. However, some see research prioritisation as working against economic and societal balance. The lifecycles and timescales of research vary from sector to sector. Therefore different strategies are needed in different sectors. Prioritising strategic areas of research for investment is sensible but this cannot be the totality of our investment strategy. Also, it is argued that implementation of research prioritisation has left no

room for the unanticipated. It is a big risk for the country if there is no mechanism to take on new and emerging areas. While research prioritisation has been detrimental in the view of some it was also said that the strategy should align with the EU and that research prioritisation has had a substantial impact and positions Ireland well. Equally, it is seen as necessary to be selective as one cannot be a leader in everything while research prioritisation has also proven its value during difficult economic times when research prioritisation and its impact were key to securing and maintaining budgetary allocations for research funders against the backdrop of decreasing public finances.

The view is expressed that we should not lose sight of the kind of society we want to live in and also cultural heritage is important. Very little funding goes on the human sciences and humanities and yet their contribution is immense. The strategy should be more imaginative.

Whatever about the balance between basic and applied, it is suggested that the real question relates to the source of funding. There is a need to develop a mechanism to determine the levels of funding balance and the source of funding – the two issues are seen as interlinked. It is pointed out that the combination of PRTL and SFI over the 2000s was very powerful for building Ireland's research capacity from essentially zero. This shows the value of diversity of funding instruments.

In terms of international best practice, reference is made to Denmark and Germany in terms of link between industry and research institutes. Israel is seen as a good example of how to turn “science” into businesses where MNC's are used to ‘spawn’ spinout indigenous companies.

#### **A few quotes from the day:**

**‘We need to be honest and acknowledge that not everyone in HEIs is doing research.’**

**‘Research funding should be mainly competitively won.’**

**‘One will not get the rankings from applied research alone.’**

**‘Doing applied research builds credibility and gains confidence of the corporate HQ.’**

**‘Ireland is a small country and cannot do everything well.’**

#### **Theme 1: Supporting the Full Continuum of Research**

**Question 2: What is the appropriate balance between research for economic benefit, for societal benefit and to support policy and practice, how can we maximise the synergies between these and how should we measure success?**

Many argue that there is no difference between research for economic or social benefit: ‘they are effectively one and the same thing’. Not only are they linked (e.g. climate change, ageing demographics) but there are also significant spill over benefits. They are mutually beneficial. It is suggested that no distinction between economic vs societal should be made as it is a matter of timescale; long term societal relevance has economic impact, and strong economic impact (jobs, wealth and innovation) has societal impact. It is even suggested that it may not be clear what societal impact means or what the posed question is aimed at.

Some contend that research for societal benefit needs extra support. There are societal challenges (eg climate change) that industry may not look at. Also, we are global citizens and we should be

performing research which is feeding into world development. It is therefore suggested that a research fund is needed for societal impacts while there must be continuity of strategy – ‘play the long (economic) game’. While the point is made that the SFI approach to impact is based on a narrow definition of economic impact only, it is also stated that it is up to the researcher to demonstrate the impact of their research – it is this narrative that gets assessed.

In terms of measuring impacts, the point is made that research provides not just trained people but knowledge. While societal impacts are more difficult to quantify and measure and are more longer term in nature, they have huge economic benefits. The generation of human capital also has an important impact. The question of how to quantify impact is difficult but it is also considered necessary. While there are a range of metrics used (e.g. publications, Institutional Rankings of HEIs), it is perhaps more about good communication: ‘if we could communicate better, we would have to measure less’. Quality of research is also emphasised as a driver. If the focus is on excellence; and the spread of funding is kept broad; societal impacts will be generated and human capital will emerge.

Many argue that the word ‘strategic’ is missing; whereas a strategic approach is needed. The question should be posed of how does research prioritisation fit around a country’s challenges, e.g. in terms of our large spend on healthcare. National research prioritisation to date has created a difficulty for access to funding for the humanities. We need clarity on how those areas outside of research prioritisation will be funded going forward. The perception is that the National Research Prioritisation Exercise (NRPE) is too restrictive and narrow and that, for example, health research has not done well out of NRPE as societal research is not prioritised.

A strategic approach in terms of leadership requires that we must identify what areas we want to lead in. There may be too many priority areas. We may need to invest in fewer priorities. Agri-Food has been the area where we have won substantial funding in Horizon 2020; this is a specialist area to us. We are delivering globally in terms of excellence in this area.

Governance and organisational structures are key to an innovative society. Therefore we should invest in this as a research topic in its own right: research for policy. Identify problems of relevance to the broader society and orient the research around those challenges. Focusing in on the research that appears the most relevant from a market perspective may therefore be the wrong approach. See box.

#### **The Shortcomings of Market Based Criteria**

Take the work done on radiation impact on astronauts. It would never have been funded under narrow market-oriented criteria. However, that research is now impacting on cancer research which is both a societal challenge and part of a major industry. One can’t separate these things. Tourism is another example - in other countries research into cultural heritage (archaeology etc.) directly feeds into the tourism sector. In Ireland, we have a rich cultural heritage including major tourism opportunity in the east of the country.

The EU approach is quoted as best practice. H2020 is a vehicle for giving a picture of all societal impacts. The EU is driving societal challenges and interdisciplinary research (including social sciences) through its programmes which have a societal and economic (enterprise) outcome. In

contrast, the current NRPE approach is seen as siloed and not multi-disciplinary. H2020 presents a good mix and match between economic and societal. Perhaps the strategy could map closer to these pillars.

Finally, an interdisciplinary or multi-disciplinary approach is seen as a major feature of getting the balance right. The future of research is interdisciplinary. For innovation, a multi-disciplinary approach is also seen as critical. Societal and economic benefit should drive each other through such an approach.

#### **A few quotes from the day:**

- **‘What societal benefit research does not have an economic benefit?’**
- **‘A good number of societal challenges require multi-disciplinary inputs.’**
- **‘We're still new to the game and we need to mature.’**
- **‘Building a knowledge economy is as much about societal issues as about economic ones.’**
- **‘The future of research is interdisciplinary.’**
- **‘High tech companies employ less engineers than one might expect relative to the numbers they take from the humanities.’**

### **Theme 2: Enhancing Collaboration Between Business and Academia**

#### **Question 3: How can we encourage more collaboration between academia and enterprise?**

It is hard for industry to know what is there. Surveys have shown that after funding, the biggest barrier for industry is information about what is out there and what each scheme offers. The myriad of schemes needs to be simplified. The current fragmentation is the perceived key issue from industry and industry is generally not aware of the competencies in public research system. Many SMEs do not know how to find the necessary expertise across the public research system.

It is about communication and contacts. For scientists in the universities, they must realise when an idea has commercial potential and they need to be educated as to how to link in with industry. More exchange between academia and industry would be useful. A lot of companies do not know about the schemes e.g. innovation vouchers. Industry is not aware of what is already available in terms of support for research collaboration. Some researchers are not good at interacting with industry.

Building and brokering relationships between both sides – industry and academia – is seen as very necessary. Industry needs more frequent levels of engagement and more intense levels of contact. There is an urgent need for a brokerage service to help industry navigate the system.

Industry is a follower reacting to HEIs and needs to step up and begin to set out their requirements. Industry research largely exists in a parallel ecosystem – it is not strongly connected to HEIs. Clarity is required on who does what. What is the difference between SFI and EI for example?

There is also a need for a greater understanding of what industry needs and a need for enhanced communication from Higher Education Institutions (HEIs) to industry about their capabilities.

There may be obstacles also. There may be (perceived) overlap between institutions and a need for creating centres of excellence. Intellectual Property (IP) is an issue and needs a national framework. While this is now in place, more clarity is needed in what it entails. Technology Transfer Offices in HEIs are seen as too defensive and protective. Especially small companies are getting lost in the plethora of schemes and programmes. There are so many funding schemes it can be confusing for industry.

The increase in collaborations is welcome but the question is asked whether more collaboration is always better. Should we consider the nature and type of collaboration to achieve the objectives posed in the question? Collaboration would work much better if industry and HEIs understood each other's needs better. However, it is also noted that Ireland is doing a good job in putting the instruments in place for collaboration such as SFI centres, EI/IDA Tech centres, schemes to encourage mobility. Knowledge Transfer Ireland is there and can be expanded upon.

A number of suggestions are made to achieve greater collaboration:

- *Industry placements*: most colleges have industry placements now.
- *Open access points*: an open access point to the HEIs in terms of liaison needs to be looked at once more.
- *Innovation Vouchers*: Enterprise Ireland Innovation Vouchers are an example of small instruments to get industry going. For €5,000 companies can dip their toes and the initiative has been very successful.
- *Employment of graduates*: put graduate(s) into a company and most will be kept.
- *Data*: the EI database (40 years of data) is valuable and should be used more.
- *Staff rotation*: staff rotation between and to industry should be supported.
- *Horizon 2020*: H2020 is an excellent opportunity and project management skills are improved through participation.
- *Cooperation models*: we need to foster three-way collaborations: HEI + MNC Irish operation + MNC corporate HQ in US.

A certain regional focus and agenda is considered necessary. Industry wants to connect into the local Institute of Technology and find out who will solve their particular problem or issue. The question is how to incentivise collaboration. It is important for industry to know what the competencies are regionally and it can be difficult to know these for companies. One instrument is regional clusters between IoTs and Universities and regional firms.

There is a question to be addressed about the role of research in relation to the next wave of products. In ICT this is as much by acquisition of tech companies as by R&D. Also, SMEs are very different and need a very different model to the MNCs. For SMEs research is not necessarily a priority. One also need to be clear on what 'research' is; very often what is given to a company is 'consultancy' not research. Often access to a modest piece of equipment can make a difference to a company.

It is suggested that the HEI sector needs to focus on engineering and manufacturing. The current lack of focus on manufacturing engineering is a missed opportunity for the HEI sector. This point is made vigorously: there is a need for large scale investment in manufacturing research. We need to increase our focus on engineering based research. This needs to be mentioned in the strategy.

The Irish Centre for High-End Computing (ICHEC) was cited as a useful example of basic skills transfer to industry. The Tyndall model works well for licensing and should be looked at (see box). In Germany Fraunhofer sits on top of the structure so that HEIs and companies share the same vision, strategy and teams. HEI funds the research which is then shared with the Research Technology Organisations when at the point of design for manufacture thus it takes an idea and moves it from idea to plant floor. Also, one should look at performing resource centres, e.g. NIBRT.

#### **The Tyndall Institute**

Some shining examples are quoted including Intel and Tyndall. A lot of people in Tyndall are from industrial backgrounds. It is difficult for traditional academics to have the same connection with companies. Tyndall has a “machine” for H2020 applications and offers this service to SMEs.

#### **MIT’s Media Lab, and North Carolina Research Triangle Park**

MIT's Media Lab is placing industry people there to explore research outcomes that might be of value to that company e.g. Fujitsu, Motorola, Lego, and to replicate a variant on it in Ireland. The concept is based on acceptance of the fact that it is industry's own people who are best placed to identify research developments which would be of value to individual companies rather than academics and/ or administrators trying to guess what these needs are. The North Carolina Research Triangle Park is also cited as example of best practice; Ireland could develop a central Institute to market Irish research expertise internationally, RTP has grown its staffing to some 2,000 - most of them being research scientists located at RTP - by marketing the research expertise of the three prominent universities in NC; Ireland could replicate that success given its positive and non-aligned image internationally. It could also engage a number of Research Centres in Ireland to develop joint and multi-disciplinary research projects and proposals and also ensure the greater use of high cost facilities in research centres.

#### **Knowledge Development Box**

With the removal of the “double Irish” tax avoidance mechanism, the forthcoming Knowledge Development Box represents a great opportunity to increase industry funding of research in the public system. Industry will require academics to undertake research in order to avail of the KDB (the IP must be generated here in order to qualify). However, this is contingent on the scope of the KDB – if the scope is too broad i.e. it includes intangibles then MNCs could source the IP from abroad and claim that it originated here.

### Best Practice: ESA

Large scale international projects lend themselves to natural collaboration between academia and enterprise – i.e. there is a common goal in the project's mission. A good example of this is the European Space Agency (ESA) which is particularly successful in attracting SMEs to develop niche products for specific mentions. As this technology is at a very high level it gives companies a significant edge in them bringing the product to a wider market. Other international projects such as the ESO and CERN have a very similar profile in having strong research and industry linkages. 'For ESA contracts, the economic multiplier is 7, and a similar one will hold for ESO'. Investment in these areas will lead to significant industry return as evidenced by other member countries. It is noted that at least 16 Irish companies are supporting the case for Irish membership of ESO - a good example of a research/industry collaboration arising from a shared goal.

#### A few quotes from the day:

- **'Industry wants one place they can go to get all the relevant information.'**
- **'It is all about relationships.'**
- **'We have an SFI but we don't have an Engineering Foundation of Ireland!'**
- **'A one-stop shop approach is needed for industry-academic engagement.'**

### Theme 2: Enhancing Collaboration Between Business and Academia.

#### Question 4: How should we realise and measure the impacts of research activity?

Many metrics are suggested: economic metrics (e.g. GDP growth), whether companies are acquired, number of PhDs, surveys, impact case studies, publication and citations, time to achieve an agreement, sales and jobs from a piece of research, income generated, rankings based on excellence, repeat business, intellectual property (IP), patents, spinouts, international reputation.

*Surveys* can be valuable to measure impact on those who are benefiting such as employers and civic society. The new Employers Survey of IRC is quoted as an example. The actual impact of patents or spinouts can be tracked via employer satisfaction surveys.

By making it compulsory to do *impact case studies* and have them vetted by international panels and benchmarked against best practice, impacts can be measured.

In specific sectors such as Health, one can use specific measures like 'new technologies introduced' or 'attraction of clinical trials to Ireland'.

A key metric in terms of industry engagement is how much money industry has invested in research. The metric '*income generated*' can measure the income coming in from the company to the HEI. Measuring the number of repeat customers (*repeat business*) is a powerful measure of impact.

The measurement of the human capital element is also important. Measuring impacts on *skill levels* is difficult to capture but considered important. Industry to industry collaboration is also important

and should be measured. How do institutions engage with their alumni? Fraunhofer has its red book alumni system. LinkedIn is seen as a good source of alumni tracking.

It may also be appropriate to include negative metrics - what is lost if the system chases particular metrics to the detriment of others.

While the metric number of PhD is mentioned, it is emphasised that one must also measure how many PhD researchers are retained in Ireland. For many PhDs and post-docs there is no clear career path which can lead to emigration. The number of PhDs should be increased but they need a career path in the research sector. We must ensure that we are producing the “right kind” of PhDs so that they will be employed in industry.

Where academia has multiple engagements with one company, this is an indicator of value. The Small Advanced Economies initiative is mentioned as having a suite of metrics for measuring impact.

Metrics do not necessarily capture quality and quality metrics are needed. Inappropriate metrics can lead to undesired or perverse outcomes. Best practice combines quantitative and qualitative (case-studies) measures and looks at a wide range of issues. The point is made that the outcome may need to be more in the narrative and not just metrics. Also it is pointed out that there is a need to take a longitudinal approach and look at more macro trends over a longer time. These type of longitudinal studies are not common in Ireland.

According to industry representatives, the recent re-constitution of the Irish Centre for Manufacturing Research, coordinated jointly between the IDA and EI, and involving both MNCs and SMEs, is an example of best-practice.

There may be an over-emphasis on citations. Researchers with a high level of experience in industry find it hard to get into academia as researchers and lecturers. The point is also made that we must distinguish between institutions and individuals.

#### **International Examples**

The Netherlands has developed a framework for impact assessment with real buy-in from stakeholders – one could look at this for a broad set of impact measures. The UK approach is relevant also. It is based on a broad interpretation of impact measurement, not the narrow approach adopted in Ireland which centres on licences and spin-outs as the main (only) outputs of research that matter. We need to find better metrics for following the money through from the outputs of HEIs through to how they generate value within a company. The Danes are very good at this. They have longitudinal tracking of graduates over many years.

### The Example of Teagasc

The list in the question (publications, citations, intellectual property, spinouts, startups, contract research, consultancy services, international benchmarking and societal benefit) contains activity indicators rather than impacts. The point is made that the list does not capture the transfer of know-how. An example of this is the transfer of knowledge from the Teagasc advisory service to farmers. There is a need to measure what has changed over time to gauge the impact of such knowledge transfer. In the case of Teagasc an annual survey of farm productivity is carried out. Teagasc is seen as an effective structure outside of the university structure albeit with strong collaborations. It was 50 years in the making. It is also quoted as a good example of industry engagement.

#### A few quotes from the day:

- **'The approach has to be more sophisticated than just numbers.'**
- **'Key question is why so few companies have signed up to H2020?'**
- **'Ireland is ranked number one in terms of skilled labour. This is a major metric of success.'**

### Theme 3: Evolving the Research Landscape

#### Question 5: How do we ensure that we have sustainable research infrastructure to meet future needs having regard to awareness, access and funding?

The point is made that infrastructure is more than just buildings and equipment. As an example the impact of legislation such as the Health Information Bill is quoted. The unique patient identifier can be seen as an example of infrastructure and provides a rich opportunity for big data.

Adequate technical support is mentioned as an important element of infrastructure. There is an issue of ongoing maintenance needs that are not currently serviced. Technical and support staff have declined and this needs to be addressed. HEIs are unwilling to renew technician's contracts beyond five years due to the Fixed-Term Work Act.

Data repositories, access to open data, archives etc. are seen as essential infrastructures in any system while access to journals is very important for humanities researchers.

It is suggested that duplication of equipment is an issue, e.g. throughout the HEI sector. This needs to be reduced. The Large Items of Research Equipment (LIRE) database will help in this as well as allowing access to equip by others to ensure maximum usage.

In terms of collaboration with industry good examples of collaboration are noted but a systematic approach is lacking. Research infrastructure is hugely valuable to industry. DCU has pooled all its equipment into one facility; Tyndall interacts well with industry.

The location of research centres is considered important. Industry could prefer that these are located outside universities as this could facilitate the development of clusters. Mixed use of buildings facilitates the development of synergies and industry-industry collaboration can also develop.

There is a perception that when one receives a grant one owns the equipment but it should be available for all to use. There usually is a requirement that equipment is made accessible to all potential users and there are national guidelines for this. It is noted that one must open up the facility to other countries under the European Strategy Forum on Research Infrastructures (ESFRI). It is noted that the PRLTI did not address open data which is a requirement for EU projects.

The National Access Programme was mentioned. Although the Tyndall model had effectively failed initially this was because there were too many applications for the number of awards. The model had since changed and it can be said that the initial model was fundamentally correct. National rather than an institutional approach might be preferred in order to avoid duplication of large, or highly specialised infrastructure.

The phrase 'sweat the asset' is frequently used. To offer up facilities to business outside of academic hours (e.g. electron microscope). Access charge models need to be simple. The Tyndall research infrastructure tracking model is praised in this regard. Utilisation reports are necessary to highlight spare capacity. The main priority should be effective usage and maintenance of existing infrastructure and buildings.

Also where there is research infrastructure it needs to be maintained to capitalise on the investment. Maintaining infrastructure is not that popular but the issue of maintenance is considered to be serious. Grants do not cover maintenance and spare parts but should make provision for funding technicians, maintenance and recurrent, operating costs. While superb infrastructure has been put in place in the last decade there is no funding for maintenance. With expensive equipment, the personnel and maintenance are expected to come from the block grant which has declined. This is not sustainable.

Funding for the science budget needs to be thought of in terms of decades rather than five years. There is also a need to avoid the "boom/bust" model where significant injections occur in good times followed by little investment in bad times. Sustainable investment across the spectrum to update equipment and facilities is needed. Sustainability of Infrastructure requires predictability of funding and this means that longer term financial support for research infrastructure is a necessary component of the Strategy.

Full cost recovery and treating the use of infrastructure as a business should be done. Access charging is part of this. If we had a proper approach to access charging, we would be able to factor in a sustainability model from the outset in the form of a revenue stream to take account of the ongoing cost of running these infrastructures. An appropriate depreciation model forms part of this.

It is mentioned that the success of PRLTI should be acknowledged as should be the importance that industry co-funding and philanthropy have played in PRLTI to date. Research infrastructure is also important to draw down Horizon 2020 funding and one needs to be smart in relation to this. Ireland can be a key player in Horizon 2020 in a small number of strategic areas and get a commitment in terms of infrastructure for those areas.

The HEIs should have the autonomy and discretionary resources to acquire a particular piece of equipment if it is required for a project. They will not incur the capital and recurrent costs of acquiring equipment if they can access it in another institution.

It is suggested that the support that is given to industry through the proposed knowledge box model should be linked into support for research infrastructure. The point is made that from an applied

research perspective we have adequate infrastructure available and this can be used to attract industry.

#### **Knowledge Transfer Ireland**

The HEA has a database with links to KTI but we need to communicate all of this better in terms of the public research infrastructure which is available to be used. KTI is certainly one way to help industry navigate the system and is one very valuable tool.

#### **National Research Infrastructure Group**

The idea is proposed to set up a single national research infrastructure group in order to facilitate implementation of the requirements for research infrastructure. The group would develop a roadmap, integrated platform and architectures to drive long term planning with re-use, give inventory transparency, carry out lifecycle and depreciation analysis, eliminate duplication across centres, centralise expert resources to cut costs /address gaps, common shared and selective access model provide multi-year operating budget certainty. The group would need to have authority over aspects of the IT budgets and labs in each NUI or research centre. The appointment of 3-4 senior technical management people to drive this is also recommended. Other tools that drive cross centre efficiency should also be owned centrally (e.g. collaborative technologies to support multi-location virtual centres).

#### **The Fraunhofer Model**

The model used in the Fraunhofer Institute in Germany is to fund centrally for five years. After that research teams must self-fund (i.e. find funding from industry) or discontinue the project. Sustainability can therefore only come from successful engagement with industry. A commercial approach is needed. Consideration could be given to the Fraunhofer model ([www.fraunhofer.de/en.html](http://www.fraunhofer.de/en.html)) of research facility which is given funding for five years and thereafter has to source business funding to ensure sustainability.

**A few quotes from the day:**

- **‘No one in the research system is prepared to have full cost recovery.’**
- **‘Do not use competitive funding for infrastructure procurement.’**

**Theme 3: Evolving the Research Landscape.**

**Question 6: How should the market focussed research centres landscape evolve to support enhanced collaboration between enterprise and academia?**

There is a clear gap at high Technology Readiness Levels (TRLs). This is the challenge. In the technology centres higher TRL levels in terms of research are being performed. The existing technology centres are considered to be attempting to be “all things to all people”. The opportunity for industry engagement is however at higher TRL levels.

There is consensus that a decision must be made on what model of research centre is best for Ireland. There appears to be sufficient market focus as the point is made that all research centres should have a market focus, both for near term application and long term research while all work done in IoTs is market focussed. However, two views are expressed in relation to how closely the centres should be linked to HEIs. There was support for the argument to take the technology centres out of HEIs and develop more stand-alone RPOs/RTOs. The point is made that industry likes research centres being located outside universities and being a single institution.

However, a contrasting view is that the centres should not be taken out of HEIs but instead maintain the links with the HEI while being given greater autonomy. Also it is noted that Ireland is too small to support good research institutions that are divorced from universities. We need to have a smaller number of technology centres of larger scale. Concerns are expressed about any plans to build research centres outside of university campuses as it is seen to decouple research from education while Ireland may not have the critical mass for a stand-alone RTO. The view is expressed that the experience with RTOs is that they have to be closely linked to the academic base and that they are drawing on the skills, talent and expertise within academia.

A proposed model for a Research Technology Organisation (RTO) is that it would provide professional R&D services to industry, demand-driven applied research, and an interface with academia. It would be complementary to the SFI Centres, but not as ‘extreme’ as a Fraunhofer institute. An RTO should have independence in mission and management, but it should be connected to a HEI.

However, co-location or location in a HEI can be both physical and virtual. It is suggested that the ‘research centre’ does not have to be a physical building; it can be a *process* e.g. challenge-centric research does not need a building. For example, the European *Joint Technology Initiatives* are based on a roadmap defined by industry and publicly-funded research.

The risk of ‘state aid’ issues is pointed out in relation to co-funding companies at higher TRL levels. State aid is simply a more challenging conundrum at higher TRL levels and industry has to contribute to circumvent/ counteract that.

Views are expressed that RTOs could become ‘static elephants’. We need to be sure an RTO can survive by ensuring we maintain the talent linkage in HEIs. We also have to ask whether it is appropriate to keep building new things – the answer always seems to be to create something new. One could end up with a lot of fragmentation – it is an indication of an inability to make hard choices. The Irish Centre for Manufacturing Research (ICMR) has recently been set up as an independent research organisation. In choosing the optimal format, it might be worth considering RTOs as an add-on to the very good system we have already.

#### **Good Examples**

ICMR (Irish Centre for Manufacturing Research) is a good example of how the Technology Centre might evolve in terms of an RPO. Dairy Processing Centre is another good example of a technology centre. The NIBRT manufacturing centre in the bio field is a good example: one can only have one nationally. ICORG (All-Ireland Cooperative Oncology Research Group) co-funded by the Irish Cancer Society and the HRB was noted as a good example of services innovation.

### The Max Planck model

The Max Planck model ([www.mpg.de/institutes](http://www.mpg.de/institutes)) was suggested as worth considering as a way to move from the university setting in which most research on this island happens currently. The UK model of “catapult centres” was also suggested as an alternative approach ([www.catapult.org.uk](http://www.catapult.org.uk)). Also suggested was that we should further develop the research institutions we already have on the island.

#### A few quotes from the day:

- **‘There are far too many centres in the Irish system.’**
- **‘What industry does not want are new buildings! We need people rather than buildings.’**
- **‘Ireland does not have the depth of industry to support a Fraunhofer-type institute.’**

#### Theme 4: Delivering a Vision of Ireland as an Innovation Leader.

**Question 7: To deliver on a vision of becoming an Innovation Leader, how should we prioritise STI investment across areas such as human capital, infrastructure, international collaboration e.g. membership of International Research Organisations?**

The basic issue is considered to be to manage human capital development and career structures as a vital underlying component for innovation leadership. Human capital is considered key, then the supporting infrastructure and the supporting environment. Human capital has to be positioned number one; all of the other elements are enablers of the skills and human capital development.

A recurring theme is the development and attraction of human capital. There is a big gap in human capital here, in relation to the presence of high profile researchers here and our ability to retain them. There is the possibility to target a small number of high achieving people. However, a better approach might be to nurture the talent we already have and the middle level people that are already there instead of cherry picking and investing heavily in a few elites.

Repeated concern is expressed that there is little to support researchers in the middle stage of their careers. There is a difficulty in recruiting Irish researchers at the higher TRL levels and we also need to be better at retaining people in Ireland. We need to grow a cohort from within the indigenous ranks and then incentivise people to come and stay. However, there is no point in blocking mobility. Maybe we should embrace connectivity and keep people connected to Ireland even if they leave temporarily. We must place a value on the researcher as a career path and a model must be put in place to ensure researcher retention.

Notwithstanding the different points of view in relation to research prioritisation, it is agreed that one cannot be a leader in everything. To be selective is essential. It is sensible to pick an area such as food science. Ireland currently has three strengths – food and agriculture, ICT and health. One view was that 80% of the spend should therefore be focussed on exactly where one has such

strengths. Health research is seen as a priority given that people are living longer over the next couple of decades. We need to mark this out in a meaningful way in the strategy with a meaningful interpretation of societal challenges. Ultimately this can be seen as research prioritisation.

One must have the business skills and also the scientific excellence. It is about connecting the two and driving the collaboration and alignment between the two. To be an innovation leader, we need to support entrepreneurship, not just researchers. Researchers may not be sufficiently aware of the jobs that are available in industry and there is insufficient engagement from the enterprise agencies to show that these jobs are available.

Ireland is small and we should exploit the associated advantages, in terms of agility, connectedness and use it in a smart way to get additional value that others don't.

Membership of research organisations such as CERN and ESO will allow collaboration with a 'community of excellence'. To be a world leader we should align with international research organisations which facilitate this. Clear and significant benefits arise from membership of these organisations which far outweighs the cost. H2020 is very important in terms of international collaboration and human capital development. We should be more focussed and more ambitious in H2020.

It is generally agreed that it is necessary to drill down into what exactly an Innovation Leader means. Does it mean that people want to come to Ireland to do research? Why do we want to be an innovation leader? Being an innovation follower can have a very positive impact. To move from innovation follower to innovation leader may require a lot of investment. We need to specify our vision and ambition first. The new Strategy needs to be clear on what we mean by innovation. Being an innovation leader is consistent with investment across the range of supports over a longer-term planning basis. This is not the case in Ireland currently: too short-term and inconsistent.

It is suggested that it may be necessary to prioritise international collaboration in order to achieve more with limited funding. To be taken seriously as innovation leaders we also need to be member of the various international organisations. The European Commission is looking at a European Research and Innovation Area and integrating research with innovation.

A clear message is not to grow the higher TRL research, which should be substantially funded by industry, at the expense of lower TRL research. Ireland needs to have brand recognition across the TRL range, i.e. it should be clear where the leaders are in any given TRL.

#### **A few quotes from the day:**

- **'To become an innovation leader, you must link industry and academia in a successful way.'**
- **'Ireland is the only developed and well established European country which is not a member of CERN and ESO.'**

#### **Theme 4: Delivering a Vision of Ireland as an Innovation Leader.**

##### **Question 8: How do we ensure that we have the people to deliver on a vision of becoming an Innovation Leader?**

The employment environment is considered very unstable. Universities don't want people to stay longer than three years or they get tenure. The system blocks career development. One must place a

value on the researcher in terms of a career path and it is suggested that the single most constructive thing would be to re-write the Fixed Term Work Act. It is considered damaging in its current formulation and counter-productive.

Having the right type of PhDs is important; the new National Framework for Doctoral Education needs to become embedded in the system. The IRC Employment Based Postgraduate Scheme is advantageous also in this regard. PhDs should be directed towards employment.

The communications issue is important in promoting Ireland as an innovation leader and we need people to translate and communicate that. It comes back to case studies to highlight progress because one can relate to it and in this way you can credibly put forward a case for more support.

Support for science at all levels is essential, right from primary school. Access is critical. We need to look at the education system in its entirety, including primary level. The figure for women in science varies across sectors (ICT very low, biomedicine very high).

We need people in the social sciences working with scientists addressing the big challenges in a multi-disciplinary way. A multi-disciplinary approach is considered necessary. Multidisciplinary training is a key issue to consider in many sectors.

To be an innovation leader we must have investment across the range of supports over a longer-term planning basis. This is not the case in Ireland where planning and investment is too short-term and inconsistent.

The connectivity between people and groups in Ireland is considered a real strength. However, there is a need for cross-government leadership programmes to bring excellent researchers into contact with excellent leaders in business spanning all disciplines and in a systematic way in areas that we have leadership and capability. Also a greater mobility (bi-directional) of researchers between industry and academia would be beneficial.

#### **A few quotes from the day:**

- **'Industry does not want quantity it wants quality but you need the quantity to get the quality.'**
- **'It is not acceptable that 23% of secondary schools do not offer physics as a subject for the leaving certificate.'**
- **'The new science strategy should be a 20 year plan.'**

### **3 Key Findings and Messages**

#### *Question one*

- To make a distinction between basic and applied research is not necessarily relevant as both can have application in the real world. There is not broad agreement on an ideal balance. Emphasis on Technology Readiness Levels (TRLs) may be more appropriate.
- There is general agreement that excellence in research is an important criterion and that the formulation of a clear vision is crucial.
- There are still considerable barriers facing SMEs wanting to collaborate with Higher Education Institutes.
- Core funding for research institutes is considered necessary to create stability. Competitive grants can only work properly if there is a sustainable base on which to build. A balance is therefore needed between core and competitive funding. Different views are expressed regarding the appropriate balance.
- Views are expressed both in favour and against the research prioritisation. The arguments in favour are that it is necessary to be selective, that it has positioned Ireland well and that it has been valuable during times of scarce public funds. The arguments against are that it may work against economic and societal balance and leave no room for the unanticipated.

#### *Question two*

- There is no clear dichotomy between research for economic and societal benefit because the same research can have both economic and societal benefits. Both require support. However, a strategic approach is needed. This may mean that research for societal benefit needs extra support. It may also mean concentration on few priorities. Research for policy is also seen as important.
- The EU approach under H2020 presents a good mix and match between economic and societal. Perhaps the strategy could map closer to these pillars.
- The question of how to quantify impact is difficult but it is also considered necessary. Quality of research (demonstration of excellence) and good communication are seen as important factors.

#### *Question three*

- It is sometimes difficult for industry to know what is available. The myriad of schemes needs to be simplified. Suggestions are made to achieve greater collaboration between industry and academia, e.g. industry placements and employment of graduates. A certain regional focus and agenda is considered necessary as well as brokerage service to help industry navigate the system.
- Certain obstacles for collaboration between academia and enterprise are suggested. These include: perceived or real overlaps between institutions, intellectual property issues, lack of clarity and simplicity in relation to the available schemes.
- It is suggested that the HEI sector needs to focus more on engineering and manufacturing.

- Institutional structures such as the Tyndall Institute and the German Fraunhofer model are held up as best practice examples.

#### *Question four*

- Quantitative metrics are important and many are suggested. However, metrics do not necessarily capture quality and those types of metrics are needed including the measurement of the human capital element. Surveys, narratives and (impact) case studies are suggested as useful approaches.
- While the metric number of PhDs is relevant, it is observed that many PhDs and post-docs find it difficult to find employment. A career path is needed.
- There is a need to take a longitudinal approach and look at more macro trends over a longer time.

#### *Question five*

- Infrastructure is more than just buildings and equipment. Access to data, for example, is seen as essential infrastructure.
- Maintenance needs and technical and support staff needs are not sufficiently taken into account and this is raised as a serious issue.
- Duplication of equipment is an issue. In order to achieve effective usage, equipment should be available for all to use and this requires access monitoring programmes.

#### *Question six*

- While it is acknowledged that research covering all TRLs is needed, different views exist about the appropriate TRL levels. The aim is to have a balance across the levels.
- A decision must be made what model of research centre is best for Ireland.
- There are contrasting views on how closely research centres should be linked to HEIs. While the point is made that industry likes research centres to be located outside universities, the benefits of links to HEIs are also acknowledged. Perhaps RTOs could be linked to HEIs but independent with their own mission and management.

#### *Question seven*

- It is important to define what an Innovation Leader is. Longer term planning is vital.
- Human capital has to be positioned number one, all of the other elements are enablers.
- There is consensus that there is a big gap in human capital. While different points of view are expressed on the best way of achieving high quality researchers in Ireland (e.g. home-grown vs. attracting talent internationally) there is consensus that a model must be put in place to ensure researcher retention including career paths.
- One cannot be a leader in everything and it is suggested that it might be good to focus on a sector or sectors. The sectors of food and agriculture, ICT, and health are suggested and it is clear that this may lead to research prioritisation.
- Business skills and the scientific excellence must be combined to achieve results.

- Membership of international research organisations such as CERN and ESO is suggested to be important.

*Question eight*

- It was suggested that the employment environment for researchers is considered very unstable and employment legislation leads to short term contracts.
- Having the right type of PhDs is important and PhDs should be directed towards employment. Greater awareness of employment opportunities in industry may help.
- A multi-disciplinary approach is considered necessary and this means diversity in teams. Multidisciplinary training is seen as a key issue.

### Appendix A – Facilitators and Note Takers

	<b>FACILITATOR</b>	<b>NOTE TAKER</b>
1.	Mary Doyle (Department of Education and Skills)	John Dooley
2.	Nuala Bannon (Department of Environment, Community and Local Government)	Andrew Gavin
3.	Christy Mannion (Department of Education and Skills)	Brian Dalton
4.	Audrey Hagerty (Department of Health)	Michael Davitt
5.	Muiris O'Connor (Higher Education Authority)	Anne Coleman Dunne
6.	Nicki O'Connor (Higher Education Authority)	Eamonn Cahill
7.	James Conway (Department of Finance)	Marcus Breathnach
8.	Rory Hinchy (Department of Communications, Energy and Natural Resources)	Julia O'Malley
9.	Margaret Stanley (Department of Foreign Affairs and Trade)	Siobhán Fitzpatrick
10.	Brian O'Neill (Enterprise Ireland)	Ian Hughes

## **Appendix B - Guidelines for Note Takers**

In order to improve the robustness of the analysis, it is desirable that results from the discussion at different tables can be compared. For that reason it is suggested that comments are categorised insofar as is possible and practicable under a set of headings. Such a methodology of recording points made by experts on the workshop topic in a systematic manner will improve the robustness of the final report of the consultative workshop. It is therefore suggested that note takers record issues raised in a standardised format to facilitate processing in the plenary discussion and afterwards. The standardized format or template is not rigid and categories can be added. However, the following (random) list suggests a basis.

### *Issues raised*

It is desirable where issues are raised by participants these are identified with 'keywords' (perhaps underline the keywords while taking notes). These keywords can then be used to compare discussion at different tables on the same topic. Examples: funding, balance, public sector etc.

### *Examples*

In discussions people often use examples to illustrate points. Try to capture these and identify these in the notes (e.g. capital letter E in the margin). Good examples worthy of presentation in the plenary session can perhaps also be highlighted so that the moderator can collect these during the session.

### *Best practice*

While examples illustrate points made, best practice is seen by those referring to it as a model for others to adopt. Try to capture examples of 'best practice' and record whether there is consensus around the table or whether views differ.

### *Contrasting views*

Where there are contrasting views on an issue between participants, these should be recorded. Ideally, the facilitator will seek to make these explicit and check that the different views are correctly interpreted by checking with those who express them.

### *Yes/No answers*

While the questions are precise and explicit, it may not be the case that there is a simple answer given by the participants. Where the answer is clear this should be recorded.

### *Alternative questions*

Participants may suggest alternative questions or 'sub-questions'. These alternative questions should be recorded even if they do not lead to discussion. The same applies to 'sub-questions'.

### *Statements*

Where participants make very pertinent statements (e.g. 'all research is applied research'), try to record these even if they are not discussed. Where people make original statements that are worthy to be quoted, these should be captured for possible mention in the plenary session.

## Appendix C – Programme

08:30-09:00 Registration and Coffee

09:00-09:30 Introduction

09:30-10:20 Session One: Supporting the Full Continuum of Research

Question 1: What is the appropriate balance between funding for basic and applied research in Ireland and how should funding be distributed between core funding and competitive grants?

Question 2: What is the appropriate balance between research for economic benefit, for societal benefit and to support policy and practice, how can we maximise the synergies between these and how should we measure success?

10:20-10:45 Plenary

10:45-11:15 Coffee

11:15-12:05 Session Two: Enhancing Collaboration Between Business and Academia

Question 3: How can we encourage more collaboration between academia and enterprise?

- to contribute to national economic and societal development in all regions
- to improve research capacity in enterprise and academia
- to engage more enterprise in research and innovation
- to maximise enterprise and academic participation in Horizon 2020 to address global challenges

Question 4: How should we realise and measure the impacts of research activity?

- Publications, citations
- Intellectual Property (e.g. patents, licenses, agreements), spinouts, startups
- Contract research, consultancy services
- International benchmarking
- Societal benefit

12:05-12:30 Plenary

12:30-13:30 Lunch

13:30-14:20 Session Three: Evolving the Research Landscape

Question 5: How do we ensure that we have sustainable research infrastructure to meet future needs having regard to awareness, access and funding?

Question 6: How should the market focussed research centres landscape evolve to support enhanced collaboration between enterprise and academia?

14:20-14:45 Plenary

14:45-15:00 Coffee

15:00-15:50 Session Four: Delivering a Vision of Ireland as an Innovation Leader

Question 7: To deliver on a vision of becoming an Innovation Leader, how should we prioritise STI investment across areas such as human capital, infrastructure, international collaboration e.g. membership of International Research Organisations?

Question 8: How do we ensure that we have the people to deliver on a vision of becoming an Innovation Leader?

- Having regard to the Pipeline of Researchers, Researcher Careers (including gender balance), Mobility of Researchers (including movement to industry) and balance between / quality of PhDs/Post Docs/Masters

15:50-16:15 Plenary

16:15-17:00 Final Discussion and Closing Remarks

## Appendix D – Invitation Letter

Dear

A Consultative Forum on the successor to the Strategy for Science, Technology and Innovation<sup>2</sup> will be held on **Wednesday 8<sup>th</sup> July in Farmleigh House**. The Forum will take place over the full day (programme attached) and will provide a superb opportunity to elicit the views of stakeholders around specific themes and topics in the development of a successor to the Strategy.

Your participation in this Consultative Forum is requested. The new Strategy will be prepared by the Interdepartmental Committee for Science, Technology & Innovation. The Forum will address a number of thematic areas that have emerged from discussion in the Interdepartmental Committee and from inputs received by written submissions on the Consultation Paper<sup>3</sup> (attached). After the Forum event, a report will be prepared which will form an important input into the preparation of the new Strategy.

I would very much appreciate if you could confirm as soon as possible but no later than **Friday 3 July**, whether you can participate in the event.

On behalf of the Department of Jobs, Enterprise and Innovation,

Yours sincerely,



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Hendrik W van der Kamp  
(Moderator for the Forum)

*In confirming your attendance please include any specific dietary requirements and/or food intolerances you may have.*

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<sup>2</sup> *Strategy for Science, Technology and Innovation 2006-2013*, Dept. of Enterprise, Trade and Employment, Dublin July 2006.

<sup>3</sup> *Consultation Paper for Successor to Strategy for Science, Technology and Innovation*, Interdepartmental Committee on Science, Technology and Innovation, February 2015.

## Appendix E – List of Acronyms and Abbreviations

<b>Acronym</b>	<b>Meaning</b>
AHSS	Arts, Humanities and Social Sciences
BERD	Business Expenditure on Research and Development
CERN	European Organisation for Nuclear Research
CID	Contract of Indefinite Duration
EI	Enterprise Ireland
ERC	European Research Council
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Southern Observatory
GDP	Gross Domestic Product
HEI	Higher Education Institute
HERD	Higher Education Research and Development
HPSU	High Potential Start Up
H2020	Horizon 2020
ICMR	Irish Centre for Manufacturing Research
ICORG	All-Ireland Cooperative Oncology Research Group
IDA	Industrial Development Authority
IDC	Interdepartmental Committee
IoT	Institutes of Technology
IP	Intellectual Property
IRC	Irish Research Council
KTI	Knowledge Transfer Ireland
LIRE	Large Items of Research Equipment Database
MNC	Multi National Company
NIBRT	National Institute for Bioprocessing Research & Training
NRPE	National Research Prioritisation Exercise
OECD	Organisation for Economic Cooperation and Development
PRLTI	Programme for Research in Third Level Institutions
R&D	Research and Development
RI	Research Infrastructure
RO	Research Organisation
RP	Research Prioritisation
RPO	Research Performing Organisation
RTO	Research Technology Organisation
SIF	Strategic Innovation Fund
SFI	Science Foundation Ireland
SME	Small and Medium Enterprises
STEM	Science, Technology, Engineering and Maths
STI	Science, Technology and Innovation
TC	Technology Centres
TRL	Technology Readiness Level