ICSTI

IRELAND

Irish Council for Science, Technology and Innovation

ICSTI Statement

Strategic Technology Platforms

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Contents

Irish Council for Science, Technology & Innovation (ICSTI) Established 1997

Functions

- To advise on science, technology and innovation policy-related issues in response to specific requests from the Government (through the Minister responsible for Science and Technology) or from the Board of Forfás;

- To advise the Minister responsible for Science and Technology, the Office of Science and Technology and the Board of Forfás on the Council's own initiative, on policy for science, technology and on related matters;

- To advise the Minister on the strategy for the preparation and implementation of national programmes in science, technology and innovation;

- To advise the Minister on the strategic direction for State investment in science, technology and innovation;

- To undertake, from time to time, such other functions as the Minister may decide.

Summary

The Irish Council for Science, Technology and Innovation (ICSTI) has prepared this Statement as a follow up to its Technology Foresight exercise, completed in 1999, which led to Ireland's focused investment in research in the areas of information and communications technology (ICT) and biotechnology. In this Statement, ICSTI proposes the development of Strategic Technology Platforms as a mechanism to improve the effectiveness of research investment and its strategic direction. Critically, this mechanism includes a central role for enterprise, which represents a novel approach to strategic Research and Development (R&D) planning in Ireland. This is particularly important, given the ambitious targets set for Ireland in the recent Irish Action Plan for Promoting Investment in R&D to 2010 (Forfás, 2004). The proposal aims to foster continuity in the Technology Foresight process and to build on the initial achievements of that process in the context of the current science, technology and innovation (STI) and enterprise environments.

In preparing the Statement, ICSTI examined how other countries are determining and investing in technology platforms. It emerges that, while most countries are wary of 'picking winners' among research areas in a narrowly defined sense, many recognise the need for selectivity and focus, at least at the level of broad fields of R&D. Several countries have built on the results of their Technology Foresight work to identify priority areas for national R&D investment. The term 'technology platform' is used in different ways by many of these to describe these priority areas – there is little consensus on what precisely a national Strategic Technology Platform is.

In this context, ICSTI proposes a definition of Strategic Technology Platforms for Ireland, and outlines a process for identifying and developing such platforms. The process requires the active participation of key stakeholders in three phases:

1. Reviewing current practices employed by enterprise, the State support agencies, the educational and research institutions and others in making decisions relating to R&D investment. Agreeing with these stakeholders a best practice approach for identifying Strategic Technology Platforms for Ireland;

2. Establishing a mechanism for fostering communication and connection between the different stakeholders, and for enabling proposals for Strategic Technology Platforms to emerge;

3. Evaluating proposed Strategic Technology Platforms, using transparent criteria, and recommending a select number for State support.

It is envisaged that the process would be iterative, and would include strict ongoing re-evaluation against measurable objectives.

ICSTI suggests that, as in the case of the Technology Foresight exercise, this approach to identification and implementation will position Ireland at the forefront of such activity internationally and thus, will be an important step forward for the National Innovation System.

1.0   Introduction

The recent report by Forfás to the Inter-Departmental Committee on Science and Technology, Building Ireland's Knowledge Economy – The Irish Action Plan for Promoting Investment in R&D to 2010 (2004), set an ambitious target for Ireland to increase gross expenditure on R&D from 1.4% of GNP to 2.5% of GNP by 2010, in line with the levels of performance in other knowledge-based economies. This target follows the substantial increase in investment by Government in STI in the National Development Plan (2000-2006) to €2.48 billion, compared with €0.5 billion over the period 1994-1999.

ICSTI, concerned that this momentum should be sustained and built upon, has previously made recommendations to Government concerning:

● Longer-term multi-annual budgeting for public R&D investment that guarantees funding and provides stability to the research system, and

● Effective oversight and review of the investment underway, to provide strategic direction and coherence to national investment.

In this Statement, ICSTI outlines its proposal for the development of Strategic Technology Platforms as a mechanism for improving the effectiveness of research investment and its strategic direction. Critically, given that the Irish Action Plan proposes that two-thirds of the increase in R&D expenditure should come from the enterprise sector, the proposed mechanism includes a central role for enterprise: this represents a novel approach to strategic R&D in Ireland.

ICSTI has prepared this proposal as a follow up to its Technology Foresight exercise, completed in 1999, which led to Ireland's focused investment on specific research areas. The proposal aims to foster continuity in the Technology Foresight process and to build on the initial achievements of that process in the context of the current STI and enterprise environments.

2.0   Technology Foresight in Ireland

In 1998, ICSTI was requested by the, then, Minister for Science and Technology to develop and undertake a Technology Foresight exercise, that is, a structured process for bringing together scientists, engineers, industrialists, government officials and others to identify areas of strategic research and the emerging technologies likely to yield the greatest social and economic benefit and which, in the long term, will sustain industrial competitiveness in Ireland.

The Technology Foresight Task Force was chaired by Mr Brian Sweeney, the, then, Deputy Chairman of ICSTI. The initiative was jointly supported by the Office of Science and Technology, and Forfás who also provided the Secretariat to ICSTI. The exercise was carried out over a period of twelve months and, in April, 1999 ICSTI reported its findings to the Minister in the form of an Overview Report and eight Sectoral Panel Reports.

One of the key recommendations of the Overview Report was that Government should establish a Fund to invest in research in key areas of technology which would underpin the future competitiveness of the traded goods and services sector in Ireland. In response to this recommendation, the Government established a Technology Foresight Fund of £560 million (Irish Punts) for the period 2000-2006, and it set up Science Foundation Ireland to administer this Fund.

3.0   Review of Progress on Technology Foresight

In February 2003, ICSTI convened a meeting of the Chairpersons of each of the eight Technology Foresight Sectoral Panels, to review progress on the recommendations from Technology Foresight. That group agreed that it would be useful to identify:

- The major achievements from the 1999 exercise;
- Any outstanding issues from that exercise;
- Any new areas and technologies that have emerged since then and which now need to be examined.

ICSTI then established a Task Force to progress these tasks. The Task Force consulted with key players on the current status, relevance and possible follow up of the recommendations listed in the Technology Foresight 1999 Panel Reports. The strategic technologies identified by the Technology Foresight Panels in 1998/1999 are listed in Appendix I.

The impact of the Technology Foresight exercise was perceived to vary considerably, from very low (for example in the Natural Resources/Forestry Panel, where many activities were pursued as part of routine development rather than as part of Technology Foresight implementation) to highly significant (for example in the Information and Communications Technologies (ICT) and Life Sciences Panels, with the significant research funding through Science Foundation Ireland). Overall, Technology Foresight was recognised as beneficial for consolidation of issues, regardless of the level of sector-specific impact.

ICSTI noted that strategic planning initiatives (and foresight exercises) were (and still are) underway within different sectors, and in particular the agriculture and marine areas, where initiatives have been taken by Teagasc and the Marine Institute respectively, and ICSTI deems these to be adequate for sectoral planning. Cross-sectoral activities, inter-institutional cooperation and openness in development of R&D strategies were recurrent themes and areas for development identified in all sectors during the ICSTI consultation, leading ICSTI to conclude that any follow up to Technology Foresight in Ireland must be cross-sectoral to be of added value.

ICSTI subsequently agreed that the Technology Foresight recommendations were still valid, that their implementation in key areas was on track, and that there was a need to maintain this momentum. It was agreed that the focus on excellence in the ICT and biotechnology areas remains appropriate to Ireland's development. However, it was recognised that this is a long-term investment.

Several areas were identified as needing attention. These included the need to

- establish linkages between basic research, applied research, and industry visioning;

- identify areas where Irish firms can be especially productive by leveraging existing unique resources (natural resources, labour, pockets of expertise, existing multinational companies (MNCs) (sub-supply), clusters of small and medium sized enterprises (SMEs), public procurement opportunities, intellectual property etc.);

- audit such national resources, and link them to priority research areas in order to ensure that benefits from research expenditure are maximised.

ICSTI resolved to examine ways of ensuring the relevance to the enterprise base (both current and potential) of the basic research activities carried out in third-level institutions and other State-funded organizations. ICSTI recognized that a research agenda that lacked strategic direction would run two risks:

- That the research activities would generate knowledge and trained personnel for which there was no absorptive capacity in Irish industry, with the consequent danger that the benefits of the investment would be reaped abroad;

- That the actual needs of industry in Ireland in terms of research and trained researchers would be overlooked by the research community.

ICSTI concluded that there was a need to use a mechanism, such as that of Strategic Technology Platforms, as a planning approach to developing and elaborating the national strategic research agenda. In parallel, in December 2003, the ICSTI Task Force on Technology Foresight met with Dr Eoin O'Driscoll, Chairman of the Enterprise Strategy Group which had been convened by the Tanaiste, Ms Mary Harney, T.D. to review enterprise priorities. The potential for a common approach to identifying key technologies of strategic importance to Ireland was discussed. A decision was taken to progress aspects of the ICSTI Technology Foresight follow-up under the auspices of 'Strategic Technology Platforms', given that this could provide useful feedback to the Enterprise Strategy Group and could form the basis for longer term follow up by ICSTI.

The aim of this work was to establish a mechanism for identifying key platforms for investment for Ireland, both to underpin economic and social progress and competitiveness, and to ensure that it can influence the designation of strategic platforms at European level, so that the research effort and funding are expended in ways that are beneficial to Irish society.

4.0   Strategic Technology Platforms

4.1   European Technology Platforms

During 2003, the concept of Strategic Technology Platforms was emerging at European level. These platforms were defined as a framework to unite stakeholders around a common "vision" for the technology concerned, with mobilisation of a critical mass of research and innovation effort. The primary output of such platforms would be a European Strategic Research Agenda for the next decade (with recommendations for its implementation) and the final goal would be to achieve EU industrial leadership and meet society's needs.

Given ICSTI's interests in strategic research agendas at national level and the need to establish linkages between basic research, applied research, and industry visioning, ICSTI undertook to examine the rationale for and the key characteristics of the European platforms and to determine their fit with any proposed activities in Ireland.

The European platform concept was devised to contribute to competitiveness (as part of the European Research Area Lisbon Agenda), to boost research performance and to concentrate efforts and address fragmentation. Characteristics of such platforms should include high research intensity, major technological advances in the medium to long-term, with clearly defined European added value. The platforms should involve a wide stakeholder base (including industry, public authorities, the research community, regulators, civil society and consumers), mobilization of public and private funding as well as the Community Framework Programmes, Structural Funds, national, regional and private research funding, European Investment Bank, EUREKA etc. The European technology platforms are listed in Appendix II.

As existing or planned European platforms emerged, it became clear that they would be categorized under several headings including:

- New technologies leading to radical change in a sector, if developed and deployed appropriately and on time (e.g. hydrogen and fuel cells, nanoelectronics, nanomedicine, gas cooled reactors);

- Reconciliation of different policy objectives with a view to sustainable development (e.g. plant genomics and biotechnology, water supply and sanitation, photovoltaics, sustainable chemistry, renewal products from forestry resources, global livestock development partnership, road, rail and maritime transport);

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- New technology-based public goods or services with high entry barriers, uncertain profitability, but high economic and social potential (e.g. mobile and wireless communications, innovative medicines for Europe);

- Ensuring the development of the necessary technology breakthroughs to remain at the leading edge of technologies in high-technology sectors which have significant strategic and economic importance for Europe (e.g. embedded systems, aeronautics, European space technology);

- Renewal, revival or restructuring of traditional industrial sectors (e.g. steel, textiles and clothing, manufacturing technologies, building for a future Europe).

Discussions at EU level are currently progressing, with a view to including Strategic Technology Platforms in the 7th Framework Programme (2006-2010).

Having considered the European deliberations on the subject, ICSTI concludes that the European technology platform concept is different to the one evolving in Ireland – the key differences being:

- The European technology platforms aim to bring key players within a sector together to build a Strategic Research Agenda, while the national Strategic Technology Platforms envisaged by ICSTI would aim to bring together key players from different sectors to build a cross-sectoral Strategic Research Agenda.

- The European concept seeks to address reasonably well-defined problems in a sector or technology area (a product approach), whereas ICSTI sees a major potential for addressing deficiencies in the National Innovation System (a process approach).

ICSTI considers that developments at European level should be monitored carefully in order to maintain clarity on the complementarity, or 'fit', of any national Strategic Technology Platforms and on Ireland's ability to influence the designation of European technology platforms and, thereby, the allocation of the research and investment funding at European level.

4.2 Strategic Technology Platforms at National Level: International Best Practice

ICSTI set out to compare the way in which Ireland establishes its research and development agenda with the approach taken in other countries, and the way in which other countries develop and implement strategic technology platforms.

As there is no universally agreed definition of Strategic Technology Platforms, ICSTI set about elaborating a definition that would be particularly appropriate for Ireland.

In January 2004, ICSTI commissioned Arthur D. Little Ltd, (Consultants) to work with its Task Force to elaborate a definition of Strategic Technology Platform in the Irish context and a methodology for selection of Strategic Technology Platforms for Ireland. During the consultation, Arthur D. Little Ltd carried out an overview of international Foresight exercises and subsequent work to select strategic technologies. The following key points emerged:

- Most countries are wary of 'picking winners' among research areas in a narrowly defined sense, but many recognise the need for selectivity and focus, at least at the level of broad fields of R&D. The recent announcement of the development of the National Technology Strategy in the UK is a good example of this;

- Technology Foresight and similar exercises are a feature of national policy formulation in many countries, not only the larger or more advanced economies, and several countries have built on the results of their Foresight work to identify priority areas for national R&D investment. These countries use the term 'Technology Platform' to describe these priority areas, though their definitions of this term vary. For example, Canada, China, Norway and Sweden are developing genome-related platforms which appear to have little industry input or collaboration, whereas Finland's activities have arisen out of their National Technology Programmes in Information Technology and are clearly driven by industry;

It is not always clear that the priority areas are, in fact, technologies, nor do national initiatives always use the term 'Technology Platform' in the same way as the European Commission is using it in developing European technology platforms.

International priority areas, as determined by Arthur D. Little Ltd, together with a review of the OECD STI Indicators (2004) are summarised in Appendix III.

It was concluded that there is still work to be done to arrive at a common understanding of what a national Strategic Technology Platform is and that, therefore, the definition of Strategic Technology Platform in the Irish context would be an important step forward.

4.3   The Foundation for Developing Strategic Technology Platforms in Ireland

ICSTI examined several indicators that would inform the choice of Strategic Technology Platforms in Ireland, including size of industry, R&D spend, gross value added and growth rate. Key findings included:

- In general, there is a good foundation of activities in the research base in industry and in natural resources on which to identify and develop Strategic Technology Platforms where Ireland could build competitive advantage;

- An analysis of business expenditure on R&D (BERD), by broad product group, demonstrates significant activity in the areas of electrical and electronic equipment, software and computer-related research. This correlates with Ireland's recent high levels of public investment in ICT;

- BERD in pharmaceuticals is, by comparison, relatively low. The pharmaceuticals sector has been identified as the largest employer in the biotechnology sector in Ireland, but it is characterized by lack of innovation locally. ICSTI highlights the need to address how the significant public investment in biotechnology can be best used to leverage increased business R&D and value-adding activity in Ireland;

- The paper, print and publishing sector also shows a low BERD intensity by international standards, which is surprising given its importance to Irish manufacturing. While this sector contributes about €4 billion to the national economy, it spent only €3.9 million on R&D;

- BERD figures for the food and beverages sector suggest that, while not underperforming, there is also scope for higher R&D investment in the future;

- There is an absence of studies on supply chains supported by and exploiting Ireland's natural resources;

- There is a need for an independent assessment of the knowledge capabilities and capacities in the public research base.

ICSTI concludes that Ireland has scope to increase R&D investment by business in the high technology industries by leveraging the strategic national investment in biotechnology and ICT. However, Ireland cannot be competitive in all areas, and even the selected areas of ICT and biotechnology are very broad. Investment needs to be strategically focused on those areas of greatest relevance to Ireland's enterprise and to its strengths in natural resources. In particular, there are opportunities for Ireland in pharmaceuticals, print, paper and publishing, as well as in food and beverages.

There is intense international competition for talent and investment. Ireland's ability to create sustainable competitive advantage will depend on bringing together all elements of the National Innovation System – education, research, industry, the financial sector and others – to achieve coherence in investment and R&D strategies.

4.4 Current Strategic Approaches within the State Agencies

ICSTI reviewed the strategic activities currently underway in the individual agencies with responsibility for R&D (Enterprise Ireland, IDA Ireland, Marine Institute, Science Foundation Ireland, Teagasc, etc.) to determine current practice and whether there was a need for a formal process of identifying Strategic Technology Platforms. A summary of the agencies, their current focus areas, and their processes for selection of these areas is provided in Appendix IV.

There are many strategic activities underway within the agencies. While each agency funds a range of activities as they arise, there is evidence of focusing thematically, in terms of technology areas, and of tailoring funding mechanisms around priorities. Strategies and programmes are, for the most part, based on consultations between industry, researchers and other stakeholders. In sectoral funding organisations, initiatives are generally bottom-up and relevant and appropriate to the client base. Science Foundation Ireland is more horizontal and open. Other initiatives, such as the Higher Education Authority's Programme for Research in Third Level Institutions (PRTLI), are bottom-up from the institutions determining their competitive advantage. There are examples of:

- Best strategic practice, for example, the Marine Institute's Technology Foresight exercise and development of a Strategic Research Agenda;

- Strong capabilities, for example, Teagasc's technology transfer activities;

- Significant learning/knowledge base on an international level, for example, IDA Ireland's networking and marketing activities;

- Innovation, for example, the Marine Institute with the National Cancer Institute, USA, in biodiversity – with potential to link to the Irish Centres for Synthesis and Chemical Biology, the Dublin Molecular Medicine Centre and the pharmaceutical industry.

However, certain things are lacking:

- A formal process for developing and implementing strategy within agencies. Activities are described as being on an 'ad hoc' basis;

- A mechanism for ensuring coherence of strategy across agencies. Agency activities are primarily agency-specific or sector-specific;

- Timely response to identified opportunities e.g. post-generation of roadmaps by Enterprise Ireland, and linking of industrial interest to the roadmaps;

- A willingness to make choices, although some recognise that Ireland must make choices, as it cannot do everything.

There is a need for cross-institutional synergies and coherence/resilience across the National Innovation System, and this is widely recognised. The agencies welcome ICSTI's Strategic Technology Platform initiative as building on their activities and providing a framework for development. The timing is right, given that Ireland has built research capabilities, and is currently shifting from an industrial model based on production to one in which R&D plays a major role. In addition, there are tools emerging within the system (for example, Technology Assessment) that are complementary to the initiative.

The proposed process must build on the substantial work already going on. It must also seek the active participation of all stakeholders, in order to build maximum consensus on vision and approach, and to develop roadmaps and/or scenario tests to which all stakeholders can subscribe. It must communicate its findings effectively, not only to the active participants, but also to the wider public.

Benefits of the proposed approach include:

- Industry-academia connectedness;

- Contribution to cluster development;

- Involvement of SMEs in research activities;

- Enhancement of Ireland's competitive position and reputation;

- Progressive advances in Ireland's research base;

- Alignment of research activities with socioeconomic needs.

4.5   Definition of Strategic Technology Platforms in the Irish Context

ICSTI, working with Arthur D. Little Ltd, elaborated a definition of Strategic Technology Platform for Ireland, and outlined a process for identifying and developing such platforms. The definition is as follows:

A Strategic Technology Platform is a group of technologies that can be collectively applied to a diverse range of product, process and service applications (that is, applications are not limited to a single vertical product or industry sector).

A Strategic Technology Platform builds upon an array of underpinning scientific knowledge and skills (such as those being developed in our universities and through the investment, for example, by Science Foundation Ireland).

By identifying and developing platforms that leverage Ireland's unique strengths, we will create distinctive, significant and durable competitive advantage in Irish industry and society in general.

The Strategic Technology Platforms selected for Ireland should be sufficiently broad in scope that they can realistically be expected to feed into a variety of products, processes and services, ideally, in disparate industry sectors. At the same time, they should be sufficiently narrow that they define a set of

competencies that can be built up within Ireland, and uniquely within Ireland, so that it can establish and defend a competitive position.

ICSTI recommends that Strategic Technology Platforms be developed as a mechanism for:

- Selecting areas of research for funding;
- Setting an industry-focused applied research agenda;
- Creating industry-led clusters, involving small and large firms, both indigenous and foreign-owned;
- Stimulating research in industry, or funded by industry, or commissioned by industry with State support;
- Attracting targeted Foreign Direct Investment;
- Focusing the activities of State agencies.

4.6   Process for Identifying Strategic Technology Platforms in Ireland

Any process for selecting Strategic Technology Platforms will be based on the best current information and this information will, at any time, be imperfect, incomplete and soon out of date. The process should, thus, aim to select good candidates for Strategic Technology Platforms, based on measurable criteria. Any platforms that are supported with public monies should be subject to review at short intervals. Ones that are not performing should not be further supported, ones that have become self-financing should not be further supported. A continuous process of identifying new candidate platforms should be put in place – a process that involves all players in the innovation system, in particular, the enterprise sector.

In this context, ICSTI proposes a methodology that involves consultation and consensus-building between all the players in the National Innovation System – industry (large and small, Foreign Direct Investment and indigenous), the educational and research organizations, the State agencies, the finance community etc. ICSTI emphasises that the process of identifying and agreeing

the platforms is as important as the actual platforms identified, as the success of the platforms will depend on the active participation of the players in the implementation of the platforms. The process will involve considerable interaction between firms which are, at present, competing or 'parallel' (in the same sector, but having no interaction), and between firms in quite different sectors who share common interests or have complementary strengths. It will also foster interaction between industry and third-level colleges and researchers – interaction that is notable, at present, by its scarcity.

It is envisaged that this process will allow for a critical assessment of what is unique to Ireland in the research base, in industry and in natural resources, how technologies can be integrated and how synergies can be identified. The proposed process would include regular reviews to keep the platform choices up to date.

Figure 1 illustrates a high level outline of the process.
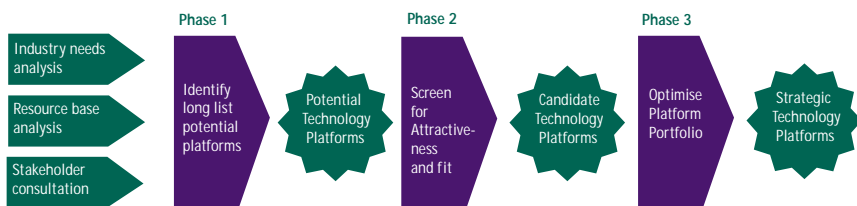
Source: Arthur D. Little

There are three Phases to the process:

Phase 1 takes information and opinion from diverse sources and arrives at a set of potential technology platforms;

Phase 2 involves screening, profiling and ranking potential platforms so as to arrive at a set of qualified candidate technology platforms;

Phase 3 analyses these candidate platforms so as to arrive at a priority set and at a series of actions for their development.

Phase 1 has the following elements:

- Bringing together key players to examine current initiatives and best practice;
- Assessing where Ireland has unique strengths (resource base). These could include:

     natural resources (e.g. Ireland has the best coastline for wave energy; it grows grass and Sitka spruce faster than anyone else; as a population, it has genetic predisposition to Retinitis Pigmentosa …);

     concentrations of expertise/experience in industry (e.g. wireless technologies, medical devices, biometrics …);

     research/knowledge base (e.g. in some of the Science Foundation Ireland Centres for Science, Engineering & Technology (CSET) areas, Teagasc, Marine Institute …).

- Identifying areas of emerging market opportunities that require some of these strengths, individually or in combination (industry needs);
- Consulting widely with players in the National System of Innovation to draw up a list of possible platforms, based on the analysis of the resource base and the industry needs.

ICSTI concludes that the selected Strategic Technology Platforms will be as important for what they do as for what they are. In other words, like Technology Foresight, the process of selecting and developing the platforms will have effects that transcend the actual subject-matter of the platform, such as

- bringing together the key Government Departments, research funding and development agencies to determine best practice, areas for collaboration and to address blockages to cooperation;

- creating a forum for dialogue between firms, and between firms and the educational and research communities;

- actively fostering coordination, cooperation and collaboration between all players in the National System of Innovation (enterprise, academia, researchers, State agencies);

- articulating vision and roadmaps for industry sectors and markets;

- ensuring the relevance, coherence and linking of the longer-term research agenda and the shorter-term applied research agenda;

- ensuring that national research needs are satisfied;

- focusing and optimising national resources.

Phase 2 will narrow down the long list of potential platforms to a list of viable candidates. It is envisaged that it will be restricted to a limited number of people and that it will be re-run at regular intervals (e.g. every one to three years) to ensure that the results are still valid in the light of scientific and market developments. The ranked set of candidate platforms might typically contain 30-40 items. The potential participants in the platform activities will be actively involved in proposing the platform agendas.

The purpose of **Phase 3** will be to select the top priority items that will become Ireland's Strategic Technology Platforms, which will be the focus of resource allocation by enterprise and the State. Like Phase 2, it will be restricted to a limited number of people and it will be re-run at regular intervals. The final set of Strategic Technology Platforms might typically contain 10-20 items.

5.0   Recommendations to Government

ICSTI recommends that the three-phase process for selecting Strategic Technology Platforms be pursued to guide future investment in science, technology and innovation in Ireland.

The Enterprise Strategy Group, in line with ICSTI's work, proposed the process to Government "as a basis for robust competitive advantage which can contribute substantially to ensuring the continuing relevance of research investment by

- articulating enterprise needs to the research and education communities;
- connecting different businesses together in networks or clusters of common interest;
- defining applied research projects; and
- prioritising longer-term research needs".

The Enterprise Strategy Group linked the establishment of the process to 'Technology Ireland', "a dedicated structure within Enterprise Ireland whose mission would be to develop a cohesive, strategic and focused approach to market-led applied research and technological development and to leverage increased enterprise investment". ICSTI, throughout the development of the Strategic Technology Platforms proposal, has highlighted the necessity to bring key players together – across research areas, enterprise sectors, Government Departments and R&D agencies/organisations. The Recommendations in this Statement are made by the Council envisaging that they will be pursued in such an interactive environment.

The Strategic Technology Platforms will be used to underpin future economic and social progress and competitiveness and also to influence the designation of future strategic platforms and, thereby, the allocation of the research and investment funding at European level. ICSTI highlights the need for an assessment of how Ireland can leverage European-level funding through such a process.

The council sets out its Recommendations under the following headings:

The Process to be Adopted;

The Methodology to be Employed;

The Stakeholders to be Consulted.

5.1 The Process to be Adopted

ICSTI recommends implementation of the process as follows:

5.1.1 Define best practice for identifying Strategic Technology Platforms;

5.1.2 Mediate connection between existing activities, and stimulate proposals;

5.1.3 Using the output from 5.1.1 and 5.1.2 above, identify the key Strategic Technology Platforms for Ireland.

5.2 The Methodology to be Employed

ICSTI has prepared the following step-by-step breakdown of the activities envisaged as part of this process and recommends that the first two steps be pursued in parallel, with the third step following immediately after these activities. ICSTI is proposing a six-month timeframe to complete the first iteration of Steps 1 & 2.

Step 1	Define Best Practice for Identifying Strategic Technology Platforms

	Activity Required
1.1	Bring together key players to examine current initiatives and best practice (to include international facilitator)
1.2	Define the concept of Strategic Technology Platforms in terms that are appropriate for Ireland
1.3	Determine the key criteria for assessing proposed Strategic Technology Platforms under the headings of: - Science and technology - Economic benefit - Added value
1.4	Review the outputs from Forfás's Technology Assessment exercise, to ascertain the appropriateness of the proposed process, and its timeliness
1.5	Design a process for continually identifying, developing, and evaluating Strategic Technology Platforms

Outcomes from Step 1 should include:

- Strategic Research Agenda (including ways to leverage private and public R&D investment);
- Roadmap (including an analysis of transition strategies);
- Deployment strategy (including recommended policy measures);
- Policy Interface/Framework (for interaction with political institutions);
- Progress monitoring system.

Primary targets include:

- Development of enterprise-led research agendas;
- Allocation of funding e.g. €50 million from the State (with a requirement to leverage €50 million from enterprise to give a total of €100 million per annum to the Strategic Technology Platform initiative);
- Appointment of a Manager with capabilities in development of Strategic Technology Platforms at national or international level.

Step 2	Play a Role in Getting Connection between Existing Activities
	Activity Required
2.1	Foster commitment of all stakeholders
2.2	Obtain endorsement of public authorities
2.3	Identify technical and managerial frameworks
2.4	Build up an appropriate flexible governance structure
2.5	Mobilise substantial public and private funding

Outcomes from Step 2 should include:

- Criteria for assessment:

  > Demonstration of stakeholder commitment;
  > Financial commitment by industry;
  > Ability to catalyse public funding;
  > Integration of existing efforts

- Public-private partnerships;

- International co-operation strategy;

- Process audit against models of best practice.

The aim should be to feed outcomes of Steps 1 and 2 into the National Development Plan (post 2006; planning to commence shortly) and into Step 3 below.

Step 3	Identify the Key Strategic Technology Platforms for Ireland
	Activity Required
3.1	Using the output from (1) and (2) above, implement the process to identify a list of candidate Strategic Technology Platforms
3.2	Assess where Ireland has unique strengths: - Natural resources - Concentrations of expertise/experience in industry - Research/knowledge base
3.3	Identify areas of emerging market opportunities that require some of these strengths, individually or in combination (industry needs)

Activity Required (continued)	
3.4	Consult widely with players in the National System of Innovation to draw up a list of possible platforms, based on the analysis of the resource base and the industry needs
3.5	Invite proposals from groups of stakeholders
3.6	Proceed to screen, rank, and select a small number of Strategic Technology Platforms and use them to focus both research effort and enterprise support measures.

Outcomes from Step 3 should include:

- Timeframe (proposed: 3-5 years);
- Finance: State agencies, research units and companies;
- Participants: recognised national experts (industry and research community) with agency programme managers;
- Structure: (proposed: 7-15 individuals per group; monthly and/or quarterly meetings);
- Work programme:

        - Long term vision and roadmaps;
        - Seminars to discuss new technologies, applications and
          services as well as emerging markets;
        - Strategic research and action plan;
        - Call for proposals – procedures;
        - Project clustering and reviews of research in the programme;
        - Proposals for new programmes.

- Programme emphasis: networking and cooperation; joint learning about new technologies, applications and services as well as emerging markets.

5.3   The Stakeholders to be Consulted

ICSTI recommends that the process be completed by the new Science Advisory Council with input from representatives of the following organisations/bodies:

- Government Departments;
- Funding and development agencies;
- IBEC;
- ICT Ireland;
- ISME;
- Traditional industries (representation by Chamber of Commerce or ISME);
- InterTrade Ireland.

5.4   The Outcome to be Expected

The process proposed will address a number of deficiencies in the National Innovation System, particularly in the way it fosters connection and communication between existing activities and organisations, and will concentrate effort and resources around agreed visions, strategies and programmes. It will help to embed the foreign-owned sector in the Irish Innovation System, and will find indigenous small and medium-sized enterprises involved in medium-term planning - many for the first time. It will also establish a consensus around national strategic research priorities, and ensure that there is ongoing relevance and connection between the longer-term research agenda and the more immediate applied research agenda. It will provide the enterprise sector with an opportunity and a vehicle for articulating its research needs, and a mechanism for participating in that research. Ultimately, the selection of Strategic Technology Platforms that have the committed support of all players in the Innovation System will ensure that enterprise in Ireland has sustainable competitive strength in coming years. The recommendation that the process be iterative will also ensure the continuing relevance and appropriateness of the platforms selected.

APPENDIX I

Panel Report	Identified Strategic Technologies
Chemicals and Pharmaceuticals	Advanced conventional and biological synthesis
	Advanced formulation/delivery and packaging systems
	Flexible, clean and efficient processes
	Process automation and monitoring
	ICT to manage regulatory or customer interfaces
ICT	Networks: high-speed, broadband, wireless, mobile, voice/data convergence, DSP, network management, switching e.g. photonic, internet2
	Systems: distributed, parallel, engineering for reliability, predictability and security
	Components: integration, miniaturisation, low power consumption, novel architectures
	User interfaces: multi-sensory, wearable, virtual reality, artificial intelligence, human language understanding and synthesis
	Applications: information access, retrieval, analysis, filtering and management, best practice in exploitation and delivery, bioinformatics, simulation and modelling, telemedicine and health informatics, distributed working, supply chain management, computer based training
Materials and Manufacturing Processes	Design with new and advanced materials, including biomaterials, smart materials, reusable/renewable materials
	Processing/fabrication of new and advanced materials
	Integration and miniaturisation technologies
	Exploitation of ICT, telematics and logistics, together with associated social and behavioural sciences, in order to facilitate the development of virtual enterprises
Health and Life Sciences	Genomics
	DNA chips, biomaterials
	Bioinformatics
	Proteomics
	Gene chip technology
	Knock-outs and transgenics

Panel Report	Identified Strategic Technologies
Health and Life Sciences (continued)	Robotics
	Biosensors
	Bio-remediation
	Novel instrumentation technology
	Drug delivery
	New diagnostics
Natural Resources - Agrifood Industry	Ingredient technology
	Food microstructure
	Flavour and quality
	Minimal processing technologies
	Pathogen control systems incl. risk analyses methodologies
	High pressure technologies
	Food irradiation
	Robotics and information technology
	Reduced input farming systems
	Waste reduction and management technologies
	Environmental modelling
	Information technology
	Diagnostics
	Genetics and breeding technologies
	Environmental impact assessments
	Market intelligence of consumer behaviour
Natural Resources - Marine Industry	Food processing
	Information technology incl. remote sensing, GIS, modelling/forecasting and data management
	Biotechnology incl. disease detection and management, bio-screening of marine organisms for bio-active products and food processing
	Sustainable harvesting and production systems incl. cleaner production technologies, fish-finding technology, net design and manufacture, cage and tank design

Panel Report	Identified Strategic Technologies
Natural Resources - Marine Industry (continued)	Sensor development incl. materials technology, instrumentation development, and anti-fouling techniques
	Wave energy incl. power take-off and control and structural design and mooring
	Maritime transport incl. intermodal management
Natural Resources - Forestry Industry	Wood science, materials science and applied engineering skills
	Genetic and other biotechnologies to improve the quality of Irish timber
	Information technology and communication skills
	Environmental management skills
	Planning and appraisal models
	Advanced marketing capabilities and skills
Natural Resources - Commonalities	Capacity to monitor, evaluate and harness advances in biotechnology
	Production and processing technologies and systems to meet consumer demand
	Competitive and sustainable production and processing technologies and systems
	Information technology and communication skills
Energy	New and renewable technologies for electricity, thermal and transport markets, esp. wave energy, hybrid energy systems, energy storage systems and alternative, environmentally-friendly transport systems
	Intelligent consumer energy products
	Energy efficient and renewable energy technologies in buildings
	Optimise the sourcing, distribution and utilisation of energy, at all levels of energy consumption

Panel Report	Identified Strategic Technologies
Transport and Logistics	Intermodality of transport systems
	Telematics for transport systems
	Road design and maintenance technologies
	Demand management
	Land-use development
Construction and Infrastructure	ICT
	Developments in materials
	Developments in manufacturing technologies incl. robotics, mechanisation, tools
	Sustainability of the built environment
	Health, safety and environment friendliness
	Competitiveness

Source: ICSTI Technology Foresight Ireland, 1999

APPENDIX II

European Technology Platforms, May 2004

Platform Type	Existing & Proposed
New technologies leading to radical change in a sector	Hydrogen and fuel cells Nanoelectronics Nanomedicine
Sustainable development	Plant genomics and biotechnology Water supply and sanitation Photovoltaics Sustainable chemistry Global livestock development partnership Road transport Rail transport Maritime transport
New technology based public goods or services	Mobile and wireless communications Innovative medicines for Europe
Development of high-technology sectors	Embedded systems Aeronautics
Renewal of traditional sectors	Steel Textiles and clothing Maufacturing technologies

Source: European Commission Presentation (Sean O'Reagain, DG Research), May 2004

International Priorities, June 2004

Country (European)	Priority Areas
Czech Republic	Embryonic cell research
Denmark	Biotechnology, ICT and nanotechnology
Finland	Miniaturising electronics, interactive computing and telecommunication networks **19 Technology Platforms c/o National Technology Agency, TEKES [industry led, 10 year vision, strategic agenda]**
France	Research for health, development of renewable energies, resource management (water and food), and diffusion of knowledge and promotion of scientific culture ICT, energy, transport and sustainable development, life sciences, space travel, the international thermonuclear experimental reactor (ITER) and innovation
Germany	Information and communications technologies, microsystems engineering, optical technologies, materials research, clean processes and production technologies, biotechnology and nanotechnology
Hungary	Material science, production engineering and equipment, energy, transport, electronics, measurement and control technology, biotechnology, environmental protection, and ICT and its applications
Iceland	Environment, information technology, nanotechnology, biomedical and health related R&D
Ireland	Biotechnology and ICT
Netherlands	Genomics, nanotechnology and ICT
Norway	Marine research, ICT, medicine and healthcare, environmental and energy research

Country (European)	Priority Areas
Norway (continued)	Genomics, microarrays, bioinformatics, proteomics, molecular imaging, biobanks for health, integrative genetics, transgenic animals, microbial technology and structural biology **Genomics platforms: microarrays, DNA sequencing, protein sequencing, NMR spectroscopy, X-ray crystallography, spectroscopy and microscopy, bioinformatics, biobanks/health surveys, model organisms**
Sweden	Biotechnology and information technology **14 genomics platforms: genetic variability and biological diversity, phenotype profiling, structural biology, microarrays, bioinformatics, membrane proteins and cellular imaging**
UK	Stem cells, a sustainable energy economy, rural economy and land use, post-genomics and proteomics, e-science and basic technology Brain science, addiction and drugs, cyber trust and crime prevention, exploiting the electromagnetic spectrum, cognitive systems and flood and coastal defence Biotechnology (genomics), nanotechnology, ICT and renewables (CO2 sequestration; energy efficiency; hydrogen production and storage; nuclear power (waste handling) and wave or tidal power

Country (Other)	
Australia	An environmentally sustainable Australia, Promoting and maintaining good health, Frontier technologies for building and transforming Australian industries, Safeguarding Australia, biotechnology, ICT and resource processing

Country (Other)	Priority Areas
Canada	Biotechnology, environmental technology, information and communications technologies, health technologies, and nanotechnology Internet broadband network architecture, nanotechnology, advanced aluminium technology, biotechnology, fuel cell research, medical and related sciences, astronomy and astrophysics research programs, and photonics **Genomics platforms: infrastructural support for research into DNA microarrays, DNA sequencing, proteomics and bioinformatics**
China	**9 genomics platforms: large scale DNA sequencing, functional genomics, proteomics, bioinformatics, SNP, siRNA, genescan, genetic resources, molecular cytogenetics**
Japan	Life sciences, ICT, environment, nanotechnology and materials Health and medical care, agriculture and fisheries, life sciences
Korea	Digital TV and broadcasting, displays (LCD, LED, PDP, etc), intelligent robot, new generation automobiles (intelligent car, clean car, etc), next generation semiconductors (silicon on chip, nanochips, etc), next-generation mobile communication, intelligent home-networking, digital content and solutions, next-generation batteries, and bio medicine (bio-chips, artificial organs, etc.)
New Zealand	Biotechnology, ICT and creative industries

APPENDIX IV

Activities in National Agencies/Organisations, June 2004

Agency	Focus Areas	Process
Enterprise Ireland	Programmes in advanced technologies: - Informatics - Biotechnology - Optoelectronics - Power electronics - Advanced manufacturing and materials technologies Emerging technologies: - Digital media - Photonics - Nanotechnology - Grid computing - Biometrics - Automation	Selection led by academics; evolved from enabling technologies to sectors based on end-use i.e. market led
Forfás	Wireless communications Digital content New applications software Web services	Response to agency requests
ICSTI	National technology foresight Nanotechnology	Independent advisory
IDA Ireland & Science Foundation Ireland	Pervasive technologies for networking Software Bioinformatics Diabetes Systems security	Industry led workshops comprising academic and industrial researchers
Marine Institute	Water quality monitoring – Marine/freshwater sensors and sensor systems Biosensors, gene probes & bioinformatics	Technology foresight; strategic research agenda

Agency	Focus Areas	Process
Marine Institute (continued)	Marine robotics, acoustics and marine opto-electronics ICT – data visualization and data mining Ocean energy Marine bio-discovery Strategic technology Platforms of relevance to the marine area are: - Biotechnology and biodiscovery - Information and communications technologies - Marine acoustics - Advanced technologies, optoelectronics and materials - Nano and Nanobio-technology	
Teagasc	Functional foods Food processing and production (safety, nutrition) Livestock and crop production systems Biotechnology Environmental sciences	Technology foresight; strategic research agenda
Science Foundation Ireland	Biotechnology - Cell growth and differentiation - Therapeutics - Host-pathogen interactions - Gene expression - Biomarkers and biosensors - Signal transduction, cellular context - Gene-environment interactions - Computational biology - Medical devices	Selection by technology foresight at national level involving academics, industrialists and agencies; consists of research relevant to Ireland's industrial climate

Agency	Focus Areas	Process
Science Foundation Ireland (continued)	ICT - Adaptive technologies for distributed networking - Software engineering - Machine learning and semantic web - Design and network management - Novel components, integration - Quantum effects, nanotechnology	

APPENDIX V

Members of the ICSTI Task Force on Strategic Technology Platforms

Mr Paul Holden (Chair)	Rédacteurs Ltd
Dr Leo Bishop	Business Consultant
Mr Ian Cahill	Ericsson Ltd. and National University of Ireland,Dublin
Prof. Donald Fitzmaurice	National University of Ireland, Dublin
Dr Peter Heffernan	Marine Institute
Prof. Tom McCarthy	Dublin City University
Dr David Melody	Formerly of Loctite (Ireland) Ltd
Dr Pierre Meulien	Dublin Molecular Medicine Centre
Dr Ena Prosser	Enterprise Ireland-Biotechnology
Dr Ena Walsh	Royal College of Surgeons in Ireland

Research Support

Dr Imelda Lambkin	Forfás

ICSTI Membership

Dr. Edward M. Walsh (Chairman)	President Emeritus	University of Limerick
Dr. Leonora Bishop		Business Consultant
Ms. Mary Burke	Managing Director	BioClin Research Laboratories
Mr. Ian Cahill	Chairman	LM Ericsson Ltd. and Director, National Institute of Technology Management, Nova UCD
Ms. Marion Coy	Director	Galway-Mayo Institute of Technology
Mr. Martin Cronin	Chief Executive	Forfás
Ms. Mary Cryan	Director of Technology	Cryan Associates
Dr. Ann Cullinane	Head, Virology Unit	Irish Equine Foundation Ltd.
Prof. Donald Fitzmaurice	Solar Technology Group	Chemistry Dept., National University of Ireland, Dublin
Dr. Peter Heffernan	Chief Executive	Marine Institute
Mr. Paul Holden	Managing Director	Rédacteurs Ltd.
Dr. Mike Hopkins	Physicist Scientist	Plasma Research Laboratory, Dublin City University
Dr. Brendan Hughes	Director of Drug Development	Wyeth Medica Ireland Development Facility
Ms. Josephine Lynch	Secretary to Council	Forfás

Prof. Tom McCarthy	Chief Executive	Irish Management Institute
Prof. Anita R.Maguire	Dept. of Chemistry	National University of Ireland, Cork
Dr. David Melody	Formerly Vice President for R&D	(Formerly) Loctite (Ireland) Ltd.
Dr. Pierre Meulien	Chief Executive	Dublin Molecular Medicine Centre
Dr. Pat Morgan	Faculty of Science	National University of Ireland, Galway
Dr. Mike Peirce	Chairman	Mentec Ltd.
Dr. Ena Prosser	Director	Biotechnology Research Directorate, Enterprise Ireland
Prof. William J Reville	Biochemistry Dept.	National University of Ireland, Cork
Prof. James A. Slevin	Science Secretary	Royal Irish Academy
Dr. Don Thornhill	Chairman	Higher Education Authority
Dr. Ena Walsh	Head of Operations and Business Development	Centre for Human Proteomics, Royal College of Surgeons in Ireland

ICSTI Statements (1997-2004)*

Title of Statement	Date of Ratification
Towards the 7th framework Programme for Research and Technological Development	Nov. 2004
Strategic Technology Platforms	Nov. 2004
State Expenditure Priorities for 2005	Aug. 2004
Sustainable Development in Ireland: The Role of Science & Technology	May 2004
Nanotechnology	Jan. 2004
National Code of Practice for Managing Intellectual Property from Publicly Funded Research	Jan. 2004
EU Debate on the Role of Fundamental Research	Nov. 2003
A Comparison of Starting Salaries for Science Graduates and Engineers	Aug. 2003
State Funding Priorities for 2004	July 2003
Utilising Intellectual Property for Competitive Advantage	Feb. 2003
Embedding the PharmaChem Industry in Ireland	Feb. 2003
Design and Development	Sept. 2002
Measuring and Evaluating Research	Aug. 2002
Report on Biotechnology	Feb. 2002
Commercialisation of Publicly Funded Research	Feb. 2001
Benchmarking School Science, Technology and Mathematics Education in Ireland Against International Good Practice	Feb. 2000

Title of Statement	Date of Ratification
Science in Second Level Schools	Nov. 1999
Public Sector Research and Technology Services for Innovation in Enterprises	Sept. 1999
Technology Foresight Ireland[1]	April 1999
Investing in Research, Technology and Innovation (RTI) in the Period 2000 to 2006	Mar. 1999
State Expenditure Priorities for 1999	Nov. 1998
Science Technology and Innovation Culture	Nov. 1998
Innovation in Enterprises in Ireland	July 1998
Mechanisms for Prioritisation of State Expenditures on Science and Technology	June 1998
Science in Primary Schools	May 1998
A Partnership Approach to Research Funding – The Need for a National Science and Engineering Board	May 1998
£250 million Scientific and Technological Education (Investment) Fund	Jan. 1998
State Expenditure Priorities for 1998	Sept. 1997

* A CD of ICSTI Statements published between 1997 and 2001 is available from the ICSTI Secretariat.

ICSTI Secretariat

The ICSTI Secretariat is provided by Forfás, the national policy and advisory board for enterprise, trade, science, technology and innovation.

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