

Categorisation of State
Expenditure on R&D
According to Research
Type

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Research and Analysis

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Executive Summary

The aim of this analysis was to develop a picture of the proportion of State research and development funding that is allocated to basic and applied research.¹ The data presented is based on an approach which considered the classification of funding, according to research type, by the funders of research and development, i.e. Government departments and their associated funding and research performing agencies.

The analysis was carried out using 2007 and 2009 Science Budget data. To overcome the difficulty in classifying some of the research activities that lie in the boundary between basic and applied research, two cases were considered (for both time frames): the first case classified these boundary activities as basic research and the second case classified these activities as applied research. A range of values is subsequently reported for State funding on basic and applied research in order to capture the two extreme outcomes.

Where feasible, research and development tax credits provided to firms were also taken into account as a cost to the State for research and development.

In summary, it was found that State funding for basic research lies in the range of 37% - 49% and applied research in the range 51% - 63%. State funding for basic research within the Higher Education Institutions lies in the range 50% - 68% and for applied research in the range 32% - 50%.

¹ For the purposes of this analysis all research funded by the State is categorised into either the basic research or applied research category.

1. Introduction

In the current economic climate, the return on investment by the State on research and development (R&D) activities is coming under increasing scrutiny. The total investment across all sectors of the economy climbed to an estimated €2.6 billion in 2008, which is equal to 1.43 % of GDP², and the target for the national investment in R&D is 3% of GDP.³ The proportionate investment in R&D remained at 1:2 public:private investment in 2008.

The State allocation for Science Technology and Innovation (STI) is not increasing as per the Strategy for STI (with a 7 % drop in Budget 2010 relative to the 2009 Budget), as a consequence of the current difficult economic climate⁴ and the subsequent reduction in available public finances. A renewed focus is being placed on stronger commercial outputs and the return on investment of the spending of STI allocated funding.

A key aspect in reaping economic reward from State investment in R&D is through engagement of enterprise with higher education institutions (HEIs) and Public Research Organisations (PROs) with a view to future commercialisation of the research output. However, companies will only engage with the HEIs and PROs if the State funded activities are relevant to their needs.

Recently enterprise has used the channels of the Enterprise Feedback Group (EFG) and the consultation process of an Advisory Council for Science Technology and Innovation (ASC) study, 'Maximising the Environment for Company Research and Development', to share their view that the R&D activities funded by the State do not have sufficient relevance to companies in Ireland. If this is actually the case, and not just a perception of some companies, then the State system is limiting its opportunity for commercial exploitation of State funded R&D.

There are a variety of reasons as to why such views and perceptions may have been formed by enterprise, including:

- Companies do not know how to navigate the public R&D system to find ongoing State funded R&D activities in the HEIs and PROs that are relevant to their needs, or to find R&D supports that their company can avail of.
- There is a lack of applied research being carried out within the HEIs and PROs.⁵
- There is a misalignment between the areas of the research being carried out in HEIs and PROs and the areas of interest to companies in Ireland.
- There is a lack of applied research, within the areas of interest to companies in Ireland, being carried out in HEIs and PROs.
- There is a lack of industry led research being carried out within the HEIs and PROs.

² Research and Development Statistics in Ireland, 2009 - at a glance, Forfás

³ Renewed Programme for Government, 10th October 2009

⁴ Gross domestic product (GDP) was 7.1pc lower in 2009 than in 2008, while Ireland's gross national product (GNP) was 11.3pc lower than in 2008, Quarterly National Accounts, Quarter 4 2009 and Year 2009 (preliminary), Central Statistics Office, March 2010

⁵ Companies are typically more focused on applied rather than basic research Business Expenditure on R&D, 2007/2008, CSO

- Science Foundation Ireland (SFI) have the largest single State budget for competitive funding of R&D activities, and have a mandate to fund oriented basic research. Funding for applied research is provided in a much more diverse manner through a number of different funding bodies, and companies may not be aware of all of the sources of funding for applied research activities. This difference in the mechanisms for funding basic and applied research (single vs multiple source) may have led to the development of a perception of a significant bias of State funding towards basic research.

It is conceivable, that even if 100% of the State R&D funding is spent on applied research, that companies would still view the activities within HEIs and PROs as not being relevant to their needs if the areas of research are not directly related to areas of interest to them.

Conversely, if the research activities within HEIs and PROs are in areas of interest to enterprise but all undertakings are in basic research, then companies may also view the activities as not being directly relevant to them. That is not to say that basic research is not relevant to Irish industry but that many Irish based companies may not be in the position to engage in basic research activities (as would be the case globally). Provided the correct support mechanisms are in place, some of the basic research activities are likely to evolve to applied research activities over time, and form the applied research of the future that Irish based companies can leverage.

To ensure that HEIs and PROs undertake areas of research that are of interest to industry, there must be some level of industry led/directed research (regardless of whether it is basic or applied research).

It is necessary to try and elucidate the underlying issues that are the basis for the negative views and perceptions held by companies with respect to the industry relevance of State R&D funding. To do this the following questions need to be answered:

1. Is information in relation to State funded R&D activities and supports easily accessible and well communicated to companies?⁶
2. What proportion of State funding is allocated to applied and basic R&D?
3. Are the areas of R&D activity in HEIs and PROs aligned with the R&D areas of interest to the enterprise base?
4. Within the areas of R&D that are of interest to the enterprise base, is State funding for R&D appropriately apportioned between basic and applied research?
5. What proportion of State funding is provided for industry led/industry directed R&D activities, and what is the appropriate level?

⁶ In relation to question one, recent feedback received through industry based consultations (including those of an Advisory Science Council Task Force and the Innovation Task Force) has indicated that there is need to develop greater visibility for companies of State funded research activities along with the supports available and the mechanisms for engaging in enterprise-HEI interactions.

This paper looks to answer the second question listed above, and presents a picture of the proportion of State funding for R&D that is allocated to basic and applied research⁷.

Two approaches were considered in an effort to develop this picture. The first approach was an analysis based on the classification of spend, according to research type, by the performers of R&D funded by the State; HEIs, Industry and PROs. The second approach considered was based on classification of funding, according to research type, by the funders of R&D; Government departments and their associated funding and research performing agencies.

In the first approach, data used for the analysis was taken from three sources:

- Business Expenditure on Research and Development (BERD), 2007/2008, Central Statistics Office
- Higher Education Expenditure on Research and Development (HERD), 2006, Forfás
- Science Budget, 2007/2008, Forfás

The analysis was focused on the 2007 data as this was the most recent and fullest set of data available.⁸ However, upon detailed review of the HEI data some concern was raised in relation to the fullness of the data set and the exactness of the classification of research activities with respect to research type.⁹ Considering that the HEIs accounted for 70 % of the total public spending on R&D in 2007, issues over the preciseness of the data associated with the HEIs also shed doubt as to whether the overall picture developed using this approach was wholly representative of the situation in 2007.

A second approach was also used to estimate the ratio of basic to applied research funded by the State and it is this analysis that is presented in detail in this paper. The analysis is based on the proportion of funding allocated to R&D for basic and applied research through Government departments and their associated funding and research performing agencies. Data relating specifically to the type of research funded in the HEIs by the State is also explicitly presented.

Based on scrutiny of the thematic areas for which the State provides R&D funding, some inferences are made in relation to the proportion of funding allocated to basic and applied research within the key thematic areas funded by the State.

⁷ For simplification purposes, the analysis is limited to the two categories of basic and applied research. Any funding in the category of experimental research has been included in the applied research category.

⁸ In 2007, government expenditure on R&D was €844 million, government expenditure on public research organisations was €141 million, Government expenditure on enterprise R&D activities was €91 million. By deduction government expenditure in HEIs in 2007 was estimated at €612 million (including EU funds of €38 million).

⁹ The data reported in HERD was collected based on self categorisation of the research type by the HEIs. Review of the data showed that some Universities reported close to 100% basic research, which indicates that perhaps a less than rigorous approach was taken in some instances in categorising the research type. In addition, several of the HEIs did not return data in relation to categorisation of research type. Thus, any analysis based on the HERD data would be based on a less than fully populated data set and may have resulted in the development of a misrepresentation of the national picture of applied and basic research within the HEIs.

The question of alignment between R&D activity in HEIs and PROs with the R&D areas of interest to the enterprise base will be interrogated as part of the Research Prioritisation Project.¹⁰

There is no simplistic answer to question four. In the first instance the information based on the answers to question two and three are required and further analysis would subsequently be required to determine the more detailed picture of the apportioning of basic and applied research within a given area of research.

However, the more significant part of the question is contained in the word 'appropriately'. Whether the State funding for R&D is considered appropriately allocated between applied and basic research is dependent on the national model for generating a return on State investment in R&D. The model could dictate the funding for basic and applied research and funding within the various areas of research could be assigned accordingly.

There are 3 general options that need to be considered for such a model:

A: The primary focus (within HEIs and PROs) is on basic research. The rationale for this approach being that:

- Ireland will develop human capital with strong understanding of scientific principles who will provide a strong, versatile talent pool who can apply their broad range of skills to the needs of companies. Availability of such researchers will attract companies to engage in R&D in Ireland.
- Basic research activities adds to Ireland's competitiveness in attracting foreign owned companies to Ireland.
- Output from basic research will ultimately result in disruptive market breakthroughs. Irish based enterprise can build their in-house R&D activities using the platform of the basic research activities within the HEIs. Access to expertise in the basic research aspects will provide companies with a competitive edge in their development endeavours.
- Basic research will form the foundation for the development of future new products, processes and services and can be the initiation point of spin out companies from the HEIs.

B: The primary focus (within HEIs and PROs) is on applied research. The rationale for this approach being that:

- Ireland will develop human capital with strong applied research skills that will accelerate the development of new products/processes and services in enterprise.
- Applied research outputs can be adopted by enterprise to accelerate commercialisation (through collaboration or licensing) or can be spun out from the HEIs to form new enterprises.

¹⁰ The Research Prioritisation Project was announced by the Minister for Enterprise Trade and Innovation and its focus is to identify research areas that can deliver the best economic dividend for the Irish people through enterprise development and job creation.

- With an applied research bias, Irish researchers can scan basic research outputs being generated elsewhere rather than the State directly investing in this category of research. In this scenario Ireland could focus on advancing the research to the development phase and ultimately in some cases through to commercialisation.

C: There is a focus on both basic and applied research. The rationale for this approach being that:

- Human capital with a range of R&D skills and expertise is developed for the enterprise base.
- Breakthroughs achieved in basic research activities will have a path for further development within the State funded system through the availability of funding for applied research.
- Applied research outputs can be adopted by enterprise to accelerate commercialisation (through collaboration or licensing) or can result in spin out companies from the HEIs. In some cases the underlying basic research knowledge will be paramount to the ultimate success of commercialisation.

Thus, in order to answer question four, a model could be developed as to how Ireland can best reap return on its investment in R&D. This model could dictate the levels of investment to be awarded to applied and basic research and a review of international approaches to the apportioning of State spending on basic and applied research would help to steer the development of such a national model. Different models could be applied to different thematics as considered appropriate.

Finally the fifth question is based on the following thought process: if industry lead the research, then the R&D activities should be aligned with industry needs. Any model considered as to how Ireland can best reap return on its investment in R&D should also look to provide direction on the appropriate levels of industry led research that should be funded.

2. Categories of Research

It is acknowledged that the categorisation used here is extreme, as there is a continuum of research activities that spans the spectrum from basic research on one side to commercialisation activities on the other side. However, three categories; basic, applied and experimental research form the basis under which national data is collected, and so this terminology will be used in this paper.

The OECD Frascati Manual defines the three categories of research as follows:

Basic Research - experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view

Applied Research - original investigation undertaken in order to acquire new knowledge, primarily directed towards a specific practical aim or objective.

Experimental Development - systematic work, drawing on existing knowledge gained from research and practical experience that is directed at producing new materials, products and

devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

There are many outputs derived from basic research which are beneficial to the economy and to society. Activities associated with basic research can lead to scientific discoveries which may lead to new processes, products and technologies in the future. Researchers and students engaged in basic research develop deep levels of understanding of scientific principles. Such researchers provide a deep knowledge base within companies if employed as industrial researchers. For companies looking to invest in long term R&D activities, basic research type activities within the HEIs are an attractive proposition. The HEIs have the people and equipment capabilities to take on a broad range of topics without the need for companies to make significant investments in the area until the project starts to move further through the company product/technology funnel.

Towards the other end of the R&D spectrum, researchers and students engaged in applied research activities are developing knowledge and skills that are more applicable to industry in the shorter term (assuming the areas of study are aligned with the industry base). For companies wishing to engage in collaborative opportunities, but with a shorter term view towards return on investment, then applied research activities in the HEIs and PROs are an attractive proposition. Engaging in applied research activities can help companies accelerate their R&D activities, and reduce the time to market for new products and services. This is based on leveraging the skills and capabilities within the HEIs and PROs, and this type of leverage is particularly important for many indigenous companies at the moment, where the financial resource or capability to invest in longer term basic science programmes may not exist. In the case of applied research, there is potential for a beneficial outcome that has a direct economic impact in the shorter term.

Experimental research activities are typically more associated with activities within enterprise. This type of development is typically incremental, and focused on changes to existing products and processes. It is imperative for companies to engage in such activities so as to maintain their competitive edge.

3. Data Analysis

For the purpose of this analysis, the data for State spending on R&D has been taken from the Science Budget 2007/2008 and the Science Budget 2008/2009. Two sets of data were reviewed to determine if there has been any discernable change in the levels of applied and basic research activity funded by the State, in the past few years. The analysis is based on data from 12 of the top 14 State R&D funding bricks.¹¹ For simplification purposes, the analysis is limited to the two categories of basic and applied research. Any funding in the category of experimental research has been included in the applied research category.

Categorisation of each funding brick according to research type of R&D was achieved in a number of ways:¹²

- Based on the mandates of the following entities assumptions were made as to the allocation of funding for basic or applied research: Science Foundation Ireland (SFI)¹³,

¹¹ Data for the Office of Public Works and DES with an assigned 'Miscellaneous' tag were considered difficult to track in relation to the levels of applied and basic research.

¹² Further detail is provided in Annex 1.

Industrial Development Agency (IDA), Enterprise Ireland (EI), and Sustainable Energy Authority of Ireland (SEAI).

- Funding for the Department of Agriculture, Fisheries and Food (DAFF), Teagasc and The Marine Institute were categorised in accordance with data available in the Science Budget 2007/2008 and the Science Budget 2008/2009 in the Agricultural Sciences area.
- Estimates for R&D funding for basic and applied research were provided by the Irish Research Council for Science Technology and Engineering (IRCSET), the Health Research Board (HRB)¹⁴, the Environmental Protection Agency (EPA) and the Higher Education Authority (HEA) (programme for research in third level institutions-PRTL Cycle 4) and SFI¹⁵.
- The Block-Grant spend on R&D in the Universities was categorised based on the total proportion of funding to basic and applied research as calculated through the combined funding of SFI, HEA, HRB, EI and IRCSET.^{16,17}

The first analysis, 4.1, is based on 2007/2008 Science Budget figures, and the further benefit to companies by way of R&D tax credits is not included as a State cost for R&D. The categorisation of the research type is based on estimates for the proportioning of the various funding bricks in 2007. Two different cases are considered:

- **Case 1:** SFI funding is 100% allocated to basic research.
- **Case 2:** SFI funding is considered to fund both applied and basic research.¹⁸ The percentage of SFI funding allocated to applied research is based on funding to Centres for Science Engineering and Technology (CSETs) and Strategic Research Clusters (SRCs) by way of payments in 2007.

It is noted that the manner in which SFI funding is allocated has a subsequent affect on the % allocation of the Block-Grant to applied and basic research.

¹³ In Case 1 the SFI funding was 100% allocated to basic research.

¹⁴ It is noted that the HRB is moving to a fully applied R&D agenda in 2010 - citing that SFI fund basic activities in this area.

¹⁵ In Case 2 the SFI funding was proportioned between basic and applied research based on estimates provided by SFI. It is acknowledged that the lines between basic and applied research can be blurred and that estimates for applied research by SFI reflect activities in the boundary between basic and applied research.

¹⁶ This is an estimated value- SFI, EI, PRTL, HRB, and IRCSET were the largest funders of HEI activities in 2006, The Higher Education R&D Survey 2006.

¹⁷ Annex 1 provides further detail as to how the funding associated with the Block-Grant was proportioned according to basic and applied research.

¹⁸ SFI has a mandate to fund basic oriented research and as such the nature of the research funded is not fully aligned with the Frascati definition for basic research. Based on the oriented nature of the research, it is reasonable to assume that funding in some cases is provided for research activities that sit in the boundary space between basic and applied research. In the Case 1 analysis activities funded in this part of the R&D spectrum were classified as basic research, and in the Case 2 analysis they were classified as applied research.

The second analysis, 4.2, is based on 2007/2008 Science Budget figures plus the further benefit to companies by way of R&D tax credits. The categorisation of the research type is based on estimates for the proportioning of the various funding bricks in 2007. In this case, the BERD data is used to estimate the State R&D support associated with R&D tax credits and supports provided in this manner are categorised as support for applied research. Again two different cases are considered:

- **Case 1:** SFI funding is 100% allocated to basic research.
- **Case 2:** SFI funding is considered to fund both applied and basic research.¹⁴ The percentage of SFI funding allocated to applied research is based on funding to CSETs and SRCs by way of payments in 2007.

It is noted that the manner in which SFI funding is allocated has a subsequent affect on the % allocation of the Block-Grant to basic and applied research.

Finally, the analysis in 4.3 is based on the 2008/2009 Science Budget figures. The further benefit to companies by way of R&D tax credits is not included as such data is not yet available. The categorisation of the research type is based on estimates for the proportioning of the various funding bricks in 2009. Again two different cases are considered:

- **Case 1:** SFI funding is 100% allocated to basic research.
- **Case 2:** SFI funding is considered to fund both applied and basic research. The percentage of SFI funding allocated to applied research is based on funding to CSETs and SRCs by way of payments in 2007.

It is noted that the manner in which SFI funding is allocated has a subsequent affect on the % allocation of the Block-Grant to basic and applied research.

It was acknowledged previously that the categorisation of R&D activities according to either basic or applied research is a rather knife-edged approach in terms of classification. In particular, it is acknowledged that activities categorised as applied research may differ vastly in their characteristics when discussed under other headings such as market relevance, time to market, commercialisation potential etc.. Furthermore, in some fields of research such as software development, there is no real distinction between basic and applied research activities. Thus, it is acknowledged that the picture developed through this analysis is limited to a top level perspective of State spending on basic and applied research.

4. Results

4.1 2007 Data

4.1.1 2007 Data - Case 1

Figure 1 represents the proportion of the budgets spent on basic and applied research by the key funders and budget holding performers of State R&D in 2007. The chart shows that the funding for basic research is primarily driven through SFI spend. The proportioning of the Block-Grant is significantly weighted by the large budget of SFI and thus also has a basic research bias. The PRTL Cycle 4 funding is also biased towards basic research (as would be expected based on its role in providing infrastructure primarily for SFI funded activities).

For all other bodies, the dominant research type funded is applied research.

In 2007, the total State funding for R&D was €844 million. €700 million of this funding (83%)¹⁹ was categorised according to research type, and based on the analysis it was found that there was close to a 1:1 ratio of State spending on basic and applied research in 2007, as indicated in Figure 2. This State funding included funding to HEIs, PROs and directly to companies.

Figure 1: Case 1 - Proportion of basic and applied research in 2007 for the 12 top State R&D funding and budget holding performing bodies.

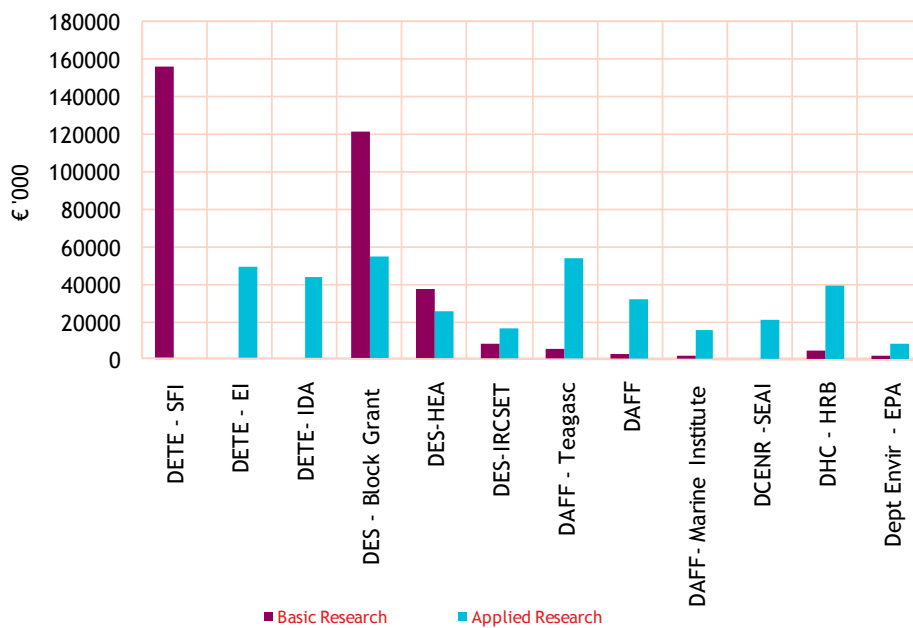
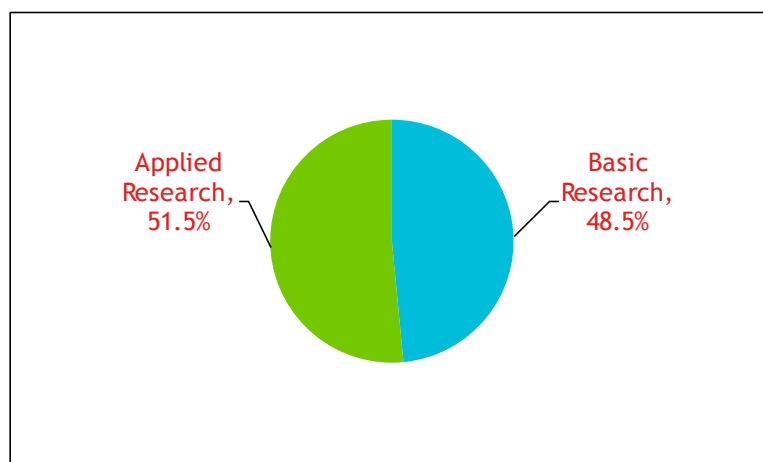


Figure 2: Case 1 - Proportion of State funding for basic and applied research in 2007, based on 83% of State R&D funding.



¹⁹ In 2007 12 of the top 14 funding bricks accounted for 83% of the total State R&D funding.

The IDA and EI are unique in that they fund industry relevant activities across all thematic areas. However, for the most part all other key funding and budget holding performing bodies fund specific thematic areas of research.

The Block-Grant spend on R&D is used to pay the salaries of many of the Principle Investigators (PIs) within the HEIs. PIs receive additional project/programme funding through national competitive funding bodies that fund the activities in HEIs (SFI, HRB, EI, PRTL and IRCSET). Thus, funding through the Block-Grant grant can be considered to be across all themes associated with these funding bodies. However, the linkage of the Block-Grant spend on R&D to the activities funded by the competitive funders indicates a significant proportion of the Block-Grant spend is in the areas of ICT, Biotechnology, and Health (in basic research for the former two).

For most of the thematic areas there is funding (to some level) in both basic and applied research. This tends to be biased more towards applied rather than basic research. The clear exceptions to this are the ICT and Biotechnology thematic areas.

Table 1: 2007 - Case 1 - State funding in thematic areas according to research type.

Funder	Theme	Basic	Applied
SFI	ICT, Biotechnology and Energy	x	
EI	All themes		x
IDA	All themes		x
DES - Block-Grant	All themes (primarily ICT, Biotech, Energy, Health)	x	x
HEA	ICT, Biotech, Energy, Food, Environment	x	x
Teagasc	Agriculture, Food	x	x
DAFF	Agriculture, Food	x	x
Marine Institute	Food, Environment, Energy	x	x
SEAI	Energy		x
DHC - HRB	Health (including Biotechnology)	x	x
EPA	Environment	x	x

Considering that there is significant investment in basic research in ICT and Biotechnology (primarily in HEIs), it would be expected that there would be a clear funding line for applied research in these thematic areas. The majority of HRB funding is allocated to applied research and as such could be considered a funding source for some of the researchers in the HEIs that are looking to move their endeavours from basic R&D activities in biotechnology along the R&D spectrum to more applied research type activities. However, there is no

corresponding body that significantly funds academic led ICT activities specifically for applied research.

Based on this analysis, the overall state investment in R&D in 2007 was split equally between basic and applied research. However, the State funding specifically in the HEIs was in the ratio of 2:1 for basic and applied research.²⁰ For a company looking inward to HEIs for opportunities to engage with academic researchers, this data indicates that the company would see a significant portfolio of basic research activities in the ICT area, but little independent academic research ongoing in applied R&D in the ICT area.

This specific point may be the reason that some companies have formed the opinion that there is a lack of applied research in the State system. For a company looking to engage in an applied research ICT project, then the significant levels of basic research ongoing within the HEIs would be palpable (SFI funding plus the supporting Block-Grant grant and PRTLTI funding). There is no similar direct source that academics can look to for funding in ICT in order to take on more applied R&D activities. This imbalance could certainly give rise to a sense that there is a lack of applied research within the HEIs within this broad thematic area.

In cases where a company sees opportunity in bringing a basic research idea forward, there is scope through EI (or IDA) to apply for applied research funding in the ICT area.

The other thematic areas funded have significant applied research elements, and thus the arguments presented by enterprise that there is a lack of applied research in these areas may be due to some misalignment between the areas of research being funded by the State and the areas that companies are interested in.

4.1.2 2007 Data - Case 2

In 2007, the total State funding for R&D was €844 million. €700 million of this funding (83%)²¹ was categorised according to research type. In Case 2, some of the SFI funding has been allocated to applied research based on SFI funding of SRCs and CSETs and the blurred boundaries in classifying R&D activities as basic or applied research.

It can be seen in comparing the data in Figure 1 and Figure 3, that by assigning a portion of the SFI funding to the applied research category there is a knock on affect on the level of applied research assigned within the Block-Grant funding brick.

Based on this approach to the analysis it was found that there was a slight bias towards State funding of applied research over basic research, as is evident in Figure 4. This State funding included funding to HEIs, PROs and directly to companies.

²⁰ State funding within the HEIs is primarily through SFI, HRB, IRCSET, PRTLTI, Block-Grant, and EI. These funders funded HEIs to the tune of ~ €480 million in 2007.

²¹ In 2007 12 of the top 14 funding bricks accounted for 84% of the total State R&D funding.

Figure 3: Case 2 - Proportion of basic and applied research in 2007 for the 12 top State R&D funding and budget holding performing bodies.

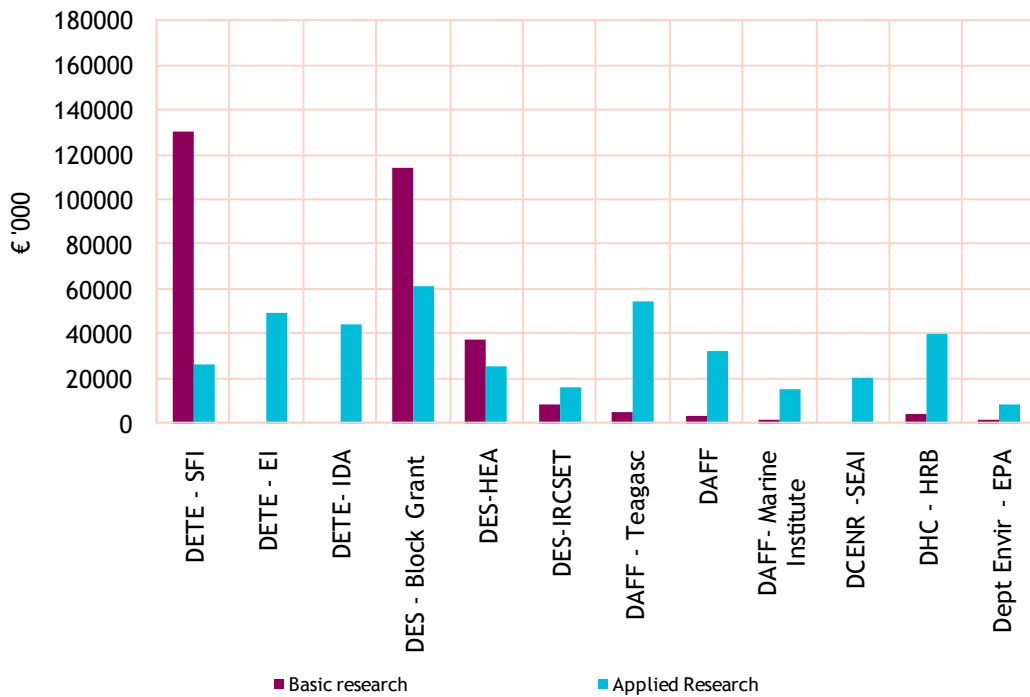
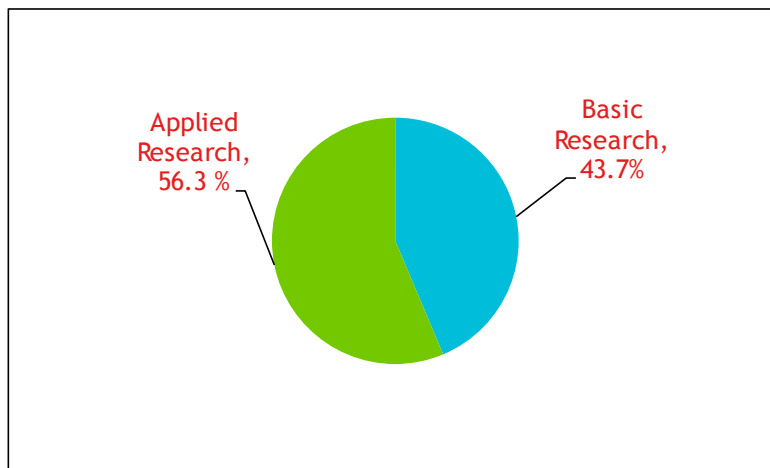


Figure 4: Case 2 - Proportion of State funding for basic and applied research in 2007, based on 83% of State R&D funding.



In Case 2, the State funding specifically in the HEIs was in the ratio of 3:2 for basic and applied research.²² Thus, if some of the activities funded by SFI are considered to be of an applied nature then the bias towards funding of basic research is not as strong as indicated in the analysis of Case 1.

²² State funding within the HEIs is primarily through SFI, HRB, IRCSET, PRTL, Block-Grant, and EI. These funders funded HEIs to the tune of - €480 million in 2007.

This approach to the analysis of research type demonstrates a line for funding of applied research activities in the ICT area through the SRCs and the CSETs. Thus, based on the Case 2 analysis, the gap for funding of ICT activities in applied research does not appear as pronounced as in the Case 1 analysis. Indeed, seven of the ten CSETs currently in existence are in the ICT area. Companies looking inward to HEIs however may view the 'applied research' activities in SRCs and CSETs as too close to the boundaries of basic research and as such not evolved far enough along the R&D cycle for them to leverage the activities effectively.

An argument can also still be made that a gap exists in terms of a funding line for independent academic researchers looking to engage in applied research in the ICT area. This would suggest that outside of CSET/SRC defined research areas that there is no further ICT applied research ongoing in the HEIs.

This may be a completely acceptable status, considering the need to focus the nation's limited resources strategically. However, it may also be a reason as to why some companies have a negative view of the relevancy of HEI activities with respect to their areas of interest.

4.2 2007 Data, Plus the Support of the State for R&D through Company R&D Tax Credits

The State further supports R&D activities through the allowance of R&D tax credits for enterprise. Although this is an incentive scheme rather than a direct funding support, it is still a cost to the exchequer. In 2007, the R&D tax credit was 20% of total allowable expenditure. Based on an incremental spend by enterprise as a whole of €493 million between 2003²³ and 2007, then an estimate of €98.6 million can be made for further State support for R&D activities in enterprise.

The State support for R&D can then be estimated to be close to €943 million in 2007.²⁴

For the purpose of this exercise, €798 million (83% of total State funding plus the cost to the exchequer of R&D tax credit) was categorised according to basic and applied research and the support provided by means of the R&D tax credit was classified as funding for applied research.

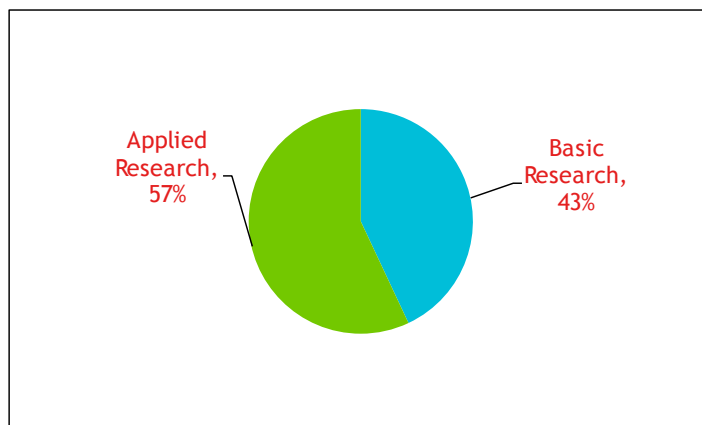
4.2.1 2007 Data Plus the Support of the State for R&D through Company R&D Tax Credits- Case 1

In Case 1, the estimate of the proportion of total State R&D support provided for basic research is 43%, and for applied research is 57%, as indicated in Figure 5.

²³ 2003 is used as the base year for calculating the incremental spend on R&D, and subsequently calculating the tax credits allowed.

²⁴ See Annex 2 for details of the calculations.

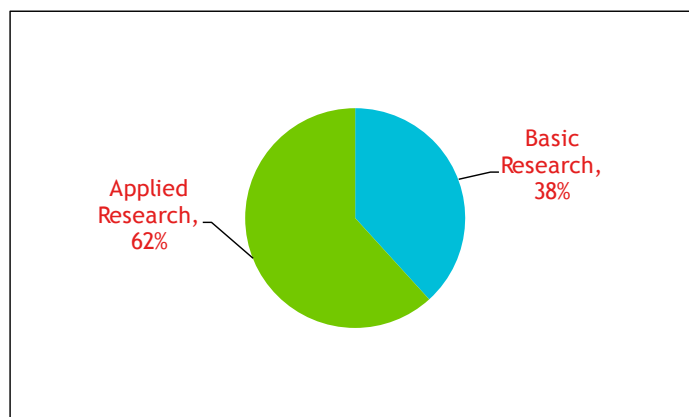
Figure 5: Proportion of State funding for basic and applied research in 2007, based on 83% of State R&D funding plus the estimated cost to the State of the R&D tax credit scheme.



4.2.2 2007 Data Plus the Support of the State for R&D through Company R&D Tax Credits- Case 2

In Case 2, the estimate for the proportion of total State R&D support provided for basic research is 38%, and for applied research is 62%, as indicated in Figure 6.

Figure 6: Case 2 - Proportion of State funding for basic and applied research in 2007, based on 83 % of State R&D funding plus the estimated cost to the State of the R&D tax credit scheme.



4.3 2009 Data

4.3.1 2009 Data - Case 1

In 2009, the estimate for State funding for R&D was €938 million. Based on the categorisation of €820 million of this funding (88%)²⁵ according to research type, it was found that there was

²⁵ In 2009 12 of the top 14 funding bricks accounted for 88% of the total State R&D funding.

approximately equal State funding on basic and applied research in 2009-Case 1, as indicated in Figure 7. It was also estimated that that State funding within the HEIs was provided in the ratio of 2:1, for basic and applied research.²⁶

Figure 7: Case 1 - Proportion of State funding for basic and applied research in 2009, based on 88% of State R&D funding.

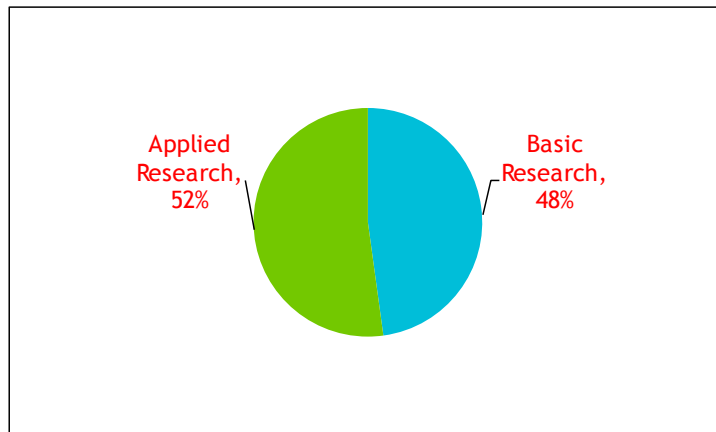


Figure 8: Comparison of the proportion of State funding for basic and applied research in 2007-Case 1 and 2009 Case 1: based on State funding on R&D to all entities and based on State funding on R&D within the HEIs.

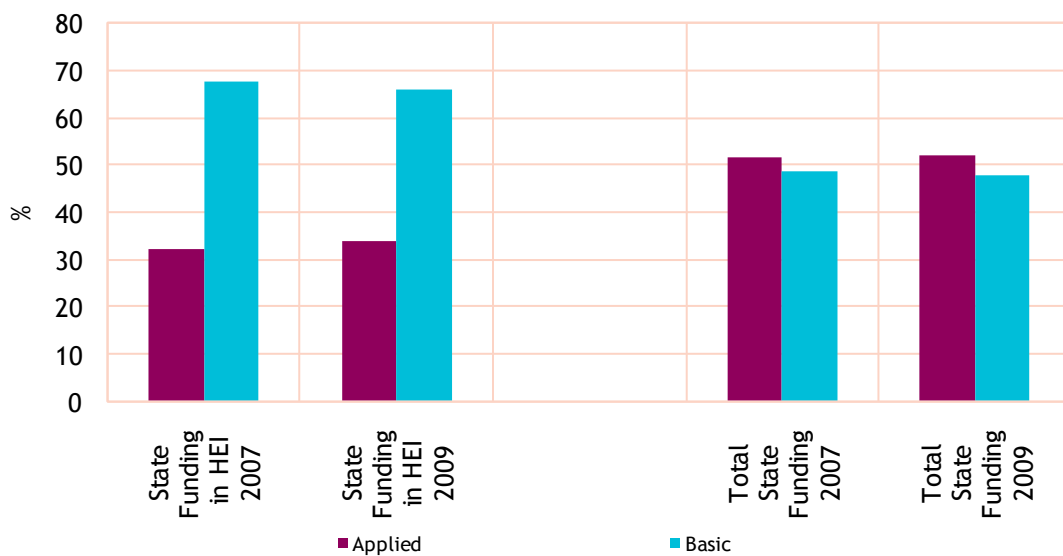


Figure 8 shows the % of State funding for basic and applied research within the HEIs and the % of the total State funding provided for basic research activities, in 2007 and 2009. The data indicates that the status of the State R&D funding has remained constant in terms of the

²⁶ State funding within the HEIs was primarily through SFI, HRB, IRCSET, PRTL, Block-Grant, and EI in 2009. These funders funded HEIs to the tune of ~ €556 million in 2009.

focus between basic and applied research from 2007 to 2009 using Case 1 analysis. There is no particular surprise in this outcome as the full SFI budget has been allocated to basic research in 2007 and 2009, and the Block-Grant proportioning between basic and applied is heavily influenced by the SFI spend according to research type.

4.3.2 2009 Data - Case 2

In 2009 €820 million of the State funding (88%)²⁷ was categorised according to research type. In Case 2, some of the SFI funding has been allocated to applied research based on SFI funding of SRCs and CSETs and the blurred boundaries in classifying R&D activities as basic or applied research. Using this approach to the analysis, it was found that State funding on basic research was 36% and on applied research was 64%, as indicated in Figure 9.

It was also estimated that that State funding within the HEIs was provided in an approximately equal ratio for basic and applied research.²⁸

Figure 9: Case 2 - Proportion of State funding for basic and applied research in 2009, based on 88% of State R&D funding.

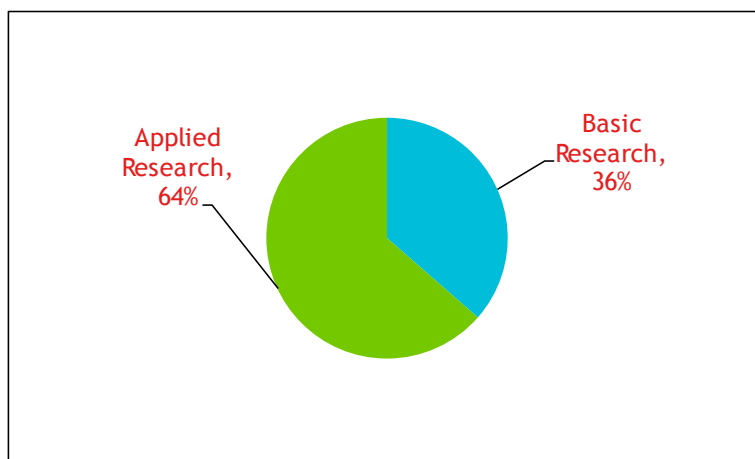
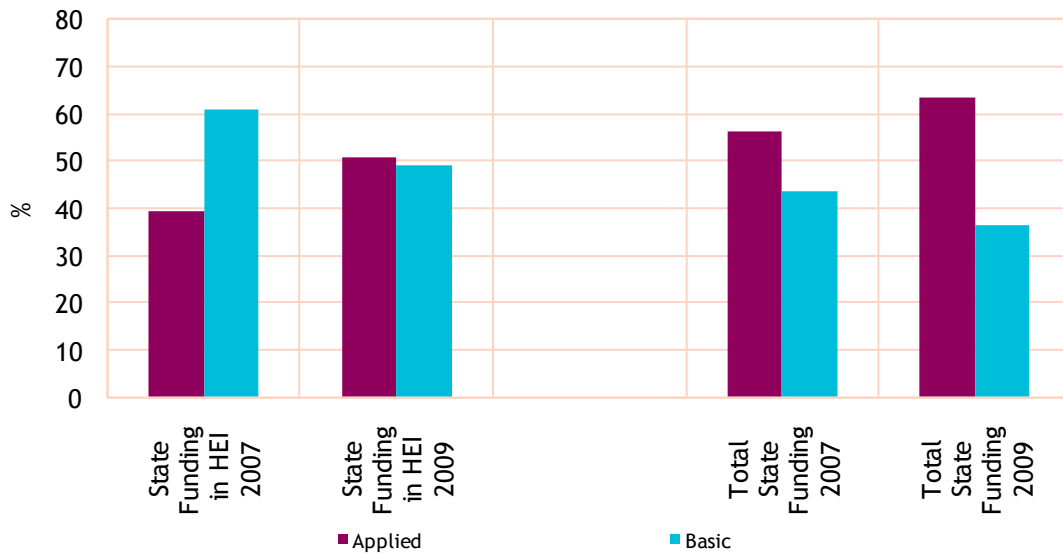


Figure 10 shows the % of State funding for basic and applied research within the HEIs and the % of the total State funding provided for basic and applied research activities, in 2007-Case 2 and 2009- Case 2. The level of State funding for basic research was less than that for applied research in 2007, and the proportion of State funding provided for basic research was reduced further in 2009. In the Case 2 analysis, the data indicates that in 2009 funding for applied research in HEIs overtook the level of funding for basic research. In the Case 2 analysis the changes in the proportions of State funding for basic and applied research in going from 2007 to 2009, are a consequence of the changes in proportion of the yearly funding payments by SFI to basic and applied research, and the subsequent affect on the categorisation of the Block-Grant.

²⁷ In 2009 12 of the top 14 funding bricks accounted for 88% of the total State R&D funding.

²⁸ State funding within the HEIs was primarily through SFI, HRB, IRCSET, PRTL, Block-Grant, and EI in 2009. These funders funded HEIs to the tune of ~ €556 million in 2009.

Figure 10: Comparison of the proportion of State funding for basic and applied research in 2007-Case 2 and 2009 Case-2: based on State funding on R&D to all entities and based on State funding on R&D within the HEIs.



5. Conclusion

The question posed at the beginning of this paper 'What proportion of State funding is allocated to applied and basic R&D?', has been answered based on an analysis of funding provided for basic and applied research according to the funders of R&D. Furthermore two tracks of analysis have been pursued. The two cases considered, Case 1 and Case 2, provide different pictures of the provision of State funding for basic and applied research.

When SFI's budget was considered solely to fund basic research type activities, then it was estimated that approximately 1/2 of State funding was allocated to basic research and 1/2 to applied research in both 2007 and 2009 respectively. Taking into account the R&D Tax credits in 2007 did push applied research in to the majority recipient of State spend on R&D.

In the HEIs, 2/3 of the funding was provided for basic research and 1/3 for applied research, and this ratio remained the same in going from 2007 to 2009.

When SFI's budget was considered to fund both basic and applied research activities, then it was estimated that State spending on applied research was greater than on basic research in 2007 and 2009, with the differential in funding between basic and applied research increasing between 2007 and 2009. The inclusion of the R&D tax credits as a state support for applied research further pushed the proportion of State funding beyond the basic research level.

In the HEIs, the analysis showed a greater level of funding for basic over applied research in 2007, however it was estimated that parity between funding for basic and applied research had been reached by 2009.

As mentioned in the introduction, upon detailed review of the HEI data some concern was raised in relation to the fullness of the data set and the exactness of the classification of

research activities with respect to research type, by the performers of R&D funded by the State (Approach 1). Nonetheless, it is worth noting that when this approach was used it was estimated that, in 2007, 43% of State funding was spent on basic research and 57 % on applied research. Specifically within the HEIs, an estimate of 55% of the State funding provided to the HEIs was spent on basic research and 45 % on applied research. This picture is closely aligned with the picture developed in the Approach 2 Case 2-2007 analysis presented in this paper; with only a 1% deviation between estimates of the proportion of total State funding on basic and applied research, and a 5% deviation between estimates of the proportion of State funding within the HEIs for basic and applied research.

In summary, it was found that State funding for basic research lies in the range of 37% - 49% and applied research in the range 51% - 63%. State funding for basic research within the HEIs lies in the range 50% - 68% and for applied research in the range 32% - 50%. The OECD country mean for State funding of basic research in HEIs was found to lie in the range reported here, at 55 % in 2003.²⁹

It is considered that the Case 2 approach provides a better reflection of the level of basic and applied research funded by the State. However, the extent to which the applied research activities funded by the SFI penetrate beyond the boundaries of basic research into the applied research spectrum³⁰ is limited. It seems plausible that some of the negative views held by enterprise may be a consequence of the lack of a clear line of funding for applied research, which has greater penetration into the applied research spectrum of activities. This may be particularly true in the ICT thematic, where there is no significant funder outside of the SFI. This may lead to the view by enterprise that there is a considerable imbalance in funding between basic and applied research which could conceptually lead to a number of companies viewing the activities in HEIs as irrelevant to company needs.

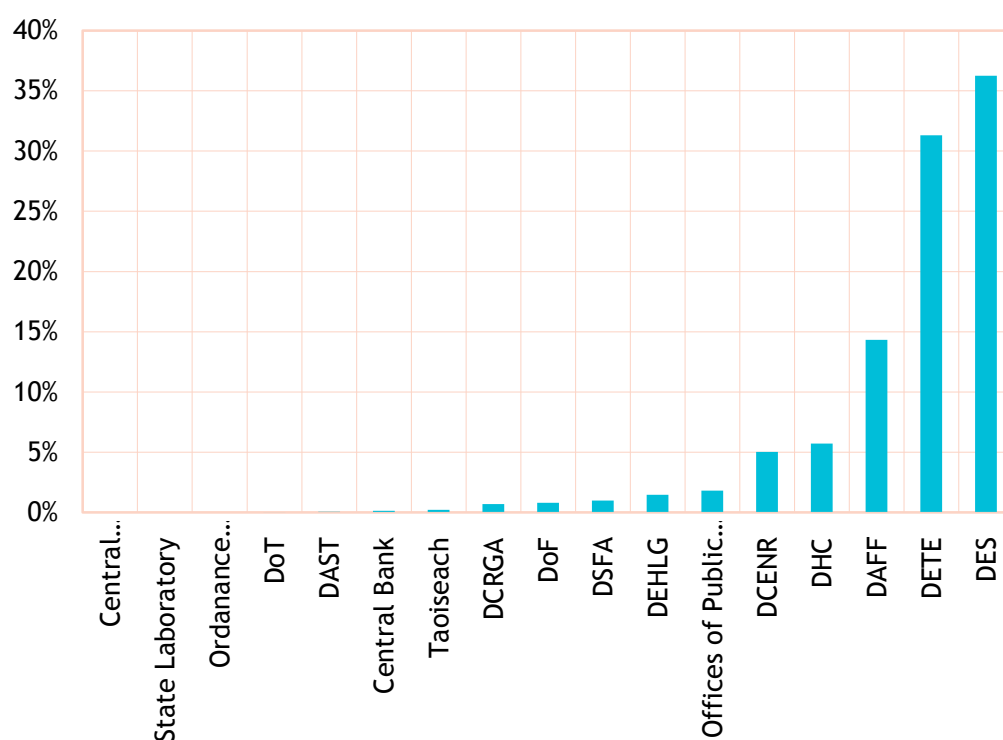
²⁹ Stephen Vincent - Lancrin, European Journal of Education, 41, 2, June 2006

³⁰ The applied research spectrum could be considered to be bounded by basic research on one side and commercialisation on the other.

Annex 1 - 2007 and 2009 Data

Based on the figures in the Science Budget 2007/2008 it is clear that the majority of the estimated €844 million spend on R&D by the State in 2007 was through five Government Departments as indicated in Figure 5. As expected DETE and DES are the primary sources of funding for R&D.

Figure 11: The % of the total State R&D spend by each Government Department in 2007.



Of the estimated €844 million spend on State R&D in 2007, there were 14 direct department or agency funding bricks, each greater than €10 million. In total these 14 sources of funding contributed €735 million to the State spend of €844 million (~87%). These 14 sources of funding are listed in Table 2. The proportion of the budget spent on basic and applied research is indicated for each funding brick. There are two cases shown: the first case where SFI funding is allocated 100% to basic research, and the second case where SFI funding is allocated to both basic and applied research.

Of the estimated €938 million spend on State R&D in 2009, 12 direct departments or agencies contributed €820 million to the State spend of €938 million (~88%). These 12 sources of funding are the same 12 funders used for the 2007 analysis and are listed in Table 3. There are 2 cases shown: the first case where SFI funding is allocated 100% to basic research, and the second case where SFI funding is allocated to both basic and applied research.

Table 2: Top 14 funders of R&D - budgets greater than €10 million in 2007. The proportion of the spend on basic and applied research is indicated.

	Budget in 2007 € '000	Case 1			Case 2		
		Basic Research	Applied Research	Source of information	Basic Research	Applied Research	Source of information
DETE - SFI	156622	100.00%		Based on mandate	83.00%	17.00%	Based on estimate by SFI
DETE - EI	49587		100.00%	Based on mandate		100.00%	Based on mandate
DETE- IDA	43917		100.00%	Based on mandate		100.00%	Based on mandate
DES - Block Grant on R&D	175910	69.00%	31.00%	Based on combined proportion of applied and basic of SFI,EI, PRTL I and IRCSET	65.40%	34.60%	Based on combined proportion of applied and basic of SFI,EI, PRTL I and IRCSET
DES-HEA-PRTL I	62476	59.30%	40.70%	Based on estimate from HEA	59.30%	40.70%	Based on estimate from HEA
DES-IRCSET	24029	33.33%	66.66%	Based on estimate from IRCSET	33.33%	66.66%	Based on estimate from IRCSET
DAFF- Teagasc	59370	8.50%	91.50%	Science Budget 2007/2008 data	8.50%	91.50%	Science Budget 2007/2008 data
DAFF- Direct Fund	34767	8.50%	91.50%	Science Budget 2007/2008 data	8.50%	91.50%	Science Budget 2007/2008 data
DAFF - Marine Institute	16580	8.50%	91.50%	Science Budget 2007/2008 data	8.50%	91.50%	Science Budget 2007/2008 data
DCENR-SEAI	20639		100.00%	Based on mandate		100.00%	Based on mandate
DHC - HRB	44000	10.00%	90.00%	Based on estimate from HRB	10.00%	90.00%	Based on estimate from HRB
Dept Environment - EPA	10652	15.40%	84.60%	Based on estimate from EPA	15.40%	84.60%	Based on estimate from EPA
Office of public	15093			unknown			unknown
DES- Miscellaneous	20780			unknown			unknown

Table 3: 12 of the top funders of R&D in 2009. The proportion of the spend on basic and applied research is indicated.

	Budget in 2009 € '000	Case 1			Case 2		
		Basic Research	Applied Research	Source of information	Basic Research	Applied Research	Source of information
DETE - SFI	165441	100.00%		Based on mandate	67.25%	32.75%	Based on estimate by SFI
DETE - EI	70320		100.00%	Based on mandate		100.00%	Based on mandate
DETE- IDA	60000		100.00%	Based on mandate		100.00%	Based on mandate
DES - Block Grant on R&D	230959	67.00%	33.00%	Based on combined proportion of applied and basic of SFI,EI, PRTL and IRCSET	50.00%	50.00%	Based on combined proportion of applied and basic of SFI,EI, PRTL and IRCSET
DES-HEA	84908	59.30%	40.70%	Based on estimate from HEA	59.30%	40.70%	Based on estimate from HEA
DES-IRCSET	25100	33.33%	66.66%	Based on estimate from IRCSET	33.33%	66.66%	Based on estimate from IRCSET
DAFF- Teagasc	62602	9.50%	90.50%	Science Budget 2007/2008 data	9.50%	90.50%	Science Budget 2007/2008 data
DAFF- Direct Fund	26581	9.50%	90.50%	Science Budget 2007/2008 data	9.50%	90.50%	Science Budget 2007/2008 data
DAFF - Marine Institute	15364	9.50%	90.50%	Science Budget 2007/2008 data	9.50%	90.50%	Science Budget 2007/2008 data
DCENR-SEAI	25891		100.00%	Based on mandate		100.00%	Based on mandate
DHC - HRB	44463	5.00%	95.00%	Based on estimate from HRB	5.00%	95.00%	Based on estimate from HRB
Dept Environment - EPA	8640	10.00%	90.00%	Based on estimate from EPA	10.00%	90.00%	Based on estimate from EPA

The basis for categorising whether funding was provided for basic or applied research is described below for each funding body:

SFI Case 1:Based on the mandate of the agency to fund basic orientated research, this funding brick was assigned fully to the basic research category.

SFI Case 2: The % of funding provided for more applied type activities (based on the blurred boundaries between basic and applied research) was estimated by SFI based on payments to SRCs and CSETs.³¹

EI Based on their role of funding industry focused research, this funding brick was assigned fully to applied research.

³¹ SFI provided estimates of funding for applied and basic research based on grants awarded in the years 2007 and 2009, and the cumulative grants awarded for applied and basic research to the end of 2007 and the end of 2009. In addition, the cumulative payments to the end of 2007 and the end of 2009 provided for applied and basic research were provided. However, to maintain consistency with the analysis of other funding data, the data used in the analysis for Case 2 was based simply on the proportion of payments provided for applied and basic research in 2007 and 2009 respectively. The Science Budget 2007/2008 and 2008/2009 monies for SFI were then allocated to applied and basic research according to these proportions.

IDA Based on their role of funding industry focused research, this funding brick was assigned fully to applied research.

DES Block-Grant There is currently no survey in place which collects data based on the type of research that the Block-Grant specifically funds within the HEIs. However, the Block-Grant funds approximately 80% of PIs in the HEIs. So if a PI is engaged in basic research then it is assumed that the Block-Grant is funding basic research. Based on this rationale, an estimate for the proportion of the Block-Grant spent on basic and applied research can be made in accordance with the ratio of the funding for basic and applied research to HEIs by national funders. The proportion of funding for basic and applied research of SFI, EI³², HRB, IRCSET and PRTL³³ was used to develop an estimate for the proportion of the R&D Block-Grant that can be assigned to basic and applied research.

This calculation was completed for 2007 and 2009.

HEA (PRTL Cycle 4) This funding brick was categorised based on an estimate of funding to basic and applied research programmes under PRTL Cycle 4.

The HEA assigned the funding to their various programmes as funding for basic or applied research. Some of the funding could not be assigned to applied or basic³⁴ and some of the funding was applied to both 'applied & basic' funding. The € value provided for both 'applied & basic research' was split and apportioned equally to the basic research and applied research categories. In total €175 million of the €260 m awarded for PRTL Cycle 4 was allocated to basic or applied research. Overall, an estimate of 59.3% of PRTL Cycle 4 funding was assigned to basic research and 40.3% to applied research.

The 2007 HEA spend on R&D was estimated at ~ € 63 million, thus this spend has been apportioned to basic and applied research categories in accordance with the analysis of PRTL Cycle 4 data (59.3% to basic and 40.3% to applied research).

The 2009 data HEA PRTL funding was categorised based on the same proportions (59.3% to basic and 40.3% to applied research).

IRCSET For 2007 and 2009, this funding brick was categorised based on an estimate provided by IRCSET that 2/3 of all IRCSETs spend is in career formation in which they are direct applications of the research funded.

Teagasc For 2007 this funding brick was categorised based on the data provided in the Science Budget 2007/2008. It is reasonable to apply the basic to applied research proportions according to the data presented in the Science Budget 2007/2008 in relation to Agriculture. Basic research = 8.5%, Applied research = 81.2%, Experimental research = 10.3%. For the purpose of this analysis, the proportion of funding assigned to the experimental category has been added to the applied research category.

³² Only the proportion of the EI budget which is provided for collaborative funding was used - Innovation partnerships, industry led networks, international collaborations and basic research. For the purposes of this analysis it is assumed that the full budget spend is in the HEIs and not in the PROs.

³³ These are the five highest funders to HEIs, The Higher Education on Research and Development 2006.

³⁴ Some programmes cannot be classified as basic or applied since they may relate to a graduate school or to capital-only programmes (difficult to assign infrastructure projects as basic or applied since it depends on the research hosted).

For 2009 this funding brick was categorised based on the data provided in the Science Budget 2008/2009. Basic research = 9.5%, Applied research = 79.3%, Experimental research = 11.2%.

DAFF For 2007 this funding brick was categorised based on the data provided in the Science Budget 2007/2008. It is reasonable to apply the basic to applied research proportions according to the data presented in the Science Budget 2007/2008 in relation to Agriculture. Basic research = 8.5%, Applied research = 81.2%, Experimental research = 10.3%. For the purpose of this analysis, the proportion of funding assigned to the experimental category has been added to the applied research category.

For 2009 this funding brick was categorised based on the data provided in the Science Budget 2008/2009. Basic research = 9.5%, Applied research = 79.3%, Experimental research = 11.2%.

Marine Institute For 2007 this funding brick was categorised based on the data provided in the Science Budget 2007/2008. It is reasonable to apply the basic to applied research proportions according to the data presented in the Science Budget 2007/2008 in relation to Agriculture. Basic research = 8.5%, Applied research = 81.2%, Experimental research = 10.3%. For the purpose of this analysis, the proportion of funding assigned to the experimental category has been added to the applied research category.

For 2009 this funding brick was categorised based on the data provided in the Science Budget 2008/2009. Basic research = 9.5%, Applied research = 79.3%, Experimental research = 11.2%.

SEAI This funding brick was categorised as 100% applied research based on the focus of SEAI's agenda, for both 2007 and 2009.

HRB This funding brick was categorised based on an estimate provided by the HRB of their funding spend on basic and applied research. In 2007 10% of funding was for basic research and 90% for applied research. In 2009, 5% of funding was categorised as spend on basic research and 95% was categorised as spend on applied research.

EPA This funding brick was categorised based on an estimate provided by the EPA of their funding spend on basic and applied research. In 2007, 15% of funding was provided for basic research and 85% for applied research. In 2009 10% of funding was categorised as spend on basic research and 90% was categorised as spend on applied research.

Of the top 14 funders on R&D, the funding brick associated with the Office of Public Works³⁵ and the funding brick assigned to DES under 'miscellaneous' were considered too difficult to categorise without engaging in a more in depth analysis.

³⁵ Office of Public Works budgets are for physical infrastructure - whether funding differentiation between applied and basic research is attributable in this case needs to be determined. Specific projects carried out in 2007 may potentially be easily assigned to applied or basic research, however this emphasis may change from year to year, and so an average proportioning would be required over several years to provide a more accurate picture of the spend.

Annex 2 - 2007 Data Plus the Estimate of State Support for R&D through Enterprise R&D Tax Credits

In 2003, the enterprise spend on R&D was €1.105 bn. In 2007, this spend had risen to €1.598 bn. The R&D tax credit allowance introduced in 2004 was based on a rate of 20% for R&D expenditure (on capital or revenue costs) on the incremental spend over the base year 2003 spend.

An estimate of the State cost of the R&D tax credits in 2007 is made based on the simplistic calculation of the differential between the total enterprise spend in 2007 and the total enterprise spend on R&D in 2003. It is assumed that all companies have made sufficient profit to pay corporation tax and can avail of the full advantage of the 20% R&D tax credit.

Based on these assumptions, the cost of the R&D tax credit incentive in 2007 is estimated as €98.6 billion. This could be considered further State R&D support for applied research activities.

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