

VALUE FOR MONEY REVIEW OF THE FOOD INSTITUTIONAL RESEARCH MEASURE (FIRM)



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THE DEPARTMENT OF
AGRICULTURE, FISHERIES & FOOD
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Glossary of Terms

COFORD	National Council for Forest Research and Development
DAF	Department of Agriculture and Food
EI	Enterprise Ireland
EPA	Environmental Protection Agency
ESRI	Economic and Social Research Institute
FHRI	Food for Health Research Initiative
FIRM	Food Institutional Research Measure
FSAI	Food Safety Authority of Ireland
FSPB	Food Safety Promotion Board (SafeFood)
IBEC	Irish Business and Employers Confederation
ICOS	Irish Co-operative Organisation Society
ICSTI	Irish Council for Science, Technology and Innovation
IP	Intellectual property
MSc	Master of Science degree
NDP	National Development Plan
NUIG	National University of Ireland, Galway
PhD	Research Doctorate
PSOP	Public Sector Operational Programme
R&D	Research and Development
RELAY	Research Dissemination Service
RSF	Research Stimulus Fund
RTDI	Research Technological Development & Innovation
SSTI	Strategy for Science, Technology and Innovation
TCD	Trinity College Dublin
UCC	University College Cork
UCD	University College Dublin
UL	University of Limerick
VFM	Value for Money

EXECUTIVE SUMMARY

Context

The Value for Money and Policy Review Initiative is part of a framework introduced to secure improved value for money from public expenditure. Value for Money (VFM) Reviews involve a process of evaluation carried out by Government departments as part of their annual business planning. The objectives of VFM Reviews are to analyse Exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made on priorities within and between programmes. A joint Steering Group representing the relevant spending Department/Office and the Department of Finance undertakes each VFM Review.

Terms of Reference

The purpose of the Food Institutional Research Measure (FIRM) VFM Review, as set out in its Terms of Reference, is to:

- Outline the objectives of the FIRM programme.
- Examine the current validity of those objectives and their compatibility with relevant National and EU policy documents including the Department's Statement of Strategy and the National Development Plan 2000-2006.
- Outline the outputs and outcomes associated with the programme activity and the level and trend of those outputs.
- Examine the extent that the programme's objectives have been achieved, and comment on the *effectiveness* with which they have been achieved.
- Provide a breakdown of the Department resources employed on the FIRM programme and comment on the *efficiency* with which it has achieved its objectives.
- Evaluate the degree to which the objectives warrant the allocation of public funding in the light of evolving scientific policy.
- Specify potential future performance indicators that might be used to better monitor the performance of the FIRM programme.

The review was completed in December 2007 and covers expenditure under the FIRM for the duration of the National Development Plan 2000-2006.

Food Institutional Research Measure

The National Development Plan (NDP) sets out Ireland's development strategy and investment priorities over a 7-year framework. The Food Institutional Research Measure formed part of the Research, Technological Development & Innovation Priority within the Productive Sector Operational Programme of the NDP 2000-2006.

The FIRM is the primary national funding mechanism for food research in third level colleges (Universities and Institutes of Technology) and Teagasc food research centres. The type of research funded by the FIRM runs from basic or fundamental research through to more applied type research. Areas covered by research include beverages, consumer foods, dairy, meat, food ingredients, food safety, nutrition, food viruses and residues.

Awards of approximately €7 million were made during the period 2000-2006. Funding is awarded on the basis of open competition. Proposals for funding are invited in tranches throughout the lifetime of the NDP.

FIRM Objectives

The FIRM aims to establish a base of knowledge and expertise in generic technologies that can support a modern, consumer-focused food industry. It concentrates on increasing collaboration and building capabilities in Irish research centres. A key output of FIRM is young researchers, trained to MSc, PhD and postdoctoral level, with specialist scientific skills.

The two objectives of the FIRM programme are:

(i) **Food Industry Objective:** To provide a base of information and expertise in generic technologies that will support innovation and product development in the food industry;

(ii) **Food Safety Objective:** To assist in assuring consumer protection and in ensuring that product/process development is underpinned by attention to food safety and quality issues.

This review also identified a third objective as follows:

(iii) **Information Dissemination Objective:** To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies and innovations by Irish food companies.

Methodology

The methodology applied in this review involved the following:

- Review of literature concerning research evaluation;
- Desk research - review of quantitative inputs, outputs and outcomes associated with 58 completed projects;
- Survey of research and food industry personnel;
- Stakeholder consultation (including interview of research institution personnel) and;
- Review by external evaluator with subsequent consideration of comments.

Findings

A highlight of the inputs, outputs and outcomes associated with completed FIRM projects is given below. In addition, the review findings are presented in terms of the five evaluation criteria proposed for all VFM reviews – *rationale, efficiency, effectiveness, impact and continued relevance*.

Inputs, Outputs and Outcomes

During NDP 2000-2006, 193 projects were awarded funding of over €7 million - €0.3 million of which had been spent by the end of 2006 – the under spend being due to ongoing projects. Of the 58 projects completed at the time the review commenced, the following inputs, outputs and outcomes were noted:

- The 58 projects cost a total of just under €27 million - an average of €463,000 per project;
- These projects resulted in 53.5 MScs and 83 PhDs;
- 53 of the 58 projects (91%) had a total of 526 refereed international papers published – an overall average of 9 papers per project;
- Reports from 50 of the projects (86%) had been presented at a total of 447 workshops – an overall average of 8 per project.

- There were 108 “outputs with commercial potential” associated with the completed projects. These outputs include new products or product components, new processes, new technologies, and industrially relevant knowledge or information.
- 26 of the completed projects resulted in outputs which have already been taken up by the food industry or which have led to changes in industry behaviour.

Rationale/Objectives

The survey and consultation process confirmed that the two objectives outlined for the FIRM are appropriate and it supported the Steering Group’s recommendation of a third objective as referred to above.

Efficiency

The FIRM is managed by an inter-divisional team, which includes professional scientific staff qualified to Masters and Doctorate level. The total management costs for FIRM (including payments for travel, subsistence and evaluation) amount to 4.3% of total expenditure. No suitable comparator for this cost was available but the Steering Group is satisfied that, at the very least, it will provide a useful benchmark for monitoring costs in future years. The review established that there is a relatively high level of satisfaction with the management of FIRM and it is managed in an efficient manner, particularly as regards throughput, timeliness, monitoring, evaluation, and resource allocation.

Effectiveness

The Steering Group evaluated the effectiveness of the FIRM as regards 6 key success factors:

1. *Research quality*: FIRM has produced high quality research which compares favourably to work being undertaken internationally
2. *Development of expertise*: FIRM has led to a large output of expertise (as noted above) and contributed to the build-up of a strong informational resource within research institutions. The level of movement of this expertise into the food industry is said to be rising, albeit from a low level.
3. *Value-added of the research*: This looks at the wider impact of the programme on the food industry and society, and is referred to below (impact)
4. *Relevance of the research*: Stakeholders were generally satisfied with the theme areas being addressed and the relevance of the research being undertaken. However, most requested more input into setting the research agenda and particularly noted the need for more industry involvement.
5. *Level of collaboration*: FIRM has encouraged a considerable amount of collaboration within and between research institutions. It has also begun to encourage research in key crosscutting areas such as “food for health”. While not all public good research is amenable to collaboration between industry and research institutions, the review suggests that more collaboration is both possible and desirable.
6. *Dissemination of results*: The review shows that the dissemination of research results has been a very successful component of the FIRM programme – RELAY in particular, which was established to disseminate research results, is seen to have performed very well.

Impact

There is a divergence in views regarding the overall impact of the FIRM programme, with researchers more positive than the industry itself. In general the review finds that, despite the difficulty in validating FIRM's wider impact, it has contributed significantly to innovation and food safety in Ireland. However, there is still scope for further returns.

Continued Relevance

The review concludes that the analysis undertaken illustrates not only the value for money achieved heretofore, but provides the justification for continued investment under FIRM.

Recommendations

1. Programme Management: There is a vast bank of information within DAF regarding the outputs and outcomes from FIRM based on the final reports submitted at the time of completion of the research projects. However, there is no formal mechanism for identifying what happens to the research after the final report is submitted to DAF. The Steering Group recommends the introduction of post completion questionnaire to capture impact of research further down the road and to assess the career paths of the PhDs and MScs produced. **(P50)**

2. Programme Management: As referred to at 1 above, there is a large volume of information within DAF regarding the inputs, outputs and outcomes associated with each project. This is only available through scrutiny of the individual project files. The Steering Group recommends the development of an IT database to collate and store this information – this will permit better analysis, management and reporting of the various aspects of the programme **(P52)**.

3. Objectives: As noted above, the dissemination of the FIRM research results is vital if the investment in research is to impact in the required areas. As such, the Steering Group recommends that the dissemination of results be made an explicit objective of the FIRM **(P54)**.

4. FIRM approach: FIRM funds both fundamental and applied research – the expected outputs and outcomes from each are very different. DAF should categorise projects between both types so as to aid the identification of the different achievements under each and to assist comparison **(P56)**.

5. Research Quality: The analysis in this report suggests that the quality of the research is of a very high standard. Nonetheless, there is a need to provide a measure of this quality that can be benchmarked internationally. Bibliometric analysis is a universally accepted means of doing this; the Steering Group recommends commissioning such an analysis of FIRM research **(P58)**.

6. Research Quality: The aforementioned bibliometric analysis provides a measure of where we are now in terms of quality. In the future, there is a need to adopt procedures for the *expost* evaluation of projects along a common scale so that there is a consistent qualitative measure of the quality and the value-added of the research as well as the level of expertise developed **(P58)**.

7. Development of Expertise: Supporting graduate development programmes is a new departure under FIRM that is aimed at giving graduates a wider skill set to help them succeed in the food industry. The impact of this investment needs to be measured so that informed decisions regarding future efforts in this area can be made (P59).

8. Research Value-added: FIRM predominantly lays the platform from which to commission industrially relevant technologies rather than actually delivering them. As a result, it is important that potential opportunities for further developing FIRM research are identified. DAF must consider ways to encourage researchers to be more attentive of potential commercial outlets for their research (P62).

9. Research value-added: The food industry and wider society are not fully aware of the role FIRM plays in building expertise, enhancing food safety and underpinning a lot of the innovation in the food industry. There is a need to widely market the outputs and outcomes of FIRM so as to build support and buy-in for FIRM (P64).

10. Research Relevance: Improving the relevance of FIRM research for the food industry requires more input from that industry. DAF must consider new approaches to bringing food companies together so as to articulate common research needs and shared strategic priorities (P67).

11. Research Relevance: The body of knowledge developed under FIRM can be considered as Ireland's research portfolio. As with any portfolio, it must be managed in the context of a strategic vision. The Agri-Food Research Subgroup should consider possibilities for reviewing Ireland's food research portfolio so as to inform its future direction (P67).

12. Collaboration: Collaboration between research institutions and the food industry should be encouraged where appropriate. However, many perceive the public good aspect of FIRM to be a barrier to such collaboration. DAF can help to overcome this by clarifying the types of collaboration permissible under FIRM (P70).

13. Collaboration: Crosscutting areas of research, such as the Food for Health Research Initiative, have the potential to become an important pillar of FIRM research and similar opportunities in this regard should be explored. In addition, the Steering Group feel that formalising the annual exchange of views with key stakeholders would also benefit the FIRM and identify barriers to success (P70).

14. Dissemination: RELAY has played a vital role in disseminating research results. There is now an opportunity to articulate a more wide-ranging strategy for its future, particularly in terms of aligning it with the technology transfer process in research institutions (P72).

15. Dissemination: The management of intellectual property (IP) is an important consideration for industry. The public good nature of FIRM is not a barrier to securing IP but is often perceived as such. The Steering Group recommends that DAF clarifies procedures regarding the management of IP generated through FIRM (P72).

CHAPTER 1

INTRODUCTION

Chapter 1 introduces the Department of Agriculture & Food (DAF)¹, the Food Institutional Research Measure (FIRM) and the Value for Money Review (VFM Review) process. It identifies the review team and Steering Group, and outlines the Terms of Reference for the review as agreed by the Steering Group. Finally, chapter 1 includes a brief outline of the structure and methodology for this particular review.

1.1 The Department of Agriculture and Food

The mission statement of the Department of Agriculture & Food is “to lead the sustainable development of a competitive, consumer-focused agri-food sector and to contribute to a vibrant rural economy and society”. The high level goals of the Department include:

- To develop an internationally competitive consumer-focused agri-food sector and support and facilitate trade in agriculture and food.
- To ensure the highest standards of food safety and consumer protection, animal health and welfare and plant health.

1.2 Background to the Value for Money Review Process

The Government’s Value for Money and Policy Review Initiative was introduced in 2006 to replace the Expenditure Review Initiative, which had been in operation since 1997. The Value for Money and Policy Review Initiative aims to secure improved efficiency and effectiveness from public expenditure.

The objectives of the Value for Money and Policy Review Initiative are to analyse Exchequer spending in a systematic manner and to provide a basis on which more informed decisions can be made on priorities within and between programmes. It is one of a range of modernisation initiatives aimed at moving public sector management away from the traditional focus on inputs to concentrate on the achievement of results.

The Government has approved 92 formal reviews for the 2006-2008 round. Within this round, the Department of Agriculture and Food is reviewing 9 major spending programmes – one of which is this review of the FIRM. The aim is (i) to assess the objectives, efficiency and effectiveness of the programmes and to identify ways to improve their delivery, and (ii) to identify indicators which will improve monitoring of the performance of the programmes and their success in meeting their objectives.

1.3 The Food Institutional Research Measure

The Food Institutional Research Measure of the Department of Agriculture and Food is the primary national funding mechanism for food research in third level colleges

¹ Note. During the completion of this report, the title and functions of the Department of Agriculture and Food (DAF) changed and it became known as the Department of Agriculture, Fisheries and Food (DAFF). As the statement of Strategy for this new entity has not, at the time of writing, been concluded, this report refers to DAF only.

(Universities and Institutes of Technology) and Teagasc food research centers [hereafter research institutions]. It supports public good research aimed at enhancing innovation and food safety in the food sector.

With over €7 million being awarded in funding in the period 2000-2006, a value for money assessment of FIRM was considered appropriate.

1.4 Review Team

Value for Money Reviews are conducted under the aegis of steering groups, which are representative of the Departments/Offices managing the programmes/areas being reviewed. For the more significant reviews, the Department of Finance is generally represented on the Steering Groups.

For this review, the following Steering Group was established:

- Kevin Smyth (Chair), Principal Officer, Economics and Planning Division, DAF;
- Marian Byrne, Principal Officer, Food Division, DAF;
- Tony Smith, Senior Inspector, Research, Food and CODEX Division DAF;
- John Thompson, Principal Officer, Public Expenditure Division, Dept. of Finance (replaced in October 2007 by Ms. Grainne Mc Guckin, Principal Officer, Sectoral Policy Division, Dept. of Finance).

The Review was carried out by:

- Pamela Byrne, Agriculture Inspector, Research, Food and CODEX Division, DAF;
- Declan Coppinger, Assistant Principal, Food Division, DAF;
- John Paul Mulherin, Administrative Officer, Economics & Planning, DAF

1.5 Terms of Reference

The Terms of Reference as agreed by the Steering Group, and approved by the Secretary General of DAF and the Department of Finance, are as follows:

1. Outline the objectives of the FIRM programme (Ch 3).
2. Examine the current validity of those objectives and their compatibility with relevant National and EU policy documents including the Department's Statement of Strategy and the National Development Plan 2000-2006 (Ch 3).
3. Outline the outputs and outcomes associated with the programme activity and the level and trend of those outputs (Ch 6).
4. Examine the extent that the programme's objectives have been achieved, and comment on the *effectiveness* with which they have been achieved (Chs 7&8)

5. Provide a breakdown of the Department resources employed on the FIRM programme and comment on the *efficiency* with which it has achieved its objectives (Ch 5).
6. Evaluate the degree to which the objectives warrant the allocation of public funding in the light of evolving scientific policy (Chs 3&8).
7. Specify potential future performance indicators that might be used to better monitor the performance of the FIRM programme (Ch 9).

1.6 Review Methodology

In order to answer the questions raised in the Terms of Reference, the review made use of the following primary and secondary data:

Existing Literature

The review looked at existing literature relating to research evaluation as well as a VFM review of water-related projects currently being conducted by the Environmental Protection Agency (EPA). It also examined previous evaluations of the FIRM.

Desk Research

A review of files associated with 58 FIRM projects funded under the NDP 2000-2006 was undertaken. This was done in order to gain quantitative data on inputs, timeframes, outputs and outcomes. These 58 projects constituted all projects completed by the review date. Projects that were still ongoing were excluded from this portion of the analysis – many of the outputs and outcomes associated with these projects would not be realised until the projects are completed. In any event, 58 is considered to be a sufficiently large number to indicate the outputs and outcomes from the total investment.

Questionnaire to research co-ordinators and food industry personnel

Questionnaires were issued to research co-ordinators (appendix 4) and food industry personnel (appendix 5). Details of the survey method used are contained in Appendix 3. The data gathered, which was qualitative in nature, was used to inform the analysis of objectives, efficiency, effectiveness and outcomes (result and impact).

Stakeholder Consultation

Submissions were requested from the Food Safety Authority of Ireland (FSAI), the Food Safety Promotion Board (SafeFood), the Irish Business & Employers Confederation (IBEC), An Bord Bia (the Irish Food Board), Enterprise Ireland (EI) and RELAY (see section 2.4 for more on RELAY). Each of these stakeholders was issued with a list of questions, which were to form the basis of their response.

The heads of food research at Teagasc, University College Cork (UCC), University of Limerick (UL) and University College Dublin (UCD) were interviewed to ascertain their views on the same issues as the other stakeholders referred to above.

External Assessor

Finally, in line with VFM requirements, the penultimate draft of the review report was quality assessed by Kealan Flynn of public sector consulting firm, iwrite, who is a member of the Independent Panel of Evaluation Experts. His key findings have been attached at Appendix 6. Some minor textual adjustments, as suggested by the external evaluator, were also made to the text.

1.7 Review Structure

Executive Summary

Chapter 1. Introduction to the Review

Introduces review background, team, terms of reference, methodology and structure.

Chapter 2. The Food Institutional Research Measure

Provides an overview of the FIRM, the RELAY dissemination project and FIRM's role in the agri-food industry. Concludes with a consideration of previous evaluations.

Chapter 3. Scheme Objectives

Examines the FIRM objectives and the rationale for continued investment in public research. Also considers the compatibility of the FIRM objectives with National, EU and evolving scientific policy.

Chapter 4. Measuring and Evaluating Research

Looks at the literature on research evaluation, considers various approaches to research evaluation and outlines the approach taken in this review.

Chapter 5. Efficiency and Programme Management

Considers the procedures adopted managing the programme, the resources employed and the levels of efficiency achieved.

Chapter 6. Programme Analysis: Inputs, Outputs and Outcomes

Looks at inputs, outputs and outcomes associated with 58 projects completed under NDP 2000 – 2006.

Chapter 7. Effectiveness: Objectives & “Research VFM Framework” Core Factors

Appraises the effectiveness with which the FIRM objectives were achieved, particularly in terms of research quality, the development of expertise and the value-added of the research produced.

Chapter 8. Effectiveness: “Research VFM Framework” Influencing Factors

Investigates the influence of a range of issues (such as the relevance of the research, the level of collaboration and the amount of dissemination) on the effective achievement of the FIRM objectives.

Chapter 9. Development of New and Existing Performance Indicators

Introduces a number of performance indicators for the effective management of the FIRM.

Chapter 10. Conclusions and Recommendations

Synopsis of conclusions and recommendations arising from the analysis

Appendices

Appendix 1 – Summary of FIRM inputs, outputs and outcomes

Appendix 2 – Membership of FIRM Committee

Appendix 3 – Survey methodology

Appendix 4 – Researcher Questionnaire

Appendix 5 – Industry Questionnaire

Appendix 6 – Key Findings of the Independent Evaluator

CHAPTER 2

THE FOOD INSTITUTIONAL RESEARCH MEASURE

Chapter 2 provides an overview of the FIRM and its role in the agri-food industry. It also looks at the RELAY dissemination project (an extension of FIRM) and concludes with a consideration of previous evaluations of the FIRM.

2.1 The Agri-Food Industry

The agri-food industry is Ireland's largest indigenous sector, representing 8.1% of GDP in 2006. It accounts for 163,400 jobs or 8.1% of total Irish employment. It is also an important contributor to foreign earnings with exports of over €8 billion.

The food industry² itself has a turnover of over €24 billion and accounts for nearly 22% of total manufacturing turnover in Ireland. With 44,400 workers, it represents one fifth of total manufacturing employment. The food sector comprises over 700 predominantly small and medium sized enterprises, which are widely dispersed throughout Ireland. Over a period of 20 years, the industry has been moving from largely commodity-based trade to consumer-oriented, added-value goods. Capital investment has transformed the industrial base while public investment in food research has resulted in a growth in centres of excellence and training of a cadre of highly qualified researchers.

The environment in which the industry operates is evolving rapidly and poses significant competitive challenges to Irish enterprises. Specific opportunities exist in the areas of consumer foods, functional foods and beverages, food ingredients and speciality foods. R&D and Innovation are considered to be fundamental to success in this environment.

Prepared consumer foods account for around 20% of agri-food exports and there is also a very successful speciality food sector. The food and drink industry has made more progress than many other indigenous sectors in creating the scale and expertise required to compete on the world stage, with some of our larger food companies establishing industry-leading positions in niche or specialist markets such as food ingredients.

2.2 Origins of the FIRM

The National Development Plan (NDP) sets out Ireland's development strategy and investment priorities over a 7-year framework. The Food Institutional Research Measure formed part of the Research, Technological Development & Innovation (RTDI) Priority within the Productive Sector Operational Programme (PSOP) of the NDP 2000-2006. The PSOP was one of three inter-regional operational programmes in the NDP 2000-2006.

² Defined as the Food, Drink and Tobacco (FDT) sector – food sector accounts for 84% of FDT turnover

The RTDI Priority was the largest within the PSOP, both in terms of the overall level of funding allocated and the number of measures / sub-measures (7 measures and 24 sub-measures). In total, €3,495.2 million (47.6%) was earmarked for the RTDI priority. RTDI Priority funding is used to meet the PSOP objectives for the food industry through a number of elements including (1) in-company research, (2) technology transfer and (3) public good research.

The Industry Measure and the Food Industry Measure are two complementary measures within the seven measures of the RTDI Priority. The former caters for in-company research & technology transfer and is managed by Enterprise Ireland. The latter (food industry measure) caters for public good research and is managed by DAF i.e. the FIRM.

Under the new NDP 2007-2013, FIRM is part of the Agri-food research Sub-Programme within the Enterprise, Science and Innovation Priority. This sub-programme, which is one of 8 under the Enterprise, Science and Innovation Priority, has an indicative budget €641 million. This is divided between core funded Teagasc and DAF programmes, and competitive public good research in Agriculture (Research Stimulus Fund), Food (FIRM) and Forestry (co-ordinated by COFORD – the National Council for Forestry Research & Development). The FIRM is also an important component of the Governments Strategy for Science, Technology and Innovation 2006-2013, which is dealt with in more detail in section 3.4.6.

2.3 Firm: An Overview

The FIRM is the primary national funding mechanism for food research in third level colleges (Universities and Institutes of Technology) and Teagasc food research centres. FIRM, including its predecessor the Non Commissioned Food Research Programme, has been funding research through National Development Plans since 1994. Funding is awarded on the basis of open competition. Proposals for funding are invited in tranches throughout the lifetime of the NDP and can take the form of either a general call covering a wide number of theme areas or a targeted call in more specific theme areas.

The importance of new product development and the need for product innovation is well recognised. The 2004 report “Ahead of the Curve – Ireland’s Place in the Global Economy”, states that “*A decade of government sponsored food research in third level research institutions, undertaken partly in partnership with industry, has provided a basis for innovation in products, technologies and packaging from which to develop the goal of the “knowledge-based economy”.*”

Awards of approximately €7 million were made for the period 2000-2006. Expenditure is expected to double over the period of the new NDP 2007-2013. The type of research funded by the FIRM runs from basic or fundamental research through to pre-commercial research. Once it goes beyond pre-commercial research, it is no longer considered to be within the scope of FIRM to provide funding; this is where Enterprise Ireland funding becomes applicable, to bring the research that final step to the market place

FIRM is concerned with developing the technologies that underpin a competitive, innovative and sustainable food manufacturing and marketing sector. It is establishing a base of knowledge and expertise in generic technologies that can support a modern, consumer focused industry. It concentrates on increasing collaboration and building capabilities in Irish research centres. A key output of FIRM is young researchers, trained to MSC, PhD and postdoctoral level, with specialist scientific skills that benefit the Irish food sector. Many of the research outputs under FIRM have commercial potential and some have already been adopted in the food sector.

Food safety is another important dimension of the FIRM research with much collaboration involving the Food Safety Authority of Ireland and the Food Safety Promotion Board. The research undertaken informs food safety both at the micro industry level in terms of individual production processes and at the macro level in terms of national food safety programmes and requirements.

The research funded by FIRM is located at approximately 20 participating research institutions throughout the country. Multi-disciplinary teams from two or more institutions usually carry out the projects; some are linked directly with food manufacturers. Themes covered by research calls include beverages, consumer foods, dairy, meat, food ingredients, food safety, nutrition, food viruses, residues etc. Example of research in the prepared consumer foods area completed in 2006 includes the development of a naturally occurring enzyme preparation for baking which increases loaf volume and crumb softness. In the area of food safety, a miniature disposable biosensor was developed that detects antibiotic residues in milk.

2.4 The RELAY Dissemination project

RELAY, established in 2001, is the national dissemination service charged with communicating the results of publicly funded food research to the Irish food industry. Its primary responsibility has been to disseminate the research outputs from the FIRM but has recently expanded its scope to become a 'One-stop-shop' for all publicly funded food research conducted by Irish research institutes/universities. RELAY is funded directly by the FIRM and costs about €300,000 per year.

RELAY has established itself as the main source of food research information in Ireland and currently has over 1,500 organisations, 3,860 company contacts and 330 researchers on its database. RELAY tailors the methods of communication to provide stakeholders with easy access to research information. Through its website www.relayresearch.ie and targeted use of e-mail, industry contacts are provided with user-friendly updates on every FIRM funded project. RELAY hosts workshops on the latest topics in food research and conducts face-to-face meetings with industry to learn about current research from institutions and universities. RELAY also provides food companies with access to specific researchers to help them meet their R&D needs.

2.5 Previous Evaluations of FIRM

2.5.1 INDECON Report³

³ Available at <http://ndp.fusio.net/documents/publications/evaluation/RTDIPriority.pdf>

The FIRM was evaluated as part of the Department of Enterprise, Trade and Employment's mid-term evaluation of the PSOP. An independent consultancy firm, INDECON, carried out the evaluation and the draft report was published in the autumn of 2003.

The evaluation work undertaken by INDECON on the FIRM programme concentrated largely on the level of expenditure achieved at mid term compared with the expenditure targets set down. Expenditure was at 82% of forecasted figures. The shortfall was due mainly to differences between estimates and agreed funding combined with some delay hiring staff during a period of strong economic growth and labour market buoyancy.

In terms of outputs, the report looked at the number of projects supported and completed. Impact is judged in terms of the level of R&D by Irish food businesses and the reduction in the number of food borne diseases reported to the FSAI. Identifying the level of causality between FIRM and these indicators is difficult. The report did not consider any other outcomes of the research.

2.5.2 ESRI Report⁴

The Economic and Social Research Institute (ESRI) carried out a mid-term evaluation of the NDP as a whole, in association with an independent economic consultancy group. The PSOP was part of this evaluation and the draft final report was published in October 2003.

The ESRI report did not examine the FIRM programme in any detail. However, their conclusion stated: *"It is not clear why this sector should be treated separately from research in other industrial sectors. This measure should be eliminated and the food sector should compete under the industry measure"*. DAF has long argued the importance of the food sector to the Irish economy, the contribution it makes to regional economies and the special position it reserves vis a vis other sectors, particularly the importance of adding value to agricultural output and sustaining the agriculture sector.

2.5.3 M.Sc. Thesis – Mid term Evaluation of FIRM

This thesis, completed in 2003, considered the previous two evaluations to be unsatisfactory. It found that publicly funded research is complementary to industrial research and that one does not replace the other. The thesis concluded that the FIRM has been *"highly successful in growing critical mass, creating useful technologies and in developing collaborative networks both between academic institutions and with the food industry. This is necessary to underpin a vibrant, competitive and innovative Irish food industry..... Support for the food industry is justified based on the significant contribution it makes to both GDP and employment within Ireland"*.

2.5.4 ESRI Ex-Ante Evaluation of the NDP 2007-2013

⁴ Available at <http://www.ndp.ie/documents/publications/evaluation/PRS.pdf>

This report was commissioned by the Department of Finance with a view to informing the construction of the NDP 2007-2013. The ESRI reserve a chapter for R&D, where it notes that spending on R&D has been relatively small under NDP 2000-2006. The report also refers to research showing that the long-term impact of R&D is higher when performed by the public sector than by the business sector, as it generates a higher social return.

The report does not refer to FIRM directly. The ESRI does refer to targeted support for R&D in the food sector, stating that there is little economic justification for prioritising one sector over another. It goes on to state that this type of R&D should be done to inform policy making by Government. While some of the FIRM research informs public policy in areas such as food safety, it predominantly serves a different purpose i.e. knowledge generation in the food sector and support of Higher education research. The ESRI does refer to Higher Education R&D but restricts this to discussion on Science Foundation Ireland and the Programme for Research in Third-Level Institutions⁵(PRTLII).

⁵ The programme provides integrated financial support for institutional strategies, programmes and infrastructure and ensures that institutions have the capacity and incentives to formulate and implement research strategies

Chapter 3

SCHEME OBJECTIVES

This Chapter outlines the objectives ascribed to the FIRM and subsequently considers the rationale for investing in public research. The final part examines the compatibility of the FIRM objectives with contemporary National, EU and evolving scientific policy.

3.1 Background

As outlined in chapter 2, the FIRM is mandated and funded by the National Development Plan⁶. The Firm contributes to three of the four high level objectives outlined in the NDP 2000-2006 viz.

- Continuing sustainable national economic and employment growth;
- Consolidating and improving Ireland's international competitiveness and;
- Fostering balanced regional development.

The NDP's Productive Sector Operational Programme⁷, of which the FIRM is a component, aims to increase productivity through:

“Building the Research, Technological Development and Innovation (RTDI) capacity of the country and;

Maximizing the potential of the food industry through attention to competitiveness and market orientation and by providing for quality and food safety assurance at all stages of the food chain and to respond to changing consumer requirements”

The new round of investment under the NDP 2007-2013⁸ prioritises, amongst other things, support for enterprise, innovation and productivity in addition to supporting agriculture and the rural economy. It envisages research that will address the requirements of a “*diverse modern, innovative, market-led food industry*”. The role of FIRM is to fund research in the area of food quality, safety and nutrition while also contributing to product and process technology development. In addition, the FIRM is seen to underpin many of Ireland's national food safety programmes.

3.2 Objectives

The objectives of the FIRM follow on from the aims stipulated in the NDP and its public good dimension. There are two core objectives outlined in the Productive Sector Operational Programme 2000-2006. The former relates to food industry output and the latter to consumer protection and food safety. The Steering Group also identified a third key objective for the FIRM that was not made explicit in either the NDP or the PSOP.

⁶ Available at http://www.ndp.ie/documents/publications/ndp_csf_docs/NDP_complete_text.pdf

⁷ Available at <http://www.entemp.ie/publications/enterprise/2000/productivesector.pdf>

⁸ Available at <http://www.ndp.ie/documents/ndp2007-2013/NDP-2007-2013-English.pdf>

(i) Food Industry Objective: To provide a base of information and expertise in generic technologies that will support innovation and product development in the food industry;

(ii) Food Safety Objective: To assist in assuring consumer protection and in ensuring that product / process development is underpinned by attention to food safety and quality issues;

(iii) Information Dissemination Objective: To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies and innovations by Irish food companies.

3.2.1 Food Industry Objective

The FIRM seeks to provide a base of information and expertise in generic technologies that will support innovation and product development in the food industry. As such, this objective has two components. Firstly, the FIRM supports the development of generic technologies – i.e. technologies that are generally useful to the food industry and are broadly applicable. For example, the FIRM research carried out on barrier/film technologies should be applicable across a range of products including bread, pizza and processed meats. These technologies have the potential to increase shelf life and also to reduce packaging waste. As is explored in more detail in section 3.3, the FIRM funds basic or fundamental public good research which can form the basis for much in-house pre-commercial and commercial research. Without such research, the New Product Development and R&D capability of the Irish Food industry is considered to be severely reduced.

Secondly, the FIRM invests in human capital. The development of expertise is seen in terms of (1) training people and (2) developing skill sets and competencies in particular areas within universities, research institutions and subsequently in the industry itself. Training predominantly takes the form of postgraduate education (MSc degrees, PhDs and postdocs) and the employment of contract researchers who are then available for employment in the food industry on completion of their educational programme/research contract. Such individuals bring with them the expert knowledge they have developed as a result of their involvement in the research project.

This human capital is in a position to drive a culture change within food companies towards in-house R&D. Investment in this area is vital if Ireland's food industry is to retain and increase its competitive edge in the global food market. The FIRM also leads to a build up of capabilities within the Universities and research institutions which acts as a valuable resource for the food industry; a place to go if they require information about a particular technology or if they require research facilities not available within their own companies.

3.2.2 Food Safety Objective

The FIRM aids consumer protection by ensuring that product/process development is underpinned by attention to food safety and quality issues. It is the largest source of funding for food safety research in Ireland. As with the previous objective, food safety research should be generic in nature. It aims to provide general principles or models

for food safety that may then be customised by a particular food industry to suit their plant/product requirements. FIRM supports research that underpins food safety and consumer confidence through fundamental and pre-commercial research into a variety of food safety issues. It also leads to a build up of human capital which provides the same benefits as per objective 1, except of course these benefits are in the area of food safety.

Salmonella, Campylobacter, E. coli O157 H7, Listeria, TSE's, new diagnostic tests for food pathogens, HACCP development, traceability, food viruses, and alternative antibacterial compounds are some of the food safety topics that have been researched using FIRM funding. This research not only informs the food industry of new advances in technologies and processes that ensure food safety but also underpins many of the Department of Agriculture and Food's (DAF) food safety and disease control programmes including *Salmonella*, Johne's and BSE.

One project (00/R+D/G22) on detection and survival of *Mycobacterium avium subsp. paratuberculosis* played a fundamental part in getting the threat of this disease established as a core animal health issue in DAF. These investigations also allowed for some useful follow up analysis on the economic costs of this disease if it were allowed to spread. Another project (00/R &D/D/32), which involved an investigation of factors affecting *Salmonella* control programmes in pork, paralleled the national control programme and allowed DAF to get some very valuable information on Salmonella in the pig sector. It also allowed the research work link directly with, and support, the industry funded national control programme (SI 165,2002).

The Food Safety Promotion Board and the Food Safety Authority of Ireland, who do not have large research budgets of their own, assist in the allocation of funding. A number of FIRM projects have also been co-funded by the FSPB or have involved the FSAI in their research.

3.2.3 Information Dissemination Objective

The FIRM aims to communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies and innovations by Irish food companies. A fundamental requirement of any public research programme is to ensure that the information obtained through the research is made available to the relevant stakeholders. The Steering Group believes that this objective is inherent within the aims of the FIRM. The dissemination of food research is also one of the specific commitments made in the AgriVision 2015 Action Plan.

As noted in section 2.4, a dissemination team branded as RELAY has been assigned the task of disseminating the results of the Food Institutional Research Measure to the Irish food industry. RELAY uses a multi-faceted approach to communicate the research results to industry, including issuing technical summaries on each project, meeting with companies to discuss the outputs of the research and organising workshops designed to meet the needs of industry. In addition, RELAY emphasises the importance of institutional research to support the development of the Irish Food Industry. There is also an onus on researchers themselves to promote their research through the various channels available to them.

Apart from RELAY, DAF has also funded two smaller projects under FIRM that compliment the work undertaken by RELAY. However, both are concerned with technology transfer rather than just information dissemination. Technology transfer is “*a formal transferring of new inventions, creations, discoveries, innovations, processes and the like which result from scientific research conducted at public research organisations to a commercial environment*”⁹.

The first of these projects (04/R&D/TN/268) involves the development of a technology commercialisation toolbox for publicly funded food research. This toolbox will provide a range of techniques, approaches and management frameworks that will support researchers and research centres in transferring technologies developed through publicly funded research activities to industry. The second project (04/RTD/TN/260) aims to simplify the technology transfer process, through analysis of the main steps involved, and then tailor the approach to the Irish meat sector. This will result in a ‘best-practice’ technology transfer manual for the Irish meat sector.

3.3 Why have public research – what purpose does it serve?

In its 2002 report “Measuring and Evaluating Research”¹⁰, the Irish Council for Science, Technology and Innovation (ICSTI) outlines two approaches to explaining the rationale for investing in public research. Both approaches are considered below.

3.3.1 Market failure/public goods: Linear approach

Much pre-commercial and commercial research cannot be carried out without first being underpinned by more basic, or fundamental research. This type of research does not always have clear or immediately realisable outcomes – it is often speculative in nature and the organisation that undertakes it may not be able to utilise the technology or processes that emerge. In addition, it may require equipment, infrastructure and expertise that can only be afforded by the very largest companies (such as multinationals) or by high-tech, high-return companies (such as the pharmaceutical industry). This is particularly true in the case of food safety research.

The foregoing puts such research beyond the reach of many of the companies that comprise the Irish food industry. The provision of such research is of considerable benefit to the Irish economy and the deficit in its supply is regarded as a ‘market failure’ that needs to be corrected by government intervention. The provision of such research is regarded as a ‘public good’ which is economically beneficial to society and which is freely available to all. In economics, public goods are deemed to be non-rival and non-excludable in consumption. They are non-rival as the consumption of the output by one person/organisation does not reduce the amount available to others. They are non-excludable as it is not possible to exclude others from consuming the output. Publicly funded primary/basic research can be considered to be freely

⁹ ICSTI “National Code of Practice for Managing and Commercialising Intellectual Property from Public-Private Collaborative Research”, 2005 available at http://www.sciencecouncil.ie/reports/acsti051125/acsti051125_ip_code_of_practice_webopt.pdf

¹⁰ Available at http://www.forfas.ie/icsti/statements/stiresearch02/020827_icsti_measuring_and_evaluating_research.pdf

available to all and the use of research by one company, in theory, does not affect another from using it.

3.3.2 Evolutionary/institutional approach

The ICSTI believes that the above approach is an over simplification of the situation; if scientific knowledge was freely available to all, then Ireland could ‘free-ride’ on the work that is undertaken in other countries. The ICSTI refers to the “*evolutionary/institutional approach to innovation [which] stresses the extent to which knowledge is embodied in specific researchers and the institutional networks within which they conduct their research. Of crucial importance are skills, networks of researchers and tacit knowledge accumulated through experience and years of effort*”.

As such, the outputs of research would not be considered pure ‘public goods’ by the ICSTI as they are not freely available to all. The outputs only benefit those with the necessary skills, education and membership of the appropriate networks. It would follow then that the FIRM should seek to go beyond necessary research to ensure collaboration and relationship building.

3.3.3 Rationale for the FIRM – which approach?

The review team consider both approaches to have merit. Rather than being opposing views, it is held that both arguments are complementary. The outputs of FIRM are public goods which are best utilised in the context of appropriate industry and institutional networks. The FIRM addresses a ‘market failure’ in so far as publicly funded research tackles a research and development deficit that would otherwise put the Irish industry at a competitive disadvantage. A key question for this evaluation is then whether any of the funded research would have occurred in the absence of the FIRM (see section 8.4)?

In the context of the economic definition of a ‘public good’, the FIRM’s output can be utilised by all food companies, both Irish and international, and the consumption by one company does not affect consumption by another. While Irish companies could plausibly free ride on the research undertaken in other countries, this would leave them at a competitive disadvantage. There is a first mover advantage in much R&D development and the skills/expertise to develop and utilise new technology would not necessarily be available within Ireland or within Irish food companies. In any event, there are unique approaches or underlying conditions in Ireland that may not be replicated abroad – it is not a one size fits all industry. Furthermore, the FIRM produces a range of other outputs, other than knowledge, which could not be subject to free riding such as PhDs, MScs and enhanced institutional capabilities.

These latter points feed into the institutional approach referred to above. While the output of the FIRM is a public good, the ability to gain the maximum from such research is predicated on close institutional relationships and collaboration. Primary research is not a one-way flow of information. The research institutions and universities must be informed by the conditions in the food industry. Neither party to the process (research or industry) can work in isolation. As the ICSTI report notes, “*the process is best considered as a system, where institutional relationships and the*

flows of knowledge between actors in the systems assume critical importance". As such, an examination of such relationships must also inform any evaluation of the FIRM (see chapters 7&8).

3.4 How Does the FIRM fit in with current policy?

3.4.1 National Development Plan

Issues of compatibility are dealt with in Section 3.1, which examines the background to the FIRM objectives. As regards maintaining the links with the NDP, DAF feeds into the reporting requirements under the PSOP, RDTI sub group etc.

3.4.2 The Lisbon Agenda

In March 2000 at the Lisbon Summit, EU leaders agreed a strategy, known as the Lisbon Strategy, to set about increasing employment and economic growth in Europe over a 10-year period. This strategy stated that Europe needed to focus on science and technology, with increased research and development, and enhanced use of IT, in order to become the world's most competitive knowledge-based economy.

The Lisbon agenda set a target of increasing investment in research and development activities to 3 per cent of GDP by 2010.

3.4.3 Enterprise Strategy Group

In July 2003, An Tánaiste established the Enterprise Strategy Group to develop policy options for an enterprise strategy for growth and employment for the coming decade.

The Group's report "Ahead of the Curve – Ireland's Place in the Global Economy"¹¹, was published by Forfas in July 2004. In the report, the importance of new product development, product innovation and marketing were identified as key success factors.

A separate sub-chapter titled "Developing the Agri-Food Sector" was included in the appendices to the Group's main Report. It points out that Ireland's future competitiveness as a food exporter will depend on a number of efficiencies across the entire supply chain and that product differentiation and the capability to satisfy evolving consumer requirements will be essential. The report also notes that "*if appropriate policy initiatives are taken, by 2015 Ireland will be internationally recognised as an important location for the production of high value-added foods products such as prepared consumer foods; functional foods and beverages; food ingredients and speciality foods*"

In relation to food Research and Development, the Report states that in order to reinforce Ireland's success in the agri-food sector, increased collaboration between research institutes and enterprise, both at national and international levels, will be actively fostered to drive market-led R&D. Research will be carried out in a number of world class research institutes and there will be active collaboration in research

¹¹ Available at <http://www.forfas.ie/esg>

agendas. This collaboration between enterprise and academia in applied research and innovation will facilitate knowledge transfer and commercialisation.

3.4.4 Statement of Strategy 2005-2007¹²

DAF's Mission Statement, as set out in the Statement of Strategy 2005-2007, is "to lead the sustainable development of a competitive, consumer-focused agri-food sector and to contribute to a vibrant rural economy and society".

DAF's vision is for an agri-food sector that:

- Provides high quality, nutritious, safe food for consumers on home and export markets.
- Is profitable, internationally competitive, innovative and sustainable.

Sustained investment in research and development is highlighted in the Statement of Strategy as an essential foundation to maintaining competitiveness and to developing Ireland as a knowledge-based economy. Consumer behaviour, global competition and retail trends are the key drivers of change facing the industry. Evolving food trends require new skills, especially in product innovation and marketing.

Food research focussed on the health and well-being of the consumer must be a priority. An industry with the ability to develop innovative and competitive products, particularly those with a specific health and nutrition element, is essential.

A number of Goals, Strategies and Performance Indicators contained in the Statement of Strategy directly relate to enhancing public good food research. These include:

Table 3.1 Statement of Strategy Goals and Performance indicators

Goal No.	Strategic Actions	Performance Indicators
1.3	Implement Plan of Action for 2015 Agri Vision Report	<ul style="list-style-type: none"> • Degree of implementation of Agri Vision 2015 Plan of Action • Implementation of Food Industry Development Programme
1.5	Support market orientation, productivity and innovation in agriculture, forestry and food	<ul style="list-style-type: none"> • Number of research projects funded under Irish and EU research programmes • Level and quality of participation in international collaborations
2.4	Support for and promotion of research into food safety, animal health and zoonoses	<ul style="list-style-type: none"> • Number/scale of food safety projects under FIRM • Number of collaborative programmes with FSAI and FSPB

The Statement of Strategy acknowledges that FIRM has stimulated inter-institutional partnerships resulting in recognised centres of excellence, has facilitated product and process development, and is providing a cadre of research graduates to industry. The

¹² Available at <http://www.agriculture.gov.ie/publicat/publications2005/SoS2005-2007/sos2005-2007e.pdf>

Strategy Statement also refers to future research priorities, as set out in the “Irish Action Plan for Promoting Investment in R&D”. These priority research areas, which are covered under section 3.4.6, include innovation/product development in the functional, probiotic and nutraceutical foods and research into food safety and nutrition. It also mentions the need for technological development in the biotechnology areas.

3.4.5 Agri-Vision 2015

The Minister for Agriculture and Food established the Agri-Vision 2015 Committee in early 2004. The Committee was asked to review the strategy and recommendations contained in the Agri Food 2010 Report.

The Committee’s report contains 53 recommendations covering a number of wide and diverse areas including the need to develop competitive, knowledge-based agriculture and food sectors. Specifically on food R&D, the Committee emphasised that *“Research and Development will need to be better focused and more highly resourced with greater State and institutional integration and cooperation”*.

In March 2006, in response to the Report of the Agri-Vision 2015 Committee, the Minister for Agriculture and Food launched the Agri-vision 2015 Action Plan for the future of the Agri-Food Sector. The Action Plan also takes account of the material from a wide variety of other reports and sources such as the Enterprise Strategy Group. The Plan sets out a vision for the future of the sector in the light of new changes impacting on it such as a more liberalised trade policy, changes in lifestyle, and the clear emergence of technology and R&D as significant market drivers. The Plan focuses on three key requirements for success in the light of these challenges: competitiveness, innovation and consumer-focused marketing.

The Plan contains 167 specific actions. In the area of building the knowledge base and innovation, the following actions are relevant to the public good research programme:

- DAF will support research and programmes which facilitate accurate assessment of possible risks from food constituents or contaminants in the diet of consumers.
- DAF will commission further research in the area of human nutrition and food science, including dietary requirements, nutritional assessments, food composition and food uses, to provide information to the food industry to support innovation, new product development and product promotion.
- DAF, in co-operation with other Government Departments and state agencies, will examine food use and food consumption patterns among the Irish population to determine areas for food production, marketing and promotion initiatives.
- The Department of Agriculture and Food will prioritize increased funding for Research and Development in the National Development Plan 2007-2013.

- DAF will ensure that its public good competitive research programmes (FIRM, RSF, COFORD), will be focused on the needs of the sector and will continue to facilitate collaboration and capacity building in Irish research centres.
- DAF will ensure that food research provides a base of expertise in generic technologies to support a modern, innovative and consumer focused food industry, with attention to food safety and quality issues.
- Results of food R&D will continue to be rapidly and widely disseminated to industry through RELAY, the food research dissemination programme.
- DAF will promote and assist collaboration by Irish researchers in collaborative international research initiatives and EU Framework Programmes.

3.4.6 Strategy for Science, Technology and Innovation (SSTI)

In 2005, the Cabinet Sub-Committee on Research and Development adopted the National Action Plan for Promoting Investment in R&D and mandated the Inter-Departmental Committee to bring forward a Strategy for its implementation. This resulted in the “Strategy for Science, Technology and Innovation 2006-2013”.

The Strategy acknowledges that the development of a sustainable food and agriculture sector is crucially important to Ireland’s future development. RTDI has a key role to play in the sustainable development and competitiveness of the sector. In a rapidly changing business, economic and regulatory environment, the current level of RTDI in this sector is low. The priority under this strategy is to build a knowledge economy in agri-food so as to provide a scientific foundation and support for a sustainable, competitive, market-oriented and innovative agriculture, food and forestry sector.

As was the case in DAF’s Statement of Strategy, the SSTI stresses that future Research and Development will emphasise the need for innovation in the food sector so as to move Ireland’s position up the value chain from commodity and ingredient supplier to product innovation and licence ownership. Driving industry up the value chain is a major challenge and is predicated on greater industry R&D involvement, which will require the support of public funded knowledge generation and expertise.

In particular, the SSTI states that food research will emphasize Food Quality, Safety and Nutrition, with a focus on Food for Health and Product Innovation. The Action Plan also recognises that there is scope for improved performance in the Pharma, Health and Food Sectors. As lifestyle related illnesses such as heart disease, obesity, cancer and diabetes become more prevalent, consumers are seeking healthy alternatives. A key strategy is to increase R&D in Functional Foods, which are forecast to be one of the key drivers in the sector, and in which Ireland has already built a strong capability through the public funded programmes.

The SSTI recognises that there is scope to optimise linkages between Irish publicly funded research and industry. Many Irish companies have underdeveloped R&D infrastructure and are therefore dependent on the public research system. At the same time, markets and the environment in which the agri-food industry operates are

rapidly changing and it is vital that the public research system is in a position to assist the sector to adapt and meet the new challenges.

3.5 Conclusion

The objectives of the FIRM are essentially about building new ideas, new expertise and new capabilities, and incorporating this into the food industry. We have seen that these objectives are mandated by a range of policies at National and EU level, not least the Lisbon agenda agreed by the EU Member States, the National Development Plan setting out Ireland's investment priorities for the next 7 years and the Strategy for Science, Technology and Innovation which "*is based on a shared vision of placing Ireland firmly on the global map in terms of the excellence of our research and its application for the benefit of society*"¹³. Chapter 3 has shown the rationale for investing in public research based on both the traditional public good approach and the more recent institutional justification; both approaches are relevant for the FIRM. The following chapter builds on this and other theory to identify the best means of evaluating the achievement of FIRM's objectives.

¹³ Michael Martin T.D. Minister for Enterprise, Trade and Employment, "Strategy for Science, Technology and Innovation"

CHAPTER 4

MEASURING AND EVALUATING RESEARCH

Chapter 4 examines the approach to be taken when evaluating public research programmes. It considers various quantitative and qualitative indicators of performance and concludes with an outline of the approach taken in the remainder of this Value for Money review.

4.1 Research Evaluation: Why it differs

Evaluating research programmes is, by its nature, a complex task. Research is influenced by many factors beyond the control of the research team and the outputs may be very different from those envisaged at the outset. The results may be intangible or may impact in totally unrelated areas. The associated impacts may not occur in the short or medium term; results may be unexpected; explorative research may yield no commercially viable outcomes; and linking causality between research and the output of food companies is fraught with difficulty. As such, there are limitations to any analysis of public research programmes. However, once these limitations are understood, there are various quantitative and qualitative indicators available to assist our analysis.

4.2 Report of ICSTI Task Force

The ICSTI approach divides indicators according to the two approaches referred to in chapter 3 of this report (linear and institutional approach).

The linear approach is essentially an input-output model of research and innovation. As such, the indicators described are more quantitative in nature:

- Indicators of R&D expenditure: input in terms of expenditure levels and staff employed, and outputs in terms of number of projects;
- Human capital indicators: No. of PhDs, MScs, post doctorates, employment of graduates, number of qualified personnel;
- Bibliometric analysis: number of publications and citations;
- Patent analysis: simple patent counts and more detailed assessment of value/impact of patents.

The institutional approach looks at throughput indicators/evaluation methods such as:

- Peer review: evaluation by other experts in the field;
- Surveys/Interviews: opportunity to integrate quantitative and qualitative data;
- Case studies: more detailed retrospective analysis;
- Models of knowledge flow: looking at patterns of knowledge diffusion.

4.3 Experience elsewhere

A report by a US Committee on Science, Engineering, and Public Policy¹⁴ states that useful outcomes of research cannot be measured directly on an annual basis as it takes a longer historical perspective to ascertain the quality/added value of the new knowledge gained. However, there are a number of measures that can be used to indicate the performance of the work in progress. These measures are divided into those that evaluate quality (peer review), relevance (users and experts evaluate relevance against goals) and leadership (international benchmarking by experts). These are measures that can be reported on regularly. Similarly, a study by the Ministry of Research in New Zealand¹⁵ notes that the increasing focus on accountability has led to a focus on “*specified and, in terms of their impact, limited outputs*”. While such measures are to an extent useful, the focus must shift to assessing ‘real’ beneficial change.

A useful guide to considering the approach to be taken is provided by the RAND Corporation, which highlights three important issues for research evaluation. Firstly, the relationship between the evaluation and the strategic framework of the funding organisation impacts on the techniques used e.g. bibliometric analysis is useful where the aim is to generate new knowledge [as with FIRM]. Secondly, the type of research is another important variable; Bibliometrics is more useful for fundamental research like FIRM (which is typically published), than applied research which may be more targeted. Finally, “*the tendency to use single indicators can be misleading, and all research evaluation criteria need a qualitative and quantitative information base*”.

4.4 EPA VFM on Water Related Research Projects¹⁶

The Environmental Protection Agency is currently completing a Pilot Value for Money study on completed and near completed water related research projects funded between 2000-2006. As part of this study, the EPA has developed a framework for research evaluation that divides the analysis into two components – research quality and research impact. Research quality examines quantitative type indicators under the headings:

- Quality inputs – number of PhDs, MScs, Post Doctorates, researchers etc.
- Quality outputs – number of completed projects, end of project reports, publications, peer reviewed publications, presentations etc. It also looks at whether new processes or methodologies had been developed;
- Reputational quality – was researcher invited onto national or international expert groups, play a lead role in scientific society or receive any awards.

The evaluator, upon analysis of the file and reports, decides the level of impact of the work by giving a high, medium or low rating in three areas – policy impact, commercial impact and collaborative impact. Each project is also peer reviewed by an internal panel, which assigns a rating of between 1 and 5 for both research quality and research impact.

¹⁴ Committee on Science, Engineering, and Public Policy (1999) “*Evaluating Federal Research Programs: Research and the Government Performance and Results Act*”, Washington: National Academy Press

¹⁵ Piric A. and Reeve N. (1997) “*Evaluation of Public Investment in R&D – Towards a Contingency Analysis*” in OECD Proceedings - Policy Evaluation in Innovation and Technology: OECD

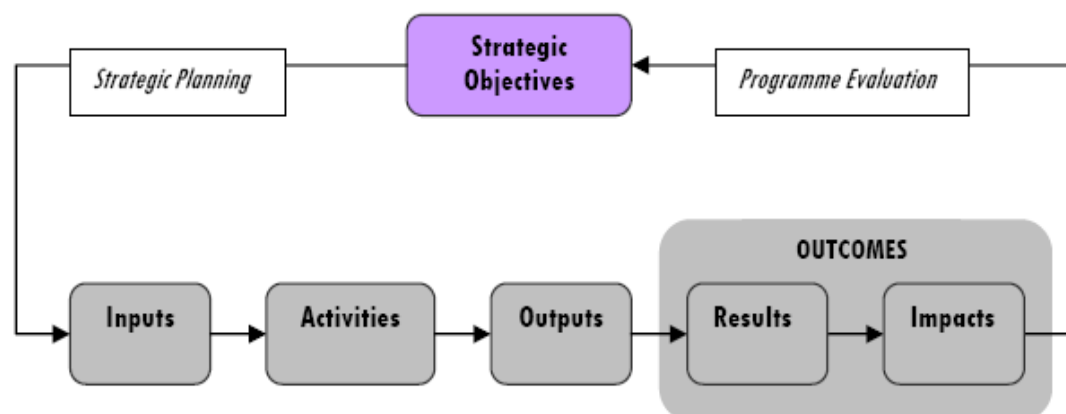
¹⁶ Not yet published – presentation outlining details of the approach is available at http://www.dcu.ie/education_studies/ien/ien_presentations/Gerard%20OLeary%20Lisa%20Sheils.pdf

4.5 Which approach for this Review?

Following on from the various considerations outlined above, the review considered the most appropriate means of evaluating the FIRM to involve a combination of the Programme Logic Model used in most VFM reviews and a specifically developed ‘Research VFM Framework’.

4.5.1 The Programme Logic Model

Figure 4.1 Programme Logic Model



The Programme Logic Model maps out the shape and logical linkages of a programme. It provides a systematic and visual way to present and share understanding of the cause-effect relationships between inputs, activities, outputs and outcomes (results and impacts). It enables programmes to be analysed in terms of inputs, activities/processes, outputs, and outcomes that are arranged to achieve specific strategic objectives.

Table 4.1 Components of Programme Logic Model

Programme Logic	Definition	Example
Input	What goes into a programme – physical & financial resources	Staff hours, programme budget
Activity	Actions that transform inputs into outputs	Processing applications, evaluating applications, ensuring compliance
Output	What are produced by a programme	Projects, PhDs/MScs, reports, publications, outputs with commercial potential
Result	Effects of the outputs on targeted beneficiaries in the short or medium term	Industry uptake, changes in industry behaviour
Impact	Wider effects of the programme from a sectoral/national perspective in medium/long term	NPD, level of R&D, food safety advances

4.5.2 Research VFM Framework

The 3 objectives of the FIRM are clearly interlinked. The food industry objective and the food safety objective are both concerned with developing levels of expertise and

integrating this expertise into the food industry. They also espouse improved research capability and high quality research that feeds into product development and process technology in the food industry. The third objective – information dissemination – is also connected to the other two; the amount of dissemination is a product of the quality of the research, the relevance of the research and the level of collaboration between industry and academia.

As such, to analyse each of the objectives in isolation would result in a considerable amount of duplication of analysis and would fail to capture the linkages and relationships that exist. It was recognised that the unique task of evaluating expenditure on fundamental research required a slightly different approach which complements rather than replaces the programme logic model. A ‘*Research VFM Framework*’ was developed following consideration of the objectives and processes involved. It is informed by the various approaches referred to earlier in this chapter.

Figure 4.2 Research VFM Framework

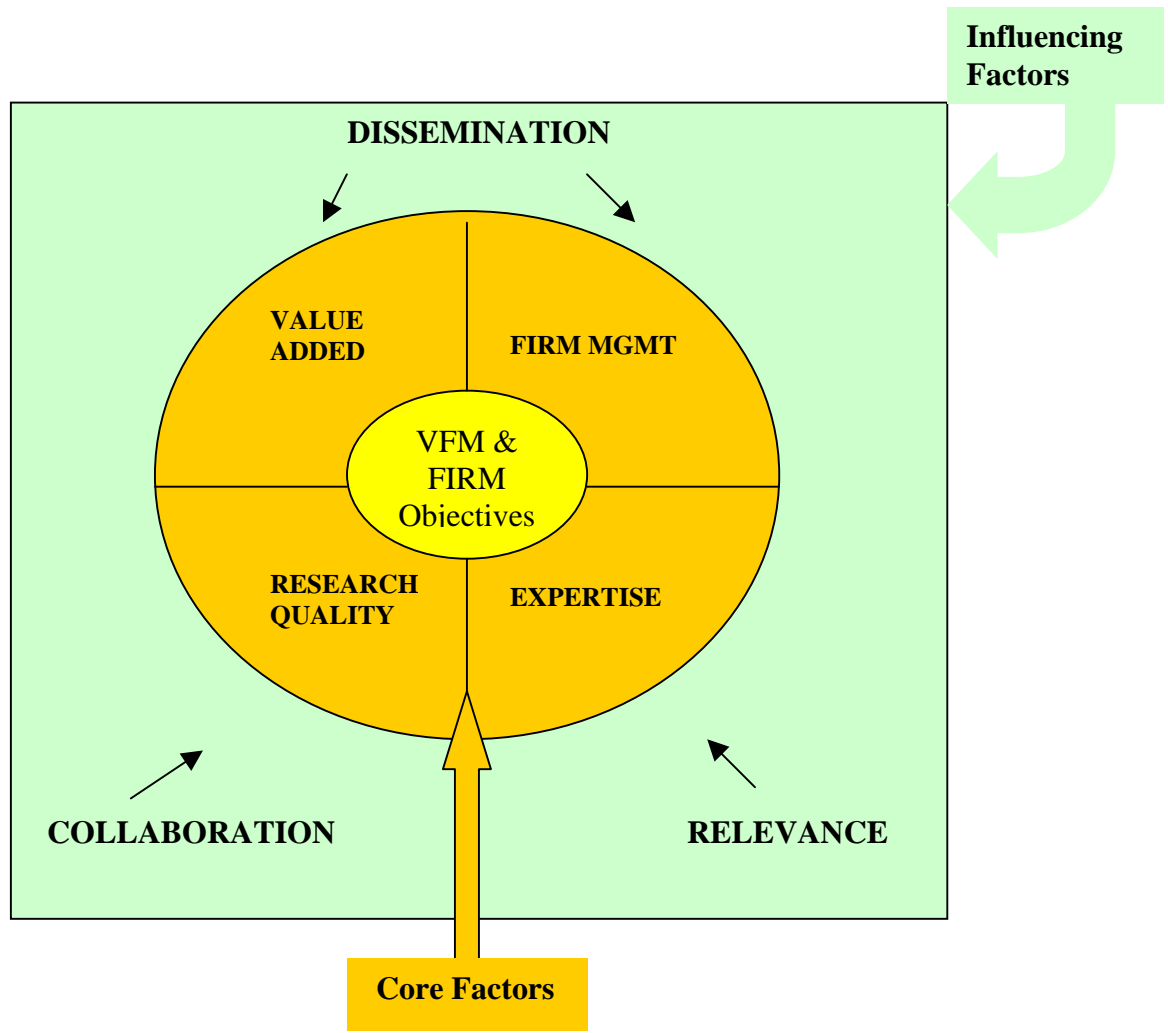


Figure 4.2 above is a diagrammatical representation of the framework developed. In the case of FIRM, 'Value for Money' is related to four separate but interrelated core areas as follows:

- **FIRM Management:** the efficiency with which the scheme is managed by DAF and the financial indicators associated with the resources employed;
- **Development of Expertise:** the skills and capabilities developed within research institutions and the food industry (*indicators – PhDs, MScs, research capability*);
- **Research Quality:** how the research compares to that undertaken internationally (*indicators – refereed papers in international journals, presentation of reports at workshops*);
- **Research Value-Added:** the impact and consequence of FIRM on all stakeholders and the wider environment (*indicators – outputs with commercial potential, industry uptake*)

These core areas (and the value for money achieved) are, to varying degrees, impacted by and impact upon a number of common influencing factors. These factors include the level of dissemination, the level of collaboration and the relevance of the research. It is a mix of all of these elements that combine to achieve the 3 objectives of the FIRM.

The methodology employed incorporates indicators from both the linear approach (bibliometrics, human capital indicators etc.) and the institutional approach (surveys, interviews) described by the ICSTI Taskforce. The aim being to include multiple indicators, which are both qualitative and quantitative in nature.

In answering the research questions posed in the Terms of Reference for this VFM, this report frequently utilises the above 2 frameworks as the basis for analysis. Both frameworks are particularly relevant in identifying the outputs and outcomes associated with the programme while the '*Research VFM Framework*' in particular is used as a proxy for examining issues of efficiency and effectiveness.

CHAPTER 5

EFFICIENCY & PROGRAMME MANAGEMENT

This chapter examines the management of the FIRM by DAF. It considers the procedures adopted, the resources employed and the levels of efficiency achieved. The results of the researcher survey (see appendices 3&4) are utilised to provide indications of performance. Researchers were asked to rate various aspects of FIRM management and were also given the opportunity to identify areas that required attention – 40 researchers (out of 72) identified such issues.

5.1 Programme Management

The Programme is managed jointly by administrative staff in Food Division and by the Agricultural Inspectorate in the Research, Food and Codex Co-ordination Division of the Department of Agriculture and Food.

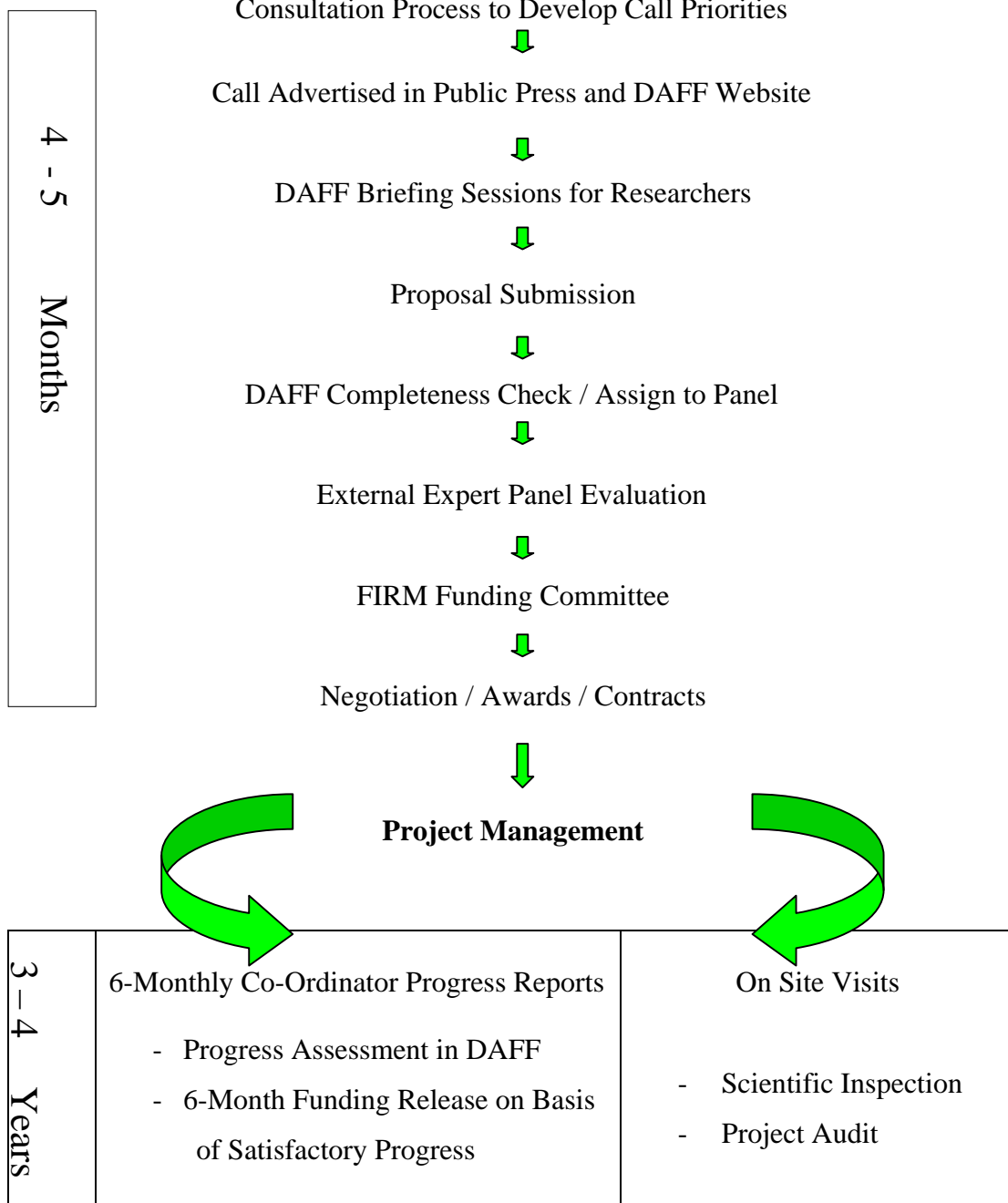
The success of FIRM is due to the dedicated programme management team who work very closely across all aspects of the process. DAFF has been in a position to draw on its own pool of scientific staff and assign people with wide scientific knowledge and professional skills, qualified to MSc and PhD level, and with a good knowledge of the research environment. The FIRM team has a close working linkage across the scientific, financial, administrative and other programme control areas. The flowchart overleaf details the stages in the FIRM management process.

Funding is awarded to research institutions on the basis of open competition. Proposals for funding are invited in tranches throughout the lifetime of the NDP. Up to the end of 2006, a total of 193 projects had been funded with over €97 million awarded to the participating institutions. Expenditure in the same period totalled €50.3 million; the difference being due to programmes that are still ongoing.

Table 5.1 Annual funding awards and expenditure

YEAR	NO OF PROJECTS AWARDED	TOTAL AWARDS €m	EXPENDITURE €m
2000	55	27.5	3.8
2001	22	9.7	3.9
2002	0	0.0	7.1
2003	1	0.1	10.4
2004	37	18.2	6.7
2005	15	7.4	7.0
2006	63	34.1	11.4
TOTAL	193	97.0	50.3

FIRM MANAGEMENT



5.1 Calls for Proposals

There have been five calls for proposals since the measure commenced in 2000. General calls for proposals covering a large range of theme areas were issued in 2000, 2004 and 2006. Targeted calls, intended to address the areas that may not have been fully addressed within the general calls, issued in 2001 and 2005. These targeted calls were more specific as to the exact nature of the research that would be funded. The targeted calls were also intended to reflect the changing requirements for food research in the light of new developments and to build research expertise. The lone project in 2003 dealt with the formation of acralymide in food products.

5.2.1 Research Theme Areas:

The research theme areas are selected based on national priorities, with input from the FIRM Committee (see Appendix 2), the research institutions, other relevant public bodies such as the FSAI, the FSPB, the Environmental Protection Agency (EPA) and Bord Bia, and by consultation with the food industry and its representative groups such as IBEC and ICOS. Co-funding of research is also pursued where FIRM research is seen to dovetail with the research of these other organisations. Both Food Waste and Food Safety research has been co-funded with the EPA and the FSPB respectively.

Table 5.2 Funding for research theme area.

THEME	AWARDS (2,000-2006) €m	EXPENDITURE (2000-2006) €m
Beverages	4.5	1.1
Consumer Foods	8.9	6.9
Dairy	8.0	5.6
DNA Technology	2.2	1.9
Food & Health	11.8	2.0
Food Ingredients	4.0	3.3
Food Quality	8.5	1.4
Food Safety	23.2	10.9
Food Viruses	0.5	0.4
Food Waste	0.6	0.4
Meat	7.4	4.4
Other	8.6	5.6
Nutrition	2.5	2.5
Process Design	1.4	1.4
Residues	1.1	1.0
Strategic Equipment	2.6	0.4
TSE	1.2	1.1
TOTAL	97.0	50.3

5.2.2 Strategic Initiatives

The strategic initiatives are designed to address core competencies required in the area of food research that may not be adequately met by the “project-type” research usually funded by FIRM. Proposals under strategic initiatives in (i) Graduate Development, (ii) Network & Team Building, and (iii) Strategic Equipment were also invited from food research institutions in 2006. The aims of these initiatives are (i) to equip researchers with wider knowledge which would be useful for careers in the food industry, (ii) to complete gaps in specialist knowledge chains and to ensure greater coherence in research and benefit the building of the knowledge society, and (iii) to ensure that the most advanced laboratory tools are available to food researchers.

Awards amounting to €2.16 million were made in 2006 in respect of 6 projects under the strategic equipment initiative. Awards under the two other initiatives will be made in 2007. This is a new and innovative approach to achieving the objectives of FIRM

in a manner other than through funding “project-type” research. It is recognition that the ultimate aims of FIRM can be achieved through more than one channel and that efficiency may be achieved by reallocating some resources to different initiatives.

5.2.3 Allocation of Funding – Application Process

Funding is allocated on a competitive basis in respect of research that is neither commissioned nor carried out in-house by individual firms. Funds are released on a tranche basis at intervals throughout the life of the NDP. Institutions are invited, by public advertisement or ‘calls for proposals’ to submit research proposals that are expected to meet the current and/or anticipated future needs of the food industry. Proposals are accepted from any Irish public institution that can demonstrate the capability to carry out the research. Interested applicants are issued with detailed application guidelines informing them of *inter alia*, the scope of the call, the application procedure, technical guidelines for completing application forms, procedure for evaluation and award of grant, and payment procedure. Information sessions are also convened by DAF to provide further information to potential applicants.

81% of researchers surveyed were either ‘satisfied’ (28%) or ‘very satisfied’ (53%) with the application process in terms of ease of application; 13% (9 researchers) were dissatisfied. When asked to rate the guidance received from DAF in relation to applications, over 90% were either ‘satisfied’ (56%) or ‘very satisfied’ (35%); no dissatisfied responses were noted. In their comments, 8 researchers considered the interval between the call for proposals and the submission deadline to be too short, particularly when calls took place during the summer months. 5 researchers noted problems with formatting the boxes on the application form. The review team note the high satisfaction ratings achieved for the application process. As for the interval between the call for proposals and the date for submission, the 2006 call gave applicants approximately 7 weeks to prepare proposals and submit to DAF – the review team believes that this period is sufficient but should not be further adjusted.

Table 5.3 Awards and expenditure by Institution

INSTITUTIONS	TOTAL AWARD €m	TOTAL EXPENDITURE €m
Athlone Institute of Technology	0.29	0.05
Cork Institute of Technology	0.79	0.25
Central Veterinary Research Laboratory	0.16	0.14
Dublin City University	1.46	0.67
Dublin Institute of Technology	1.22	0.24
Galway-Mayo Institute of Technology	0.14	0.02
Limerick Institute of Technology	0.17	0.06
National University of Ireland Galway	3.90	1.92
Trinity College Dublin	3.98	2.20
Teagasc Ashtown	18.08	8.87
Teagasc Moorepark	15.49	7.52
University College Cork	26.31	16.30

University College Dublin	20.24	10.23
University of Limerick	3.76	1.40
Waterford Institute of Technology	0.17	0.05
Miscellaneous organisations/agencies	0.95	0.38
TOTAL	97.11	50.30

Table 5.3 shows that there is a diverse range of institutions participating in the FIRM programme. While there is a notable concentration in Teagasc, UCC and UCD, these are the research centres in the country that have developed a necessary level of critical mass in food research. Given Ireland's relatively small size vis a vis our competitors, there is a need to concentrate food research in a core number of institutions. In addition, there is also notable research being undertaken in a number of other institutions such as Trinity College (TCD), UL and NUI Galway.

5.3 Evaluation & Selection

An external peer review process involving panels of evaluators is used to evaluate all proposals. Separate panels, comprising 3 evaluators and a moderator, are established for each theme area. The evaluators are drawn from industry, academia and the public sector. The academic evaluators are sourced from research institutions abroad.

Detailed evaluation guidelines and evaluation criteria are issued to members of the evaluation panels; the evaluation criteria are also included in the guidelines issued to applicants. Each project is awarded a score of between 0 and 5 (*0 being those applications which are incomplete or fail to address the issue under consideration and 5 being excellent projects*) on each of the 6 criteria viz.

- Relevance to the aims of the measure and needs of the Food Industry;
- Familiarity with relevant R&D;
- Scientific and technical quality of the proposal;
- Management & Partnership;
- Potential exploitability & economic impact;
- Costing and value for money

The scores on each of the 6 criteria are added together and an overall percentage calculated for each application. This score is included in the summary evaluation report produced by the evaluation panel. In most circumstances, only those project proposals that achieve at least 60% are forwarded to the FIRM Committee for selection for funding.

The FIRM Committee decides the final allocation of funds using the results (evaluation report and overall rating) of the peer evaluation process. The FIRM Committee (see Appendix 2) is composed of representatives from the public and private sectors. The Divisions within DAF responsible for managing the measure have observer status only. An Assistant Secretary General of DAF chairs the committee. Selection is competitive and depends on the quality of the project, plus the amount of funding available. The Committee may also suggest that certain project proposals be reconsidered for funding provided they are modified, as recommended, within a set time scale.

83% of researchers surveyed were ‘satisfied’ or ‘very satisfied’ with the time taken to evaluate applications. Just under 70% of researchers were either satisfied (50%) or ‘very satisfied’ (19%) with the procedure for evaluating proposals. 10 researchers (14%) deemed themselves ‘dissatisfied’ (8) or ‘very dissatisfied’ (2) with the evaluation procedure. Of the 10 suggestions for improving this area, half referred to the need for diverse panels of evaluators for different research areas and 3 felt the process could be more transparent so as to demonstrate its independence, quality and integrity. The Steering Group note that DAF uses different panels for each theme area, the evaluation criteria is issued to applicants, and a copy of the evaluation report and score achieved are sent to all applicants. As such, the Steering Group did not feel that the make-up of the evaluation panels was inappropriate or that the process lacked transparency.

5.4 Award Process

Co-ordinators of proposals selected for funding are informed by letter of the decision to approve funding, including the indicative level of funding, award conditions and any changes / additional information required which must be responded to within a given time frame.

Prior to signing of contracts, DAF may:

- Seek additional information it considers necessary;
- Seek and agree adjustments or modifications to proposals;
- Negotiate adjustment to proposal details to achieve consistency in approach across projects in this measure and with similar measures.

Co-ordinators of unsuccessful proposals, be they considered not worthy of funding, or worthy but not selected due to insufficient funds being available, are informed in writing of the Committee’s decision. In all cases, a copy of the relevant Evaluation Summary Report is sent to the Project Co-ordinators.

When all signed award letters are received by DAF, an advance payment issues in respect of each project.

5.4.1 Application Throughput

Table 5.4 Time taken for selection of projects

YEAR	Date call advertised	Month Projects Evaluated	Date of Selection Committee Meetings	Month awards made	No. of projects approved	Duration (months)
2000	July 2000	Sept/Oct 2000	Oct 2000	Dec 2000	55	5
2001	July 2001	Oct 2001	Nov 2001 & Jan 2002	April 2002	22	9
2003*					1	N/A
2004	Feb 2004	June/July 2004	Sept 2004	Nov 2004	37	9
2005	April 2005	July/Aug	Sept 2005	Nov	15	

		2005		2005		7
	Feb 2006	April/May	May 2006	June 2006		
2006		2006			63	4

*Targeted call dealing with formation of acrylamide in food products

The above table shows the throughput of projects from when the call for proposals is issued until award letters have been issued. The length of time required to put applications through the whole process was increasing up until 2004 but has since declined considerably; latest call for proposals took 4 months from date of advertisement until the award of contracts. The Steering Group considers the throughput time now achieved to be very good and does not envisage any need for further reductions. Maintenance of the current four-month throughput time should be the aim. At the same time, the Steering Group acknowledges that the achievement of this timeframe is dependent on a number of other factors, including the timing of the call, which could increase the timescale involved.

5.5 Eligible Costs

Projects are grant aided up to 100% funding of eligible costs. Eligible costs include staff (non-permanent only), durable equipment (depreciated according to their duration of use on the project), consumables, travel and subsistence and overheads. A limited amount of funding may also be granted in respect of modifications/additions to existing research facilities provided such modifications/additions are justified and complementary to research projects financed out of the measure.

There is no fixed maximum or minimum funding or duration for projects. The appropriate level of funding and the timescale required to complete the research are assessed on a case-by-case basis. The amount of funding provided per project is agreed on a contractual basis between DAF and the respective institutions. Typically projects run for three years, reflecting the period required to undertake a PhD research qualification. However, some projects are extended during their lifetime. This is due to issues related to recruitment of staff for the project or scientific reasoning. Where scientific issues are experienced by the project, the Project Co-ordinator must make a reasoned scientific argument in order to justify a request for an extension.

5.6 Payment Of Claims

Project co-ordinators are obliged to provide DAF with six monthly progress reports in respect of work carried out on each project. These progress reports form the basis of a claim for payment. Failure to provide the progress report in the required timescale can result in a reduction in payment due. Each progress report received is subject to an administrative check in Food Division, before being forwarded to the Inspectorate in the Food Research and Codex Division for an assessment of the scientific aspects of the work carried out. The Inspectorate examines the progress report to ensure that the tasks and deliverables set out in the awarded project have been adhered to and that the budget profiles for each expenditure category are being observed. The Inspectorate then produces a report summary making recommendations as to the level of payment to be made for the reporting period. Any issues which need to be followed up with the project co-ordinator are flagged.

The amount due to each institution is then calculated in Food Division and a payment instruction is prepared and forwarded to Accounts Division. Payments are made by electronic transfer to the relevant bank account of the institution concerned. Letters are forwarded to the institution involved giving details of payments made. A letter is also issued to the co-ordinator of the project with a copy of the summary report detailing payment and requesting responses to queries etc.

23% of researchers were either ‘dissatisfied’ or ‘very dissatisfied’ with the reporting requirements for FIRM projects. This was the least satisfactory of all management areas surveyed. When given an opportunity to identify issues with FIRM management, 15 mentioned reporting requirements – 12 of which felt there was too much reporting and 8 suggested the introduction of annual reporting as per EU programmes (as opposed to every 6 months). The Steering Group understand that reporting is an additional burden on researchers but stress the importance of accountability. Reports also allow DAF to identify issues at the earliest possible stage and payments could otherwise only be made to institutions on an annual basis – the Steering Group felt that payment on an annual basis would be unsatisfactory to all parties.

Researchers were also asked to rate the administration and scientific management of ongoing projects with the following results:

Table 5.5 Satisfaction with project monitoring (% responses)

	Very satisfied	Satisfied	Neither 1 nor other	Dissatisfied	Very Dissatisfied
Administration	20	50	15.7	12.9	1.4
Scientific Management	15.7	58.6	18.6	7.1	0

In both cases, the majority of researchers are satisfied with the ongoing monitoring of projects by DAF. 14 of the researchers believed that there was a lack of flexibility with the management/monitoring of projects and that sometimes there was a conflict between what was required administratively and what was required scientifically. Some researchers felt that very small discrepancies in budgets were being queried or that changes between budget headings were not permitted, even where this was to the benefit of the projects. They felt that more leeway was required, in light of scientific results, to alter research plans. The Steering Group believe that the integrity of the payment process and the accountability for funds issued must be a priority. It is also important that researchers continue to be given the opportunity to alter “off-course” on the basis of sound scientific justification and where it is of benefit to the research. However, both approaches need not be opposed – accountability does not prevent making sensible changes to the approach taken in a project. The Steering Group is satisfied that researchers are given sufficient opportunity to alter their approach midcourse where this is to the benefit of the research but asks the DAF inspectorate to be cognisant of the concerns raised.

5.7 Inspections and Audits

In January of each year, staff from Food Division meet with the technical staff from Research, Food and Codex Co-ordination Division to select projects for joint scientific inspections and financial audits during the coming year. The annual audit

programme envisages a full physical on site inspection, including an examination of invoices and all appropriate records, on 30% of the expenditure incurred across the participating institutions. The following random and risk-based criteria are among those used in the selection process:

- A spread among the institutions
- Size of the project
- Collaborating between projects
- Projects appearing to be having difficulties
- Level of expenditure

In general it is aimed, where possible, to visit projects during Year 2, as at this stage there is sufficient information available to make an inspection meaningful, while still leaving an opportunity to address issues that arise during the inspection. In most cases the scientific inspections take place first. These inspections focus on the physical aspects of equipment purchases, the scientific work completed and the staff involved. The aim is to “build on and verify” the information already submitted to DAF in the scientific progress reports. In the case of collaborative projects, the scientific inspection takes place concurrently for all participating institutions.

Following the scientific inspection the inspectorate forward the file to Food Division, highlighting any issues arising during the scientific inspection that could have implications for the financial audit. Staff from Food Division then carry out the financial audits. The Steering Group considered this to be a thorough inspection regime although it was noted that a sufficient number of completed or near completed projects should also be audited rather than just auditing those projects in their second year.

5.8 NDP Reporting

DAF reports twice annually on the progress of the FIRM measure to the PSOP Managing Authority in the Department of Enterprise and Employment. In turn, progress is reported on at the PSOP Monitoring Committee meetings in spring and autumn. Prior to the holding of the Monitoring Committee meetings, DAF convenes meeting of its Food Sub Committee, which is comprised of representatives of relevant Government Departments, development agencies, regional assemblies and industry representative groups IBEC and ICOS. Progress on all the food related NDP measures is reported on to this Sub Committee and the needs of the industry are kept under review. DAF also participates in the Department of Enterprise and Employment RTDI sub group that meets twice a year, just prior to the PSOP monitoring Committee meetings.

5.9 FIRM Management Costs

The main financial input associated with the FIRM programme is the salary costs of the administrative and technical staff involved. Some travel and subsistence costs, as well as project evaluation costs, were also incurred. The costs in relation to 2006 are set out below.

Table 5.6 Staff costs 2006

<i>GRADE</i>	<i>% of time on FIRM</i>	<i>Direct salary¹⁷</i> €	<i>Total salary¹⁸</i> €	<i>Total staff¹⁹</i> €
PO	10	10,000	11,504	16,911
AP	25	19,269	22,167	32,586
HEO	40	21,502	24,737	36,363
EO	100	41,471	47,710	70,134
CO	75	23,319	26,827	39,435
Subtotal - admin		115,561	132,945	195,429

<i>GRADE</i>	<i>% of time on FIRM</i>	<i>Direct salary</i> €	<i>Total salary</i> €	<i>Total staff</i> €
S.I.	10	9,472	10,897	16,019
A.I.	100	72,112	82,959	121,950
A.A.I.	130	64,974	74,748	109,879
Subtotal - technical		146,557	168,604	247,848
TOTAL		262,118	301,549	443,277

*Based on median salary cost for the relevant grade at year commencement

Total staff costs (€443,277) therefore represent 3.9% of total expenditure under FIRM in 2006 (€1.4 million).

5.9.1 Travel and Subsistence

Travel, subsistence and expenses arise in meeting with institutions to discuss upcoming calls and to advise them on any scheme changes. This usually involves two meetings a year in Cork and two meetings in Dublin. Travel and subsistence costs also arise in carrying out the audit programme. Costs also arise in hosting meetings of the FIRM selection Committee, though these tend to be low. Overall costs for these activities in 2006 amounted to €5,000.

5.9.2 Evaluation Costs

As outlined above, all proposals are evaluated through an external peer review process involving panels of evaluators – one panel for each theme. The evaluators are drawn from industry, academia and the public sector. An honorarium and travelling expenses are paid to the industry and academia evaluators. In 2006, 11 evaluation panels were put in place. Total evaluation costs for the year amounted to €45,000. Given that

¹⁷ Gross salary + Employers PRSI

¹⁸ Direct salary + imputed pension contribution

¹⁹ Total salary + allowance for overheads e.g. office space, materials, training

€4.1 million was awarded in 2006, this figure for ex-ante evaluation is approximately 0.13% of project costs.

5.9.3 Dissemination costs

As outlined in Chapter 2, the RELAY dissemination team, which is housed in the Teagasc research centres in Moorepark and Ashtown, has been assigned the service of disseminating the results of the FIRM funded research to the food industry. The contract for providing this service was awarded by competitive process as part of the 2004 general call for proposals. The current contract commenced on 1 May 2005 and will run until 30 April 2008. The cost of the dissemination project forms part of the expenditure under the FIRM programme. In the 12-month period from 1 November 2005 to 31 October 2006, costs of €286,700 (includes staff costs, travel and subsistence and overheads) were incurred on the project.

5.9.4 Total costs

The total annual cost of managing the FIRM, including travel, subsistence and evaluation costs, is approximately €493,277. This represents 4.3% of the total expenditure in 2006. Including the dissemination costs of €286,700 increases this to 6.8% of total expenditure. However, RELAY is a project supported under the FIRM programme rather than a management cost and should not strictly be considered as part of the running costs of FIRM.

The Steering Group could not identify any suitable comparator for these costs but is, nonetheless, satisfied that the above figures indicate that the FIRM is cost-effective. At the very least, the above analysis provides a benchmark for the programme in future years. These costs should be monitored on an ongoing basis so as to ensure that the FIRM is managed in a cost-effective manner.

5.10 Conclusion

While there are some slight concerns noted by researchers from the point of view of evaluation and reporting, the survey results show that the quality of management is relatively high – based on satisfaction levels with the management of FIRM. As regards other elements of efficiency, this chapter shows the FIRM to perform well in terms of throughput, timeliness, cost, and resource allocation.

CHAPTER 6

PROGRAMME ANALYSIS: INPUTS, OUTPUTS & OUTCOMES

All of the completed projects (58) funded under the NDP 2000-2006 were examined with regards to the quantitative indicators noted in the discussion on the 'Research VFM Framework' (PhD, MSc, No. of publications etc.).²⁰ The findings in respect of these projects are depicted in terms of both the programme logic model and the 'Research VFM Framework' (see Appendix 1). Those projects that are still ongoing are not included, as many of their outputs and outcomes would not yet be realised

6.1 Timeframe

Table 6.1 Average project duration

<i>No. of Projects</i>	<i>Budgeted Months (average)</i>	<i>Actual Months (average)</i>	<i>Difference</i>	<i>Difference (%)</i>
58	35	39	4	11.4%

Most programmes run for approximately 3 years, with an overall average of 39 months. Twenty-six of the fifty-eight programmes were completed within the allocated timeframe – less than half. Of the thirty-two programmes which were not completed on-time, delays range from two to 24 months (an average of just over 7 months). In most cases, extensions are related to recruitment of staff for the project or specific scientific reasoning. Where scientific issues are experienced by the project, the Project Co-ordinator must make a reasoned scientific argument in order to justify a request for an extension. The Steering Group believe that the number and length of delays need to be monitored by DAF given the importance of time-to-market for the food industry; tighter management of project overruns may help to reduce delays and hence a performance indicator to track developments is included in chapter 9.

6.2 Inputs

The total cost of the 58 projects was just under €27 million. Amounts awarded varied from €132,000 (*for the development of a robust DNA assay for detecting prohibited animal materials in feedstuffs*) to €1.715 million (*for dissemination and exploitation of results from FIRM to the food industry*).

Table 6.2 Average project cost

<i>No. of Projects</i>	<i>Amount Awarded (€)</i>	<i>Amount Paid (€)</i>	<i>Difference (€)</i>	<i>Difference (%)</i>
58	488,854	463,006	25,848	5.3%

As shown in table 6.2, the average amount awarded per project was €488,854. All of the programmes were completed on or within the allocated budget; ten programmes came in exactly on budget. In any event, DAF does not finance any spending over the

²⁰ Analysis is based on the application form, the final report submitted under each project, and the internal evaluation of that report.

budget agreed at the outset. The average difference between estimate and outturn for projects (€25,847) is just over 5% of the original project budget.

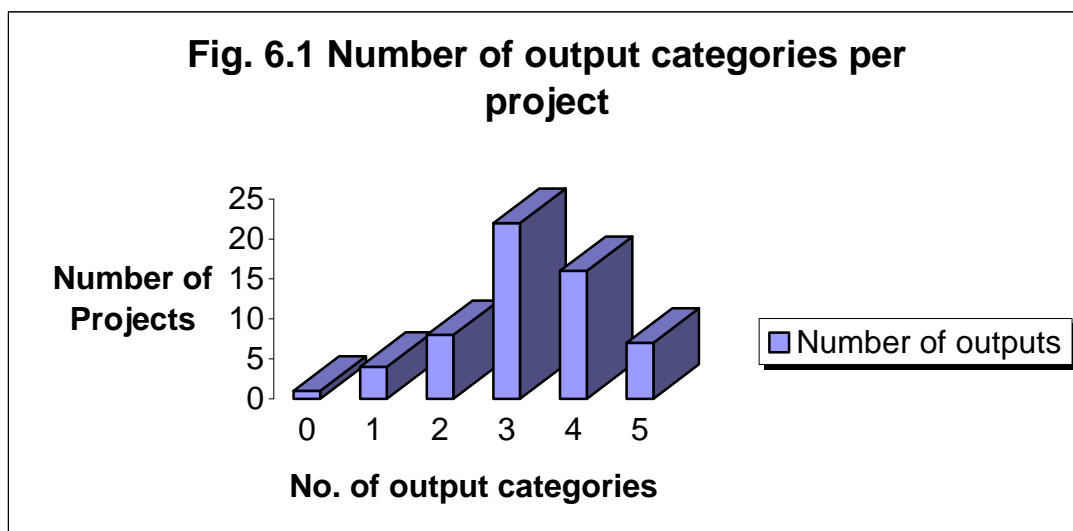
Another input into (and outcome from) the FIRM programme is the collaboration between researchers and food companies and this is considered in section 6.5.

6.3 Outputs

As per the programme logic model, an output is what the programme actually produces. For the purposes of the desk analysis of the 58 completed projects, the following 5 output categories were chosen:

- No. of refereed papers in international journals; { *Research quality* }
- No. of workshops at which reports were presented; { *Research quality* }
- No. of PhDs resulting from project; { *Dev. of Expertise* }
- No. of MScs resulting from project; { *Dev. of Expertise* }
- No. of outputs with commercial potential. { *Value-added* }

As such, each project could register outputs in between zero and five categories e.g. if a project produced 2 MScs, was reported at 7 workshops and led to 2 outputs with commercial potential then it would be said to have scored in three of the five “output categories” noted above. The spread between projects is illustrated in Figure 6.1.



Forty-five of the projects produce outputs that come under three or more of the categories noted above – a rate of 78%.

6.3.1 **Research Quality**

The number of refereed papers published and the number of presentations made at workshops were deemed to be indicative of the quality of the research undertaken (as per ICSTI linear approach: section 4.2).

All but one of the completed projects had been presented at workshops and/or had refereed papers in international journals. The one project with no output under

‘research quality’ (*the development of a robust DNA assay for detecting prohibited animal materials in feedstuffs*) cost less than all of the other projects, lasted for only 18 months, and scored well in terms of outcomes (industry uptake).

53 of the 58 projects (a 91% success rate) had a total of 526 refereed papers published. There was an average of just over 9 papers per project, with numbers per project varying considerably along a range of 1 – 32. Reports from 50 of the projects (an 86% success rate) had been presented at a total of 447 workshops. This equates to just less than 8 per project with the number for each individual project ranging from 1 – 45.

The Steering Group considers these figures to indicate a very high level of output in terms of internationally published papers (9 per project) and presentations (8 per project) at workshops. One must be mindful however that there is considerable variation between projects. Also, the quality of a project with only one or two published papers may exceed that of a project with twelve or thirteen published papers. However, the number of publications can be used as an indicator of quality.

6.3.2 Development of Expertise

Table 6.3 Qualifications supported by FIRM

<i>Qualification</i>	<i>Number of projects examined</i>	<i>Number of projects with qualifications</i>	<i>Number of qualifications</i>	<i>Average number of qualifications from all projects</i>
MSc	58	22 (38%)	53.5	0.92
PhD	58	30 (52%)	83	1.43

Where the aim is to develop expertise in the areas of food safety and food product & process development, outputs can be seen in terms of the increased number of people trained to the level of PhD and MSc [Outputs also include increased skill sets and research capabilities within research institutions]. Of the 58 projects examined, 38 resulted in qualified PhDs and/or MScs (66% of total) – 14 had both PhDs and MScs (24% of total).

83 PhDs resulted from FIRM funding; the number of PhDs per project ranged from zero to seven, with an average of approximately one and half PhDs per project. 53.5 MScs were also delivered; the number per individual project ranged from zero to nine with an average of just under one MSc per project.

The Steering Group considers this to be a satisfactory return (although useful benchmarks are not readily available). Furthermore, the group notes that while many projects result in positive results, both in terms of developing expertise and resulting in real impact on the industry, it is often the case that training new postgraduates is not a direct aim of the research. In many cases, the project is concerned with further developing skills within the research institution itself – both outputs are desirable.

Therefore, when looking at the average number of PhDs and MScs that result from FIRM, it is prudent to look at the average number of PhDs and MScs from the projects which actually aim to produce such outputs. As such, the 30 projects resulting in PhDs produced an average of 2.8 PhDs and the 22 projects involving MScs

produced an average of 2.4 MScs. Alternatively these figures equate to an output of 2.2 PhDs and 1.4 MScs per project (based on total of 38 projects involving PhDs and/or MScs). The Steering Group emphasises that the above figures are indicative of the outputs only and are mindful of the difficulties in simply averaging outputs across all projects.

As regards financing, it costs €18,745,195 for, amongst other things, 83 PhDs and 53.5 MScs. However, it is not considered useful to extrapolate a cost per individual PhD/MSc given the variation in programme aims and the fact that the qualifications are only one of the outputs from the research. Furthermore, there is considerable divergence between projects e.g. a project to investigate factors affecting salmonella control programmes in pork cost €436,752 and resulted in 1 PhD while another project examining the development of particular cooked meat joints cost €344,692 and resulted in 4 PhDs.

6.3.3 Research value-added:

The quantitative output indicator relating to ‘*research value-added*’ is the number of project outputs/deliverables with commercial or economic potential. “Outputs with commercial potential” are new products or product components, new processes, new technologies (including equipment and test methodologies) and industrially relevant knowledge/information. There were 108 outputs/deliverables associated with the completed projects analyzed – an average of 1.86 per project. The number of “outputs with commercial potential” produced by each project range between 0 and 8. Half of the projects did not result in any commercial output but the Steering Group would have expected at least this figure given the public good element and the fundamental type of research undertaken.

Table 6.4 Outputs – research “value-added”	
<i>Number of Projects (% in brackets)</i>	<i>Outputs – Research Consequence</i>
30 (52%)	Outputs with commercial potential
7 (12%)	Changed industry behaviour
5 (9%)	Require further development
4 (7%)	Expressions of interest received
3 (5%)	No commercial outputs expected at outset
2 (3%)	New methodologies developed
7 (12%)	Other

Table 6.4 shows that 30 projects resulted in outputs with commercial potential. Of the other 28, 7 led to some noticeable change in industry behaviour and 5 require further development (*one of which had secured funding from Enterprise Ireland*). 4 more have been the subject of some noteworthy further interest. Another two led to the development of new scientific methodologies. 3 projects involved activities that would not be expected to result in commercial outcomes (*development of cooked meat facility at National Food centre, an analysis of future trends using economic models and an examination of consumer perception of organic and conventionally reared muscle foods*).

Of the remaining 7 projects, the following can be said:

Project Ref	Comment
00/R&D/G/4	2 PhDs. More efforts on dissemination/industry contact would have been beneficial.
00/R&D/D/32	1 PhD. Assisted in evaluating national salmonella control programme for pork
00/R&D/C/79	6 PhDs, 1 MSc. Potential for some industry uptake.
00/R&D/C/85	1 PhD, 9MScs. Output has potential to reduce packaging waste
00/R&D/TN/103	Tried unsuccessfully to recruit post grads. Results relevant to industry but some issues with process
01/R&D/D/160	Test produced that can detect BSE prion earlier in infected cattle.
03/R&D/TN/204	1 MSc. Experience gained helped to secure 6 th framework project

The Steering Group concludes therefore that about half of the projects are producing outputs with commercial potential and that this is considered to be a very good performance in light of the public good/fundamental research aspects of FIRM. Furthermore, the above analysis shows that using this single indicator alone as a proxy for the “value-added” of research fails to encompass the wider contribution of the research projects; Most of the 28 projects which did not result in “outputs with commercial potential” still benefited the food industry.

6.4 Outcomes – Industry Uptake

“Industry uptake” goes further than the previous section which refers to the production of outputs which may have some future **potential** use for the food industry if developed further or adopted by a private entity. Projects that score under “industry uptake” have already made an impact on the food industry. 26 of the projects resulted in industry uptake or changes in industry behaviour (45% success rate). There is no readily available benchmark against which to compare this figure but the Steering Group consider this to be a very satisfactory contribution to the value-added of the food industry given general success rates for R&D and new product development, the public good nature of the funding, and the fundamental type research supported.

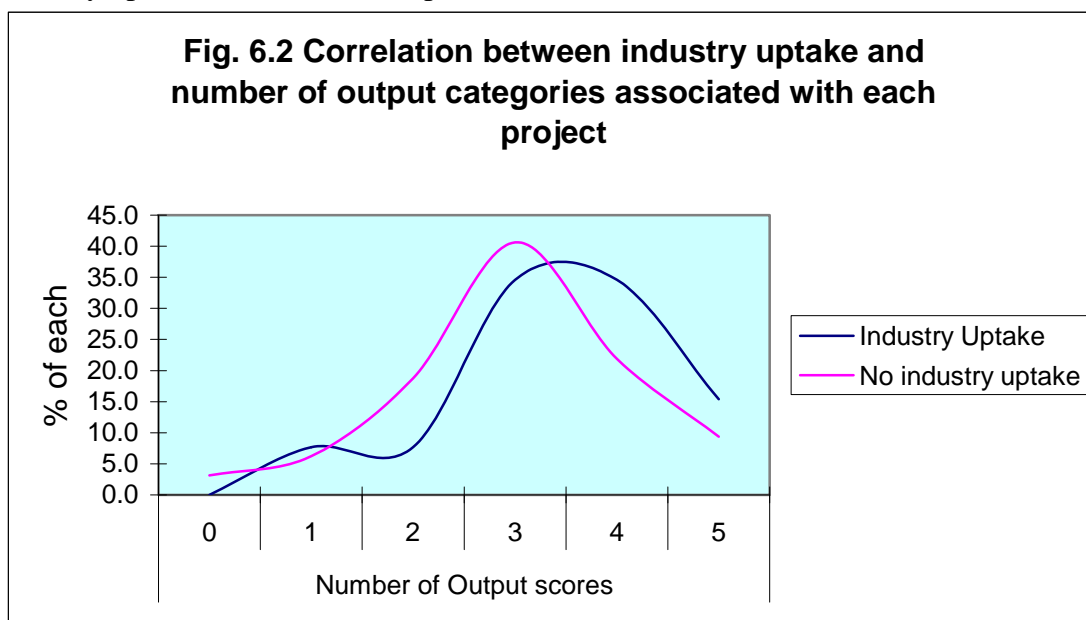
Importantly, the Steering Group acknowledges that many of the projects currently being examined may result in some form of industry uptake in the future, or further research in the future may lead to a variety of different outputs or other scientific breakthroughs. This highlights the importance of examining outcomes, not just at one point in time (i.e. on completion of the research), but to follow up progress in the months and years after the initial research is completed. If one is to get a true picture of what FIRM is, or is not, achieving, then the medium/long term impact of individual projects needs to be known. Therefore, the Steering Group recommends that DAF gathers this information in the future.

Recommendation 1: That DAF puts procedures in place to capture what happens to research results in the months and years after completion of the contract. This would also give feedback on the movement of researchers into food industry/food safety employment. This may involve the researcher completing a simple form one and three years after submission of the final report.

6.4.1 Level of Industry Uptake – a link with outputs?

Figure 6.2 below divides the 58 completed projects into two groups - those that have achieved some industry uptake and those that have not. Each group is then depicted along a graph that shows the number of output categories associated with each project. As shown in section 6.3, each project can score under 5 possible output categories viz. PhDs, MScs, No. of refereed papers, workshop presentations and outputs with commercial potential. The purpose of the graph is to show whether those projects with more outputs have led to a greater level of industry take-up.

The curve associated with 'industry uptake' is skewed further to the right than that associated with no industry uptake, indicating that projects with successful uptake have a higher number of associated outputs. This suggests that those projects that score on more of the outputs have a better chance of achieving uptake. Again, this is no guarantee of success as can be seen from the fact that 3 of the 32 projects without industry uptake score on all 5 outputs.



Furthermore, those projects with industry uptake have an average of 10.92 refereed papers and 9.62 workshop presentations compared to an average of 7.56 refereed papers and 6.16 workshop presentations for those with no industry uptake. The higher scores on these 'research quality' indicators suggests, as could be expected, that higher quality programmes have a greater impact on the food industry.

6.5 Research Collaboration

In examining the level of collaboration involved in the projects completed to-date, this review asks whether industry was involved at the outset of a project and then considers whether industry was involved at any stage overall. In the case of the 58 projects examined, 18 included industry involvement at the outset (31%) while 36 had some industry involvement at one stage or other (62%). Of importance to this review

is the relationship between this input and the actual outputs and outcomes produced. As may be expected, the effect of increased collaboration is more pronounced in the area of ‘*research value-added*’ (impact and consequence of research) than ‘*research quality*’ or ‘*increased expertise*’.

The 36 projects involving industry at some stage of the process resulted in an average of 1.33 PhDs and 0.94 MScs compared to an overall average (for 58 projects) of 1.43 and 0.92 respectively. They also resulted in an average of 10.39 refereed papers in international journals and 10.44 workshop presentations compared to an overall average of 9.07 and 7.71 respectively.

The higher number of presentations made at workshops may indicate a higher degree of relevance for research which has had some industry input. The fact that the number of PhDs and MScs is in line with the overall average is also welcome, as it shows that industry involvement does not negatively effect the output of ‘*expertise*’ in the form of PhDs and MScs.

6.5.1 Link between Research Collaboration and ‘Research Value-added’

Research Value-added refers to two indicators viz. “outcomes with commercial potential” and “industry uptake”. The 36 projects that had some industry involvement resulted in an average of 2.25 outputs with commercial potential compared to an overall average (for the complete 58 projects) of 1.86. Where the industry was involved at the outset of the projects, this average commercial output figure increases further to 2.44. There is clearly an association between the level of collaboration and the number of outputs with commercial potential. As a caveat though, it is also important to note that while industry collaboration improves the chances of success, it does not guarantee such success – 6 of the 18 projects that had industry on board at the outset resulted in no outputs with commercial potential.

When looking at the actual outcomes of the research projects (industry uptake), the importance of collaboration is again highlighted. 26 of the 58 projects completed by the end of 2006 resulted in industry uptake or changes in industry behaviour – an average of 45%. This compares to 21 of the 36 projects which had some industry involvement during the research (a return of 58%) and 11 of the 18 projects which had industry on board at the very outset (a return of 61%). Developing projects in conjunction with industry increases the chances of industry uptake by a not insignificant 36%.

6.6 Building on the analysis

The information contained in this chapter is vital to help monitor and analyze the contribution of FIRM. The preceding data on inputs, outputs and outcomes show that the FIRM is performing well as regards the development of expertise, the production of quality research and adding value to the food industry. The Steering Group is cognisant of the need to monitor this data and track progress.

All of this data, and more, is contained in the intermediary and final reports submitted by researchers. However, DAF has no routine means of co-ordinating, comparing or analysing all of this vital information so as to chart performance of funded projects.

The Steering Group feels that this information could be better managed through the use of appropriate information technology. As such, the Steering Group recommends that a suitable database be designed to collect all of the information currently available on individual files so as to aid programme management and resource allocation.

Recommendation 2: The development of a FIRM database, which would be used to capture some of the information contained in project applications and reports. This could be utilised for managing, monitoring and reporting on FIRM.

6.7 Conclusion

The foregoing analysis illustrates some significant achievements from the 58 completed projects in terms of verifiable, quantitative indicators. It also shows some important links, particularly between industry uptake and both the level of collaboration and the number of outputs produced by each project. Of course, while there is a relationship between different factors, it cannot be said that one always follows the other – in R&D there is no secret formula.

Given that there is no one best approach to research, it follows that there is no one best indicator of performance – a combination of all of the indicators used is required. This is borne out by the foregoing analysis. Even when using a variety of quantitative indicators, there is also a need for some qualitative assessment to capture achievements and successes that the quantitative indicators ignore. In this regard, the following chapters prove informative.

CHAPTER 7

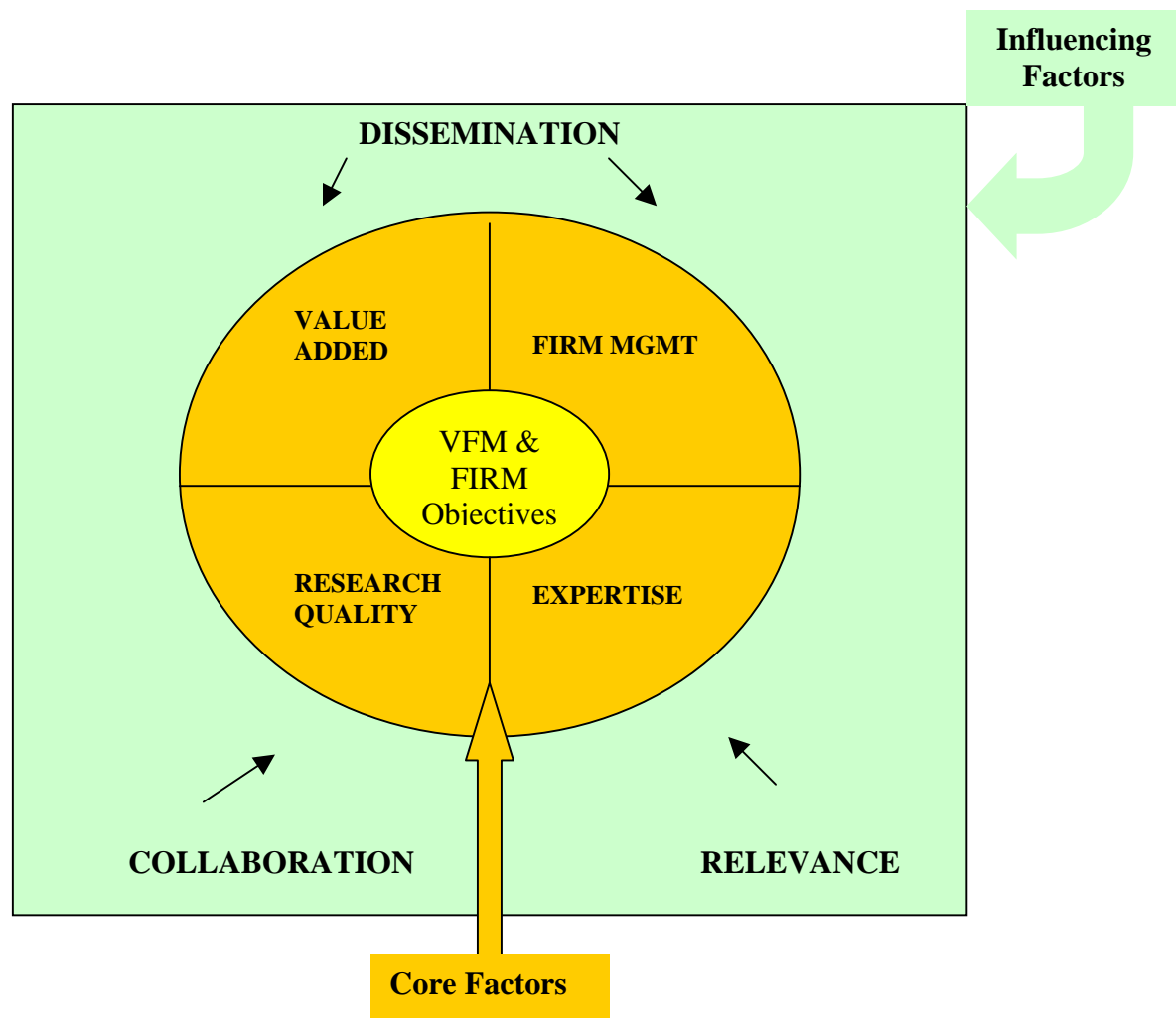
EFFECTIVENESS: OBJECTIVES & “RESEARCH VFM FRAMEWORK” CORE FACTORS

The previous chapter discusses the quantitative outputs and outcomes associated with the FIRM as they correspond to 3 of the four core factors identified in the “Research VFM Framework” below viz. expertise, research quality and research consequence. This chapter supplements the information provided in chapter 6 by providing a more qualitative assessment of the FIRM’s achievements based on the information supplied through the surveys and stakeholder consultation process.

7.1 Research VFM Framework

The measure of effectiveness is the extent to which FIRM has achieved its objectives – as such, the objectives must be amenable to measurement. We use the achievements in respect of each of the elements of the “Research VFM Framework” (*Fig. 7.1*) as a proxy for the achievement of the three FIRM objectives. The elements of this framework combine to fulfil the objectives of the FIRM and ensure “Value for Money”.

Figure 7.1 Research VFM Framework



7.2 Objectives

7.2.1 Agreeing Objectives

Over 90% of both groups surveyed (industry and researchers) deemed the FIRM objectives to be appropriate. Both groups identified the ‘Food Industry Objective’ as being most important, the ‘Food Safety Objective’ coming second and the ‘Information Dissemination Objective’ third.

When asked whether the FIRM contributed to other objectives over and above the three identified, 49 out of the 72 researchers proffered some alternatives. Nearly 2/3 of these noted that FIRM is essential for the training of researchers and the development of expertise for both research institutions and the food industry. 12 of the replies also mentioned its role in building research capacity and capability so as to contribute to the development of a knowledge economy and allow Ireland compete internationally. Others referred to the role of FIRM in building inter-institutional collaboration and promoting both food research and academic excellence. Half of the industry respondents had no opinion on this matter; 4 of the industry personnel suggested alternatives, all of which referred to training and expertise.

In the stakeholder consultation process, respondents were generally in agreement with the objectives, with numerous suggestions to expand them further to incorporate *inter alia* a consumer focus, wider dissemination to the public, development of the science base and research capabilities, commercialisation of outputs (as opposed to merely disseminating information), as well as focussing on consumer health, process development, quality improvement, novel technologies and competitiveness. One of the research institutions highlighted the importance of FIRM for inward investment and establishing links with multinationals, adding that an important objective was also to produce science that can be judged favourably compared to international benchmarks.

The Steering Group consider the majority of these suggestions to be implicit within the current objectives, particularly as regards research capacity, training, expertise, promoting food research etc. In light of continuously evolving trends and requirements in the food industry, the Steering Group feel it would be unhelpful to further define funding areas and narrow the remit of FIRM. That said, the FIRM must continue to be cognisant of the various aims noted above.

The results also support the review group’s suggestion of a third objective i.e. the information dissemination objective. The value of the knowledge produced by FIRM and other food research is severely limited if this information does not reach the key decision makers and influencers in the food sector. As such, and following on from the views expressed above, the review group feel it is now appropriate to enshrine the information dissemination objective in the FIRM lexicon.

*Recommendation 3: To include a third FIRM objective:
Information Dissemination Objective: To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies and innovations by Irish food companies.*

7.2.2 Achievement of objectives

When asked to rate FIRM's contribution to each of the three objectives outlined for it, the views of industry and researchers diverged somewhat.

Food Industry Objective

83% of researchers believed that the FIRM makes a 'good' (48.6%) or 'very good' (34.7%) contribution to the 'Food Industry Objective'. No researcher responded that it was 'poor' or 'very poor'. The number of industry personnel (31%) who thought the FIRM's contribution to this objective was 'good' was the same as the number who thought it was 'poor'. The biggest response rate for industry was in the average category – 35%.

Food Safety Objective

Again in terms of food safety, the researchers were more positive than the industry respondents. 87% of researchers described FIRM's contribution as 'good' or 'very good' with no responses in the poor categories. The majority of industry responses were in the 'good' (42%) and 'average' (39%) categories.

Information Dissemination Objective

While the divergence is also evident here, industry was more positive about FIRM's contribution to this objective than to the previous two. The majority of industry respondents described the contribution as 'good' (54%) or 'very good' (12%) while 23% described it as average. 90% of researchers described the contribution as 'good' or 'very good'.

There is some divergence between the views of researchers and industry personnel, particularly in terms of FIRM's contribution to the "Food Industry Objective". Evaluating the achievements of FIRM under each of the objectives is central to this entire review and forms the basis of this and the subsequent chapter. However, the Steering Group note that regardless of actual achievements, FIRM will need to be more cognisant of the perceptions of all stakeholders in the future – particularly the perceptions of the food industry (see recommendation 9, section 7.5.2). Ensuring positive perceptions of FIRM is a prerequisite for its success. It helps to build support for FIRM and integrate the food industry into its activities. If the beneficiaries are not aware of what it provides, or do not believe it benefits them in the long run, then its *raison d'être* would come into question. Of course, the Steering Group are also mindful of the fact that FIRM, being a public good programme supporting basic/fundamental research, will not always sit easily with the demands of the food industry. This makes building industry buy-in more difficult but not less important.

7.2.3 FIRM approach

In line with the views expressed above, the majority of researchers (75%) did not believe that there was a better approach to achieving these objectives. Where alternatives were suggested, most highlighted the need for more meaningful commercial involvement at all stages of the FIRM projects so that industry are "*co-owners*" and "*partners*" in the process. It was also suggested to establish "*food industry networks where common research needs could be identified*".

Industry replies were less positive about the approach taken by FIRM, with only 39% believing that there wasn't a better way of achieving these objectives. The same percentage of respondents (39%) suggested alternative approaches. As with researchers, the need to have greater industry involvement in the process through collaboration, consultation and focus groups was to the fore. Some industry replies go further to suggest implementation or management of the food industry objective by industry itself or through Enterprise Ireland. Again here the Steering Group was conscious of the conflict between public good research and the industry preference for company specific research.

Stakeholder responses were broadly positive about the FIRM model and the need for a dedicated competitive food research programme. Enterprise Ireland suggested a greater focus on novel, pre-competitive technologies to build capability where there is a clear need rather than simply supporting “*follow-ons to previous projects*”. It was suggested by RELAY to have two research categories – fundamental and applied – with different output expectations for each. Stakeholder responses clearly noted the need for more efforts in the area of technology transfer, commercialisation and the management of intellectual property (IP). IBEC recommended the use of a high level Steering Committee to ensure projects meet their objectives.

Other suggestions include supporting centres of excellence to provide a longer-term capability in key areas and funding postdoctoral research to build on existing expertise. The research institutions were supportive of the moves to develop more programmatic type research rather than just funding individual projects – getting the right mix was seen to be important.

The review group concluded that none of the above areas identified through surveys or consultation suggest that fundamental alterations in the FIRM methodology should be employed but acknowledge that some modification to the programme was required. The need for closer links with industry is evident again here, together with issues of IP and technology transfer – all of which is discussed later in the review. Developing long term capabilities and investing in postdoctoral research is examined in section 7.4 (Expertise). As regards the references to programmatic research, the new strategic initiative in the area of “Network and Team Building” launched by DAF in 2006 is commended by the Steering Group as a useful addition.

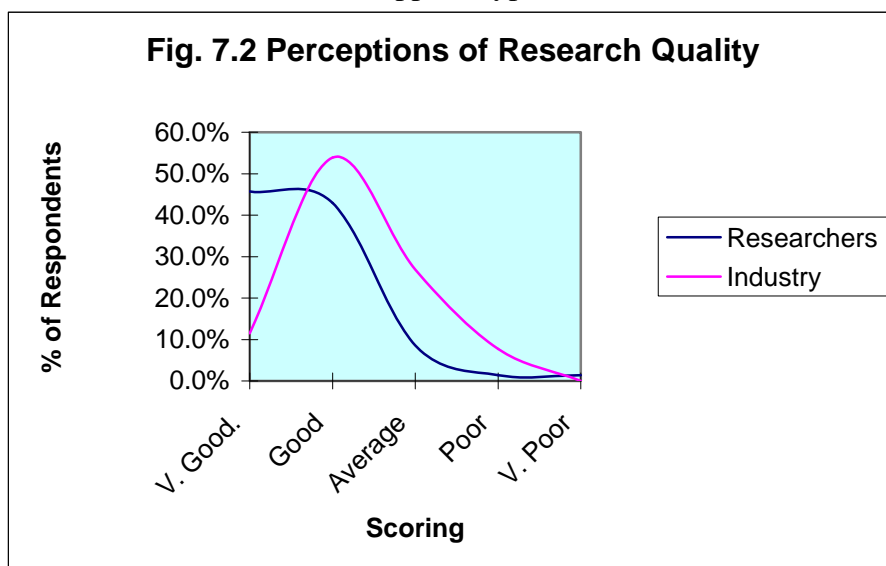
The review group feel that there may be some merit in differentiating between fundamental and applied research as suggested by RELAY – the impetus for, and outputs from, each of these can be very different. This would not involve segregating budgets along these lines and targeting each individually. Rather, the Steering Group felt that each approved project should be categorised as either fundamental or applied so that the levels of each can be monitored, together with the different outputs arising from each type.

Recommendation 4: Consider the feasibility of categorising research projects/programmes between fundamental and applied. In this way the balance between each can be more closely monitored and the appropriateness of different performance indicators can be considered

7.3 Research Quality

Figure 7.2 below shows the distribution of the perceptions of quality for both groups surveyed. 89% of researchers considered the quality of FIRM funded research to be either 'good' or 'very good', with responses more or less evenly split between both categories. Industry were generally positive and observed that 12% was 'very good', 54% 'good' and 27% 'average'.

Stakeholder responses were even more positive, with most rating the quality of research very highly. The heads of food research confirmed this view, saying it was comparable to what was being done internationally and highlighting the number of peer-reviewed publications. Taking UCC as an example, 7 of their most published scientists in 2005 and 2006 were from the food area – a substantial portion of funding for these scientists comes from the FIRM. While there was no doubts as to the quality of the research, there was some questions raised as to the degree of innovation involved in some of the more applied type of research conducted.



The Steering Group would expect researchers to rate the quality of research more highly than the food industry personnel. However, its standing is still high amongst most parties (the only question raised was as to the relevance of the research – this is examined in section 8.2). It is vital that this quality is maintained. The Steering Group also recognise the danger that increased funding levels envisaged under the new NDP, combined with the capacity constraints referred to later in section 7.4.1, will lead to reductions in quality. Careful project evaluation and selection are required to prevent this.

The Steering Group is satisfied that the research is of a very high quality but note that the exact measurement of this quality must be made explicit. There are two recommendations to this effect made below.

The Steering Group accept that the use of citation analysis would be beneficial for quality assessment, given that it is a “*universally accepted measure of the quality of scientific output*”²¹ By definition, bibliometric analysis is an instrument for documenting the publication performance of authors and institutions as well as the reception of their work measured by the number of citations. The Health Research Board commissioned a large-scale bibliometric analysis²² of Irish health-related publications in the period 1999-2005. The study is based on a quantitative analysis of scientific articles published in various journals and it assesses the publication output and impact of Ireland-based health researchers by using bibliometric techniques. The study cost €16,000. The Steering Group suggest undertaking a similar study of FIRM. It would give a definitive account of the quality of FIRM funded research and how it is viewed by the International scientific community i.e. how it is rated amongst other scientists. This would definitively provide confirmation, or otherwise, of the quality being achieved for the investment involved.

Recommendation 5: Commission a bibliometric analysis of FIRM funded research so as to inform decision makers of the quality of the work produced

The above recommendation is an important first step in assessing the quality of the research. The Steering Group also appreciate that this is a snap-shot of the past and present, but that procedures for the future evaluation of quality must be developed. There is a need to benchmark projects on an ongoing basis so as to supplement the currently available information on publications, workshops etc. Upon completion, each project could be given a rating in terms of research quality, contribution to building expertise and level of value-added. A compilation of this rating and the various outputs could then be used to monitor the performance of FIRM, document trends in that performance, and subsequently be leveraged to publicise the achievements brought about by FIRM funding. Where appropriate, the Steering Group recommend utilising the assessment teams used for *ex ante* evaluation so as to reduce costs.

Recommendation 6: Adopt procedures for the expost evaluation of completed FIRM projects by an independent assessment team, giving grading for research quality, contribution to building expertise and level of value-added.

7.4 Development of Expertise

Section 6.3 shows the large volume of output from FIRM in terms of PhDs and MScs. This section considers the wider implications of this output.

7.4.1 Institutional Capabilities

The positive contribution of FIRM to developing skills and expertise within research institutions is evident in the survey responses. 72% of researchers consider FIRM to make a ‘very good’ contribution to “*new skills and expertise within [their]*

²¹ Strategy for Science, Technology and Innovation.

<http://www.entemp.ie/publications/science/2006/sciencestrategy.pdf>

²² Available at

<http://www.hrb.ie/storage/publications/hrbpublications/researchfunding/HRBBiblioreport.pdf>

organisation”, while 26% consider it to make a ‘good’ contribution. The development of expertise and capabilities within research institutions is regarded as a very important output of FIRM by all of the heads of research – the research institutions are an important source of skills, information and technology for the food sector. They acknowledge that FIRM funding is allowing them to build “*a very strong scientific infrastructure*” and helping to “*provide a platform of capabilities in the institutions*”. The Steering Group accept that this is a very significant informational and technical resource that is being utilised by the food industry; however research institutions are not formally measuring this output. Furthermore, it does not appear that the industry equates FIRM with the assistance they receive from research institutions and the capabilities that have been developed. As in section 7.2.2, we feel that DAF may need to invest in altering industry and consumer’s perceptions of FIRM’s contribution to building institutional capabilities in Ireland (see recommendation 9, section 7.5.2).

Within the research institutions themselves, FIRM has raised the profile of food research to the point where it is a significant component of some of the University’s PRTL application. For example, food research was the number one priority in UCC’s latest PRTL application, while UCD are currently developing an Institute of Food and Health on the back of capabilities developed heretofore, much of which can be attributed to FIRM. In addition, the scale of operation developed by Teagasc and the level of support it provides to the food industry would be much less without FIRM funding.

The only negative highlighted was the restricted capacity within research institutions to expand food research further. FIRM is currently funding equipment through its Strategic Research Initiatives. The Steering Group note that funding infrastructural development within institutions, over and above the purchase of strategic equipment, goes beyond FIRM’s remit. However, we note that capacity is a constraint of which FIRM must be cognisant in light of expanding funding in this area.

7.4.2 Food Industry Capabilities

The FIRM is also charged with developing human capital within food companies – the majority of industry personnel surveyed (73%) described the contribution of FIRM to developing skills within their organisations as ‘average’ or ‘poor’. The development of this expertise in the food industry is related to (1) the suitability of the postgraduates being produced and (2) the actual level of movement of these postgraduates into food safety or food R&D employment.

42% of industry personnel believed that the contribution of FIRM to the “*provision of suitable postgraduates for the food industry*” was ‘good’, while the same amount (42%) described it as average. Again, there is a difference of opinion between industry and researchers; almost two-thirds of researchers (65%) felt FIRM’s contribution to this area was ‘very good’. The difference perhaps lies in the actual requirements of industry and their capacity to absorb the type of graduates developed under FIRM. Industry views on the movement of graduates into food industry R&D and food safety related employment were less positive again. The highly skilled research PhDs and Masters produced under FIRM may not be as directly relevant to the food industry as graduates in more technical, production and processing type

areas. EI said many companies felt there was “*a dearth of recruitment talent at all levels in R&D and technical production, particularly in basic food production*”.

The heads of research thought there was a good flow of postgraduates into the food industry but the questionnaires were not overly positive in this regard. While the number of PhDs employed is considered to have increased in the last 10 years, this is from a low base and mainly into the larger food companies. There is generally more of an appetite within the food industry for food science graduates and masters than for PhDs. Also, many of those involved in research prefer to pursue an academic career rather than enter the food industry. On the other hand, FIRM is not a vocational training programme – the need for highly skilled PhDs to drive innovation in the food industry is increasing all the time and a long term perspective is required to ensure that this skills base is available to the food industry.

The Steering Group agree that the objectives of FIRM in this regard must be made clear. It is a research-led programme. In light of the long term R&D agenda in the food industry, and the Government’s commitment to building a knowledge economy, a research-training programme is even more valid now than perhaps at any stage in the past. What is vital is that those who are trained to this high level are trained in the right areas so that industry can, as one stakeholder put it, “*see the programme focussing on areas that they agree are important for their future*” (this is discussed further in section 8.2). These postgraduates must be given as much exposure to industry as possible through the collaborative approach discussed in section 8.3. Furthermore, by building the profile of food research in Ireland, FIRM can help to encourage more students into food science areas at undergraduate level.

However, the Steering Group also acknowledge that one of the primary objectives of FIRM is to provide a base of expertise in generic technologies that will support innovation and product development. As such, it is not confined to funding research through Masters, PhD and postdoctoral research. The divergence of views between industry and researchers as regards the expertise being developed for industry must be addressed. On the demand side, the benefit of highly skilled post grads and postdocs to building the R&D base must be marketed to the food industry. Perception is again key. On the supply side, the decision taken by DAF in 2006 to fund graduate development programmes under the Strategic Research Initiatives is to be welcomed. This should supplement the existing postgraduate output of FIRM with more directly and widely applicable food graduates. The Steering Group are anxious that we should know whether this investment is worthwhile or otherwise. We recommend that the impact of this investment be measured so that informed decisions on the need for further investment can be made.

Recommendation 7: Measure the returns from the investment in graduate development programmes; this analysis will inform strategic decisions regarding the necessity for continued investment in this area.

7.5 Research Value-Added

“Research Value-Added” encapsulates the impact of the programme on the targeted beneficiaries, the consequence for the Irish food industry and the Irish consumer, and

the overall result of the spending through FIRM. It corresponds with the outcomes, (results and impacts), which form an integral part of the “Programme Logic Model” (see chapter 4) but it goes further to include outputs that provide added value for consumers or industry, such as ‘outputs with commercial potential’.

Table 7.1 Rating FIRM's contribution to Research Value-Added

Criteria	Response Group	Very Good	Good	Average	Poor	Very Poor
Links between Industry and researchers	<i>Researcher</i>	8.3%	31.9%	45.8%	13.9%	0.0%
	<i>Industry</i>	0.0%	7.7%	53.8%	26.9%	11.5%
Commercial potential of outputs	<i>Researcher</i>	7.0%	40.8%	42.3%	8.5%	1.4%
	<i>Industry</i>	3.8%	11.5%	50.0%	23.1%	11.5%
Use of FIRM outputs by food industry	<i>Researcher</i>	2.8%	22.5%	40.8%	29.6%	4.2%
	<i>Industry</i>	0.0%	15.4%	50.0%	26.9%	7.7%

Survey results show that researchers perceive the FIRM to have a greater consequence or impact than does the food industry. Table 7.1 shows that all results converge around the middle or ‘average’ response, with the remainder of industry responses skewed towards the ‘poor’ side and the remainder of researcher replies skewed in favour of the ‘good’ side. Again, these results must be considered in the context of FIRM as a fundamental research & public good programme. It does however illustrate that there is more scope to achieve improvements in the area of “Valued-added” than in any of the other core areas of the “Research VFM Framework”. Issues of collaboration, research relevance and dissemination (the VFM framework influencing factors) are also central to achievements in this area and are discussed in depth in Chapter 8.

7.5.1 Technology transfer and commercialisation

In terms of FIRM’s contribution to commercial outputs and their successful uptake, the figures above correspond, to an extent, with the “industry value-added” output and outcome indicators used in chapter 6. While there have been some notable successes, the surveys and stakeholder consultation highlight the potential for yet higher returns.

At the outset, it must be made clear that the FIRM is primarily concerned with fundamental and basic non-commissioned research; it lays the platform from which to commission industrially relevant technologies, products and processes rather than actually delivering them. There are other factors to be cognisant of also. It is a long road from conception of fundamental type public good research to a finished and viable commercial output – the vast majority of new product development (NPD) and R&D results in failure. We have started from a low base; over the last decade or so, Ireland has been building its R&D capabilities in both research institutions and the food industry; the benefits of much of this are only now being felt. That said however, there is a general consensus among all stakeholders that more commercial outputs are desirable. The responsibility for this rests with DAF, government agencies, researchers and the industry itself.

It has been remarked that success for researchers is counted in terms of publications and citations rather than patents, intellectual property and commercial outputs. Researchers within institutions have been described as “*semi-independent entities within institutions*” and the choice to bring the research to the next stage usually depends on the individual researcher and where their interests lie – some will be interested in working with industry while others may be motivated more by basic research. If outputs from FIRM are to have a greater impact down the line in terms of commercial activity, the Steering Group believes that the incentive structure for researchers must be considered. While a lot of fundamental research is speculative in nature, and defining the likely commercial output difficult, research applicants must be required to articulate where their research is likely to impact.

Potential exploitability & economic impact is one of the 6 current evaluation criteria used under FIRM and applicants are requested to identify a path to commercialisation for the research outputs. Of course, once the research has been undertaken, some of the research outputs will not be amenable to further development – nonetheless researchers must be required to investigate this possibility. Enterprise Ireland suggest giving bonus marks to proposals from researchers with a track record in commercialising results, however this would be difficult to manage and would discriminate against certain researchers. We believe that the most appropriate conduit for changing the incentive structure is the research institutions themselves, by encouraging and rewarding research that leads to patents and intellectual property. The Steering Group therefore recommends that DAF engage with research institutions to consider ways of encouraging researchers to drive any commercial applications from their research.

Recommendation 8: Consider ways to ensure researchers identify potential future opportunities for research outputs upon completion of projects

Looking at the commercialisation issue from the perspective of the food industry, many companies require assistance, expertise or resources if they are to fully exploit the opportunities presented by FIRM. This review has encountered a number of suggestions to help do this. The employment of some form of technology transfer officers was raised by a number of stakeholders. It was also suggested that FIRM could fund the employment of short-term consultants in companies who could mine the research in the RELAY database from the perspective of the individual company. There was some divergence in views as to whether the right structures were in place to allow research to be brought to the next stage using other national funding sources. The management of intellectual property (IP) is also a huge concern for industry and is dealt with in section 8.3.

The Steering Group are conscious of the need to focus more on the commercial returns from FIRM. The main food research institutions have recently been investing in technology transfer officers and new ways to manage the innovation process; this will result in improved benefits to FIRM outputs.

Actively participating in the technology transfer process is beyond the remit of DAF and the FIRM. Nevertheless, we must ensure that researchers and industry are fully

informed of the linkages that exist between DAF and EI funding for food research, and how the former feeds into the latter. The Steering Group acknowledge that bringing ideas from conception through knowledge development and onto the commercialisation stage requires a co-ordinated approach between all of the stakeholders in the chain. Ensuring that no gap exists between the DAF and EI stages in the process will help to strengthen this chain. RELAY may have a role to play here.

7.5.2 Wider environment effects

“Research Value-Added” also covers the wider impact of FIRM funding on economic society. Of those who expressed an opinion on the matter, 92% of researchers and 60% of food industry personnel consider the FIRM to provide the Irish food industry with a source of competitive advantage. The majority of both researchers (61%) and industry personnel (53%) think that the level of food safety has increased significantly in Ireland over the period of the last NDP. As regards levels of R&D, the majority of researchers (54%) again think that it has increased significantly. 35% of industry respondents felt R&D had increased significantly with most (47%) deeming it to have increased slightly.

While it is difficult to correlate investment in FIRM with levels of food safety or levels of R&D and innovation, the perceptions of stakeholders are a useful indicator of the contribution that it makes. Again, researchers are more positive, with most thinking that it makes a ‘good’ or ‘very good’ contribution to both food safety and innovation. In terms of food safety, the majority (73%) of the food industry is divided between the ‘good’ and ‘average’ categories. The industry’s impression of FIRM’s contribution to R&D and innovation was less positive with 35% describing it as ‘good’, 27% as ‘average’ and 35% as ‘poor’.

The above results are perhaps a reflection of all the survey results. Researchers in the main are more positive of the ability of FIRM to add value to the Irish food industry than are the members of that industry. Both parties may, to a certain extent, be biased in their views. While it is difficult to correlate FIRM outputs with wider national R&D and food safety levels, the Steering Group consider that, on balance, the stakeholder survey and consultation process confirms that FIRM is making a difference. The stakeholders feel that FIRM is an important part of the support structure; it is enhancing Ireland’s reputation in terms of the quality, scope and impact of food research which encourages inward investment; it is providing the industry with a high level of institutional expertise and highly skilled postgraduates; it is undertaking the fundamental research which underpins much of the innovation in the food industry. The Forfas Innovation Survey (2006)²³ found the food, beverage and tobacco sector to be among the four highest innovative sectors in the industrial field. The FSAI also confirms that good work has been done in the food safety area but it is difficult to measure FIRM’s impact.

The Steering Group believe that the lower rating afforded to FIRM’s contribution to R&D by the food industry survey is, in part, related to the industry’s perception of FIRM. Yes, a greater industry focus is crucial. However, the food industry also receives un-quantified benefits from their interactions with research institutions which

²³ Available at http://www.forfas.ie/publications/forfas060920/forfas060920_innovation_survey_webopt.pdf

they do not associate with FIRM. FIRM has helped nurture this capability and has trained the postgraduates who are working in the food industry. We believe that the FIRM needs to be properly marketed to the food industry, and wider society, so that they are aware of its contribution and are partners in its delivery. By nurturing a greater understanding of the role played by fundamental public good research, and informing all of the stakeholders of its outputs, the Steering Group maintain that the role of FIRM will be enhanced.

Recommendation 9: The outputs and outcomes of the FIRM must be publicised and the benefits to the food industry further highlighted through some form of informational campaign – RELAY may be a useful conduit for such activity.

7.6 Conclusion

Chapter 7 has added to our understanding of the effectiveness of FIRM in terms of the core factors identified in the “Research VFM Framework”. It provided a qualitative assessment of the FIRM’s achievements that builds on the more quantitative approach taken in chapter 6. In the main, the Steering Group endorse the view that the FIRM is producing the necessary expertise and quality research to sustain the food industry. The following chapter goes further to consider the performance of FIRM in the area of research relevance, collaboration, and dissemination – these are what are termed the influencing factors in the “Research VFM Framework”

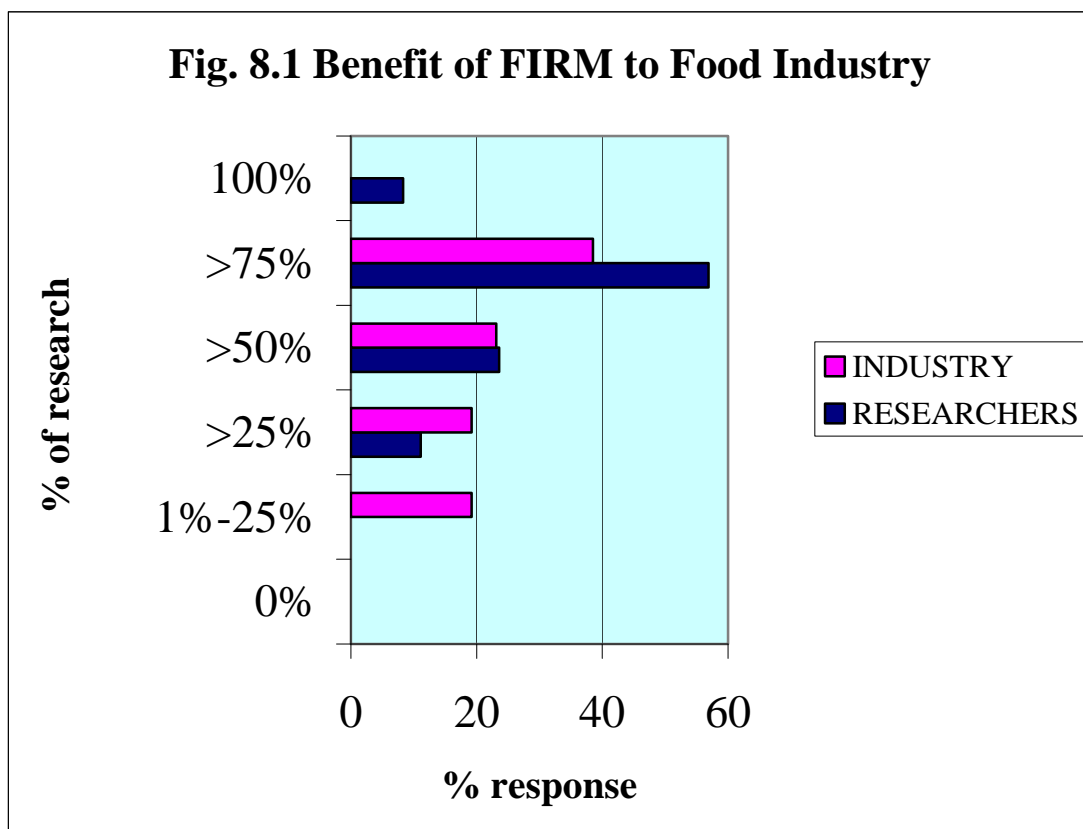
CHAPTER 8

EFFECTIVENESS: “RESEARCH VFM FRAMEWORK” INFLUENCING FACTORS

Chapter 8 continues the discussion on effectiveness began in chapter 7 and extends it to consider the effectiveness of FIRM in terms of the influencing factors identified in the “Research VFM Framework” viz. research relevance, collaboration and dissemination. Chapter 8 also examines issues of deadweight and displacement as well as the continued relevance of the FIRM programme.

8.1 Research Relevance

The relevance of allocating funding to a particular programme is a key consideration in all Value for Money reviews and as such will be dealt with in section 8.6. This section looks at the relevance to the food industry of the projects supported and the actual research conducted. If the research carried out is not relevant or is not the right research for the food industry, then it is unlikely to lead to the achievement of the FIRM’s objectives.



As can be seen from figure 8.1, there were mixed views as to the % of FIRM research which actually benefits the food industry, although the ‘more than 75%’ category scored highest among both researchers and industry personnel.

The survey results were very positive as regards the theme areas selected for funding through FIRM. 88% of researchers and 92% of industry stated that the theme areas

were either 'suitable' or 'very suitable'. Respondents were also given the opportunity to suggest alternative areas of research. A wide and diverse range of topics was received and forwarded to the Research, Food and CODEX Division of DAF.

Notably, some researchers felt recent calls were lacking in certain technology areas such as processing and packaging, with some reservations regarding what was considered to be an over emphasis on “niche health promoting” areas to the detriment of expertise in more traditional core areas and other newly developing areas. The 6 industry respondents who supplied additional comments referred to food nutrition, technology development, functional foods and the need to integrate marine and aquaculture with other food research areas. The FSAI felt it may be “*appropriate to focus some attention on research needs of artisan food producers*”.

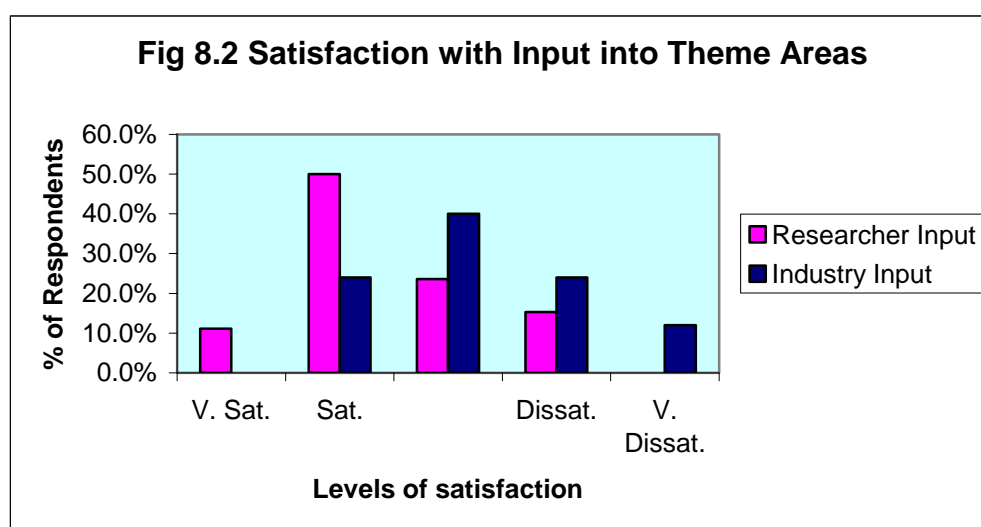


Figure 8.2 shows the different satisfaction levels of researchers and industry personnel as regards the amount of input afforded to them in deciding the FIRM theme areas. 61% of researchers are satisfied or very satisfied with the level of input afforded to them compared to just 24% of industry personnel (none of whom were very satisfied).

The priority for this review is not to identify areas of research – although responses received will be considered when deciding future theme areas. What is important is that all-inclusive, transparent and robust mechanisms are in place to ensure that research is targeted in the right areas. The replies to the questionnaires suggest that most FIRM research is of benefit to the food industry and the theme areas identified are the right ones.

However, while both groups are happy with the research being done and the areas being targeted, stakeholders (predominantly industry) do not feel that they are adequately involved in deciding the direction of FIRM research. Stakeholder consultations confirm this view with all requesting more industry involvement in setting priorities and shaping the strategic direction of FIRM funding. DAF consults widely when setting theme areas and has made numerous attempts to involve food companies. The most recent attempt involved inviting 650 food industry contacts

(sourced from the RELAY database) to participate in consultation meetings in Cork and Dublin or to provide suggestions in writing – only 3 contacts were made.

The Steering Group is satisfied that considerable effort has been made by DAF to engage the food industry; this effort must be continued and new approaches identified. The stakeholder consultation identified that the food industry is reluctant to share information or discuss strategic issues with their competitors. In many cases the food industry are only now coming to a point where they can articulate the areas that need to be explored; the challenge for FIRM is to find out how food companies can combine on platform areas that can feed into a FIRM project or programme. The food industry needs to be aware of the role they play in the FIRM process if they are to “buy-in” to what it provides for them.

This doesn't mean that industry is given *carte blanche* in deciding research priorities, merely that they feed into the process. Industry requirements for more immediate gains and research with direct commercial application is not readily conducive to public good research. DAF must manage this interaction to ensure sufficient attention to novel, pre-competitive research while ensuring that the strategic direction is industry-centric.

The FSPB suggests that research under FIRM should be treated as a research portfolio. Following widespread consultation, a multi-annual strategic plan would be developed for this portfolio, with detailed appraisal of the portfolio carried out at defined intervals. The Steering Group shares this view and suggests that some external evaluation of Ireland's research portfolio under FIRM would be useful to pinpoint possible shortfalls and ensure continued relevance in the future. This would be a useful means of engaging all stakeholders and charting a shared vision for future research direction

Building on the ideas noted above, we recommend two complementary approaches. The first is to identify ways of bringing the food industry and research institutions together to identify research priorities. The second approach is to undertake an evaluation of Ireland's existing food research portfolio. The Steering Group envisages that the new Agri-Food Research Subgroup²⁴ established under the “Agri Vision 2015 Action Plan” would help to identify ways of developing linkages between food companies and research institutions and deciding on the future direction of FIRM research. DAF must now ensure that this group is utilised to the full so that the food industry is aware of the place provided for it in deciding the direction of FIRM.

Recommendation 10: New ways of bringing the various food companies (and research institutions) together need to be identified so as to define common research areas and shared strategic priorities.

Recommendation 11: The Agri-Food Research Subgroup should be asked to consider possibilities for reviewing the research portfolio developed in Ireland and informing the future strategic direction of this portfolio.

²⁴ This Subgroup comprises industry, academic and state agency representatives

8.2 Collaboration

The level of collaboration is another of the “influencing factors” identified in the “Research VFM Framework”. Collaboration in respect of FIRM constitutes three separate but complementary elements i.e. (1) collaboration between research institutions and (2) collaboration between research institutions and industry and (3) collaboration between DAF and all stakeholders.

8.2.1 Collaboration between Research Institutions

Collaboration between institutions has long been encouraged under the FIRM programme and its predecessor, the Non-Commissioned Food Research Programme. It is widely accepted that collaboration between research institutions has increased considerably as a result of FIRM funding. Indeed, as part of the “Strategic Research Initiatives” recently launched by DAF, FIRM is funding the development of high calibre multidisciplinary collaborative research teams in selected knowledge areas under its “Network and Team Building” initiative.

The Steering Group regards the facilitation of such collaboration as being an important outcome from the FIRM. As noted by one interviewee, there is a synergy achieved through collaboration – *“individually institutions are relatively small by international standards but together they make up a decent international grouping”*. The only concern is that competition between institutions is reduced as a result of the links built up; hence smaller institutions may be squeezed out or the direction of funding will be dictated by a limited few. The latter point has been addressed in section 8.2 (research relevance). As regards the former issue, there remain opportunities for all research institutions (small and large) under project type research. In addition, the programmatic type research should be tailored in such a way as to utilise a broad range of skills from a diverse group of institutions. Care should be taken in the selection of programmatic areas to ensure the involvement of as many institutions as possible – similar to the approach in EU wide programme research. Ultimately however, the Steering Group notes that Ireland’s relatively small size means that we must have a high concentration of food research and a level of core capability in a small number of institutions rather than trying to spread resources too thinly across all institutions.

The Steering Group also identified another important form of collaboration involving institutions i.e. intra-institutional collaboration where researchers in the food area engage with those from other disciplines to identify crosscutting issues. The interplay between food researchers and medical researchers has been evident in the area of “food for health”. Continued nurturing of such collaboration has the potential to add substantial value to the output of FIRM research.

8.2.2 Collaboration between Industry and Research Institutions

Section 8.1 looked at the contribution of industry to deciding the direction of research projects whereas this section looks at collaboration in actually undertaking research projects.

When considering the level of industry participation in FIRM, most survey responses from researchers and industry were in the average or poor category. When survey participants were asked to rate the level of support amongst the industry for FIRM research, they differed slightly. Most of the industry (81%) described the support as ‘average’ (54%) or ‘poor’ (27%). On the other hand, the bulk of researchers (71%) described the food industry’s support for FIRM as either ‘average’ (39%) or ‘good’ (32%).

Again this is not altogether surprising given that we are dealing with basic/fundamental public good research. However, there is a desire for more industry involvement. The stakeholder consultation confirms this view, although it shows collaboration between industry and research institutions to be improving. A number of issues are notable. Firstly, the public good nature of FIRM research is seen to inhibit the direct involvement of industry. Indeed, there may be some confusion as to what is actually permitted in this regard and many don’t see a role for, or benefit to, individual food companies. Secondly, in many cases letters of endorsement from food companies are an artificial form of involvement with no real benefit. Thirdly, it was questioned whether there were sufficient incentives for (or compulsion on) researchers to interact with industry.

	<i>Very Good</i>	<i>Good</i>	<i>Average</i>	<i>Poor</i>	<i>Very Poor</i>
Researchers	26.4%	41.7%	20.8%	11.1%	0%
Industry	16%	48%	36%	0%	0%

When both survey groups were asked to assess RELAY’s role in building such collaboration and developing links between industry and research institutions, the responses diverged somewhat as can be seen above. The primary role of RELAY is to disseminate the information produced through FIRM. Nonetheless, it may be beneficial to exploit further the position of RELAY at the interface between researchers and the food industry. Breakfast/brainstorming meetings, networking opportunities and speed meetings are just some of the possibilities. The role of RELAY is discussed further in section 8.4 (dissemination).

We concur with the IBEC view that joint applications by industry and researchers can “*improve the commercial awareness in research institutions and the culture of innovation in food companies*”. There are benefits to industry from direct involvement, not least in terms of having an input into the direction of the research and a first mover advantage. Getting research personnel from industry and research institutions together broadens knowledge and understanding – however providing letters of support do not constitute real collaboration. Not all the areas of interest to food companies are amenable to such publicly available research. However, there are strategic areas where public research is required and where a joint approach is beneficial. The development of an industry-led National Functional Foods Research Centre, bringing industry and academia together, is an example of a very good collaborative initiative where a joint approach is beneficial.

We feel that FIRM researchers and the food industry could engage in a more meaningful way. The strong link between ‘collaboration’ and ‘industry value-added’

was noted in section 6.3.3. As noted previously, not all public good research can, or should, have a collaborative element. Nonetheless, where collaboration is possible it should be encouraged. The Steering Group believe that there is some confusion among researchers and industry as to the types of collaboration permissible under FIRM and that this may be inhibiting possible opportunities. Bringing clarity to this situation may prove beneficial.

Recommendation 12: DAF should provide greater clarity as to the forms of collaboration that are permitted under FIRM and inform all stakeholders of the benefits of collaboration - RELAY may have a role to play here.

8.2.3 Collaboration between DAF, other agencies and stakeholders

As discussed previously (section 7.5.1), DAF needs to engage fully with Enterprise Ireland in order to add further value to public investment in FIRM. This collaboration should not be confined to just EI. There is a need to look at linkages with other agencies and Departments to identify crosscutting issues where synergies may exist. DAF has been very proactive in this regard. The “Marine Functional Foods Initiative” being undertaken in conjunction with the Marine Institute is a good example of the opportunities that exist. DAF, in collaboration with the Department of Health and Children and the Health Research Board, is also in the process of funding multidisciplinary research teams under the Food For Health Research Initiative (FHRI).

These initiatives are to be commended and the Steering Group believe they will form an important pillar of FIRM in the future. The stakeholder consultation process also highlighted the benefit of direct interaction with stakeholders, on a one-to-one basis, in terms of identifying issues and shaping the future direction of FIRM. Nonetheless, having such interaction on a once-off basis is unsatisfactory and it is clear that continuing this interaction into the future would be beneficial. We recommend that DAF reviews progress annually with the research institutions, EI, FSAI and IBEC.

Recommendation 13: To continue to explore opportunities for crosscutting areas of research and to formalise an annual exchange of views with key stakeholders (the research institutions, EI, FSAI and IBEC) on a one-one basis.

8.3 Dissemination

Nearly one quarter (8 out of 34) of the industry personnel who responded to the survey declared that they were not familiar with the research funded through FIRM. This is disappointing given that the industry sample was purposely selected in conjunction with RELAY. It indicates either inadequacies in the way that FIRM research is publicised or a misinterpretation of the question. Selecting “no” to this question meant that the respondent did not need to complete the bulk of the questionnaire – this may also have influenced the selection.

Of those who were familiar with FIRM, 69% deemed the dissemination of results to the food industry to be ‘Good’ (27%) or ‘Very Good’ (42%); only one respondent felt it was worse than average. Researchers were more conclusive in their reply; 90% indicated that the dissemination of FIRM research results was either ‘Good’ (55%) or ‘Very Good’ (34.7%). While this is not a review of RELAY per se, RELAY does play a prominent role in the dissemination of FIRM outputs. Consequently, respondents were also asked to rate the contribution of RELAY to dissemination with 90% of researchers and 89% of industry classifying it as ‘Good’ or ‘Very Good’. As such, industry distinguished slightly between the job of dissemination and the role of RELAY in disseminating this information. The gap between the two ratings given for dissemination in general (69%) and the work of RELAY (89%) suggests that the industry see dissemination to go beyond the work of RELAY, possibly with an onus on researchers themselves to facilitate dissemination. Overall, the results are very positive.

Both groups were subsequently requested to suggest “*a better alternative*”. Researchers mainly focussed on the gap between dissemination and the actual technology transfer/commercialisation process. They also outlined the need for RELAY to promote more direct contacts between industry and institutions at both theme discussion and project completion stage.

The stakeholder consultation confirmed much of the information gained in the surveys. RELAY’s performance was well received with stakeholder comments such as “*great job, good, accessible, proactive, very effective, a great success, and good at getting beyond just the larger companies*”. However, nearly all of the stakeholders identified issues with other elements of the dissemination process. Should RELAY be broadened to include international research? Is the target audience (industry) receptive enough? Do smaller companies have the capacity to absorb the information and use it to their potential? Can we do more to publicise the results through mainstream media? Some queried the value of the information to the food industry once it was widely disseminated – they felt more efforts were needed to secure and protect the intellectual property (IP) associated with research outputs. Following on from dissemination, more resources need to be deployed in technology transfer and ensuring commercialisation (as discussed in section 7.5.1).

The Steering Group acknowledges the importance of widely disseminating FIRM results and commends the work undertaken by RELAY. The task of providing the link between academia and the food industry is not a straightforward one. The views supplied under this review, combined with the deliverables reported by RELAY on a 6-monthly basis, confirm the contribution RELAY is making. The RELAY brand has achieved a high degree of recognition and is important for the future dissemination of FIRM results.

The Steering Group emphasise that securing the future of this brand and the work undertaken by the RELAY team is important for the future effectiveness of FIRM. Consideration should be given to redefining the role RELAY plays so as to move beyond the narrower dissemination remit. A critical mass of information has now been achieved. The role of dissemination should be broadened to implement measures aimed at making the industry more receptive to the information generated. This would involve improving industry perception of FIRM, focusing more on improving

collaboration between industry and research institutions in identifying opportunities and jointly undertaking projects, and supporting efforts aimed at commercialisation.

RELAY might become involved in putting procedures in place to exploit the opportunities that exist to fund post-FIRM research. The manner in which RELAY packages the information may also need to be tailored to meet the varying needs of a very diverse industry. The Steering Group does not feel there would be enough return from the investment required in disseminating international research through RELAY but suggests that the feasibility of doing so be considered as part of any reformulation of RELAY's role. We recommend that this examination and reformulation of RELAY's role should be undertaken in the coming months as the current RELAY contract expires.

Research Technology Transfer (see section 3.2.3 & 7.5.1) is an important objective of the SSTI. Enterprise Ireland is working towards developing and expanding the Technology Transfer capability in the Third Level Sector, and the Steering Group consider it important that the RELAY service would not be separate to this but be in some way aligned with it, perhaps through a Technology Transfer mechanism in Teagasc.

Recommendation 14: Consideration should be given to aligning the RELAY service with the developing and expanding technology transfer capability in the Third Level sector, through a technology transfer mechanism in Teagasc.

The management of IP generated through FIRM is also an important consideration for the food industry. This is not just a matter for DAF but for the research institutions themselves. The public good nature of FIRM has not been a barrier to securing IP on certain FIRM outputs in the past. The Steering Group believe that clarification and education should form the basis for the approach going forward so as to assuage industry concerns and maximise IP. DAF and the research institutions must jointly clarify the "do's and don'ts" regarding the management of IP generated through FIRM and they should then jointly explore ways to educate researchers in this area. The "National Code of Practice for Managing Intellectual Property from Publicly Funded Research"²⁵ published by ICSTI in 2004 should form the basis for this. We believe that FIRM is not a barrier to securing IP and that much can be gained from dispelling the view that it is.

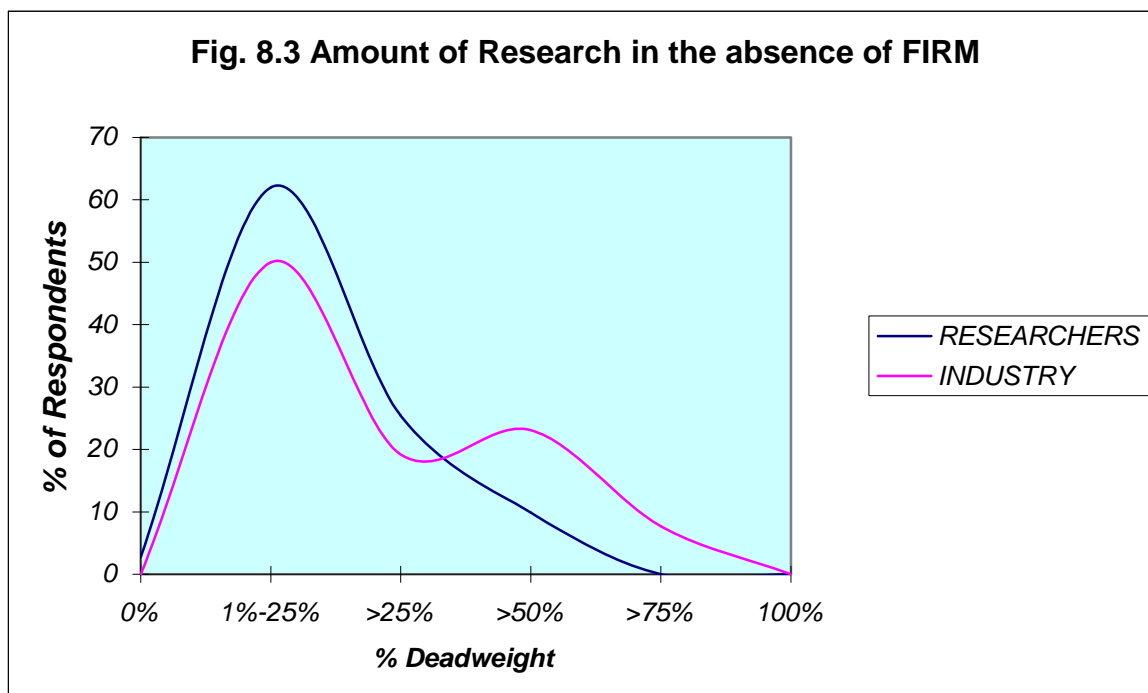
Recommendation 15: Work with research institutions, and possibly RELAY, to clarify procedures surrounding the management of IP

8.4 Deadweight & Displacement

Deadweight is that portion of increased output that would have happened irrespective of the project or programme. The majority of both researchers (62%) and industry personnel (50%) surveyed believed that less than a quarter of FIRM funded food research would have taken place in the absence of FIRM funding. Figure 8.3 below

²⁵ Available at http://www.forfas.ie/icsti/statements/icsti040407/icsti040407_ip_report_complete.pdf

shows that researchers believe there to be slightly less deadweight than industry does; however the trend in views for both is very similar.



Displacement occurs when the creation of a positive programme output in one area leads to a loss of output in another. When investing public funds in one particular sector, policy makers must be cognisant of the unintended impacts in other sectors. The FIRM programme ring-fences funding for food research and, as such, funnels activity in research institutions and universities towards certain activities. When surveyed, 4 % of researchers and 23% of industry personnel believed that FIRM was diverting research from more beneficial areas. The comments supplied by the 4% of researchers did not suggest more beneficial areas for funding but did recommend a greater industry focus. The 6 industry personnel who felt there were more beneficial outlets for this funding requested more applied, targeted or industry specific research rather than the fundamental public good type currently supported.

Based on the foregoing, we do not consider there to be any significant issues for FIRM surrounding deadweight or displacement.

8.5 Continued Relevance

A central issue for this and all Value for Money reviews is whether the continued allocation of public funds is justified in light of the findings of the review. This is the central question that dictates all that has gone before. This section provides some additional indicators over and above the information analysed heretofore.

80% of the food industry surveyed believed that the level of R&D in the Irish food industry was not sufficient and a similar number believed that responsibility for funding R&D in the food sector required a combined effort from both industry and Government. This is in line with most generally held views on the food sector and is

supported by Government policy in the area of scientific research as outlined in chapter 3.

Within this is the role of DAF in funding basic research in the areas of food quality, food safety, process technology etc. 88% of industry responses advised that this was a worthwhile investment. The stakeholder consultation provided a definitive response that FIRM is worthwhile and necessary, subject to the changes and alterations discussed in this review. FIRM is a vital component in developing the “knowledge economy” as it relates to one of our most important indigenous industries. A strategic vision for FIRM, over the period of the current NDP until 2013 and beyond, is required to maximise returns from this investment in public good food research. The Steering Group are firmly convinced that the outputs and outcomes highlighted in this review illustrate not only the value for money achieved heretofore, but provide the justification for continued investment under FIRM.

CHAPTER 9

DEVELOPMENT OF NEW & EXISTING FIRM PERFORMANCE INDICATORS

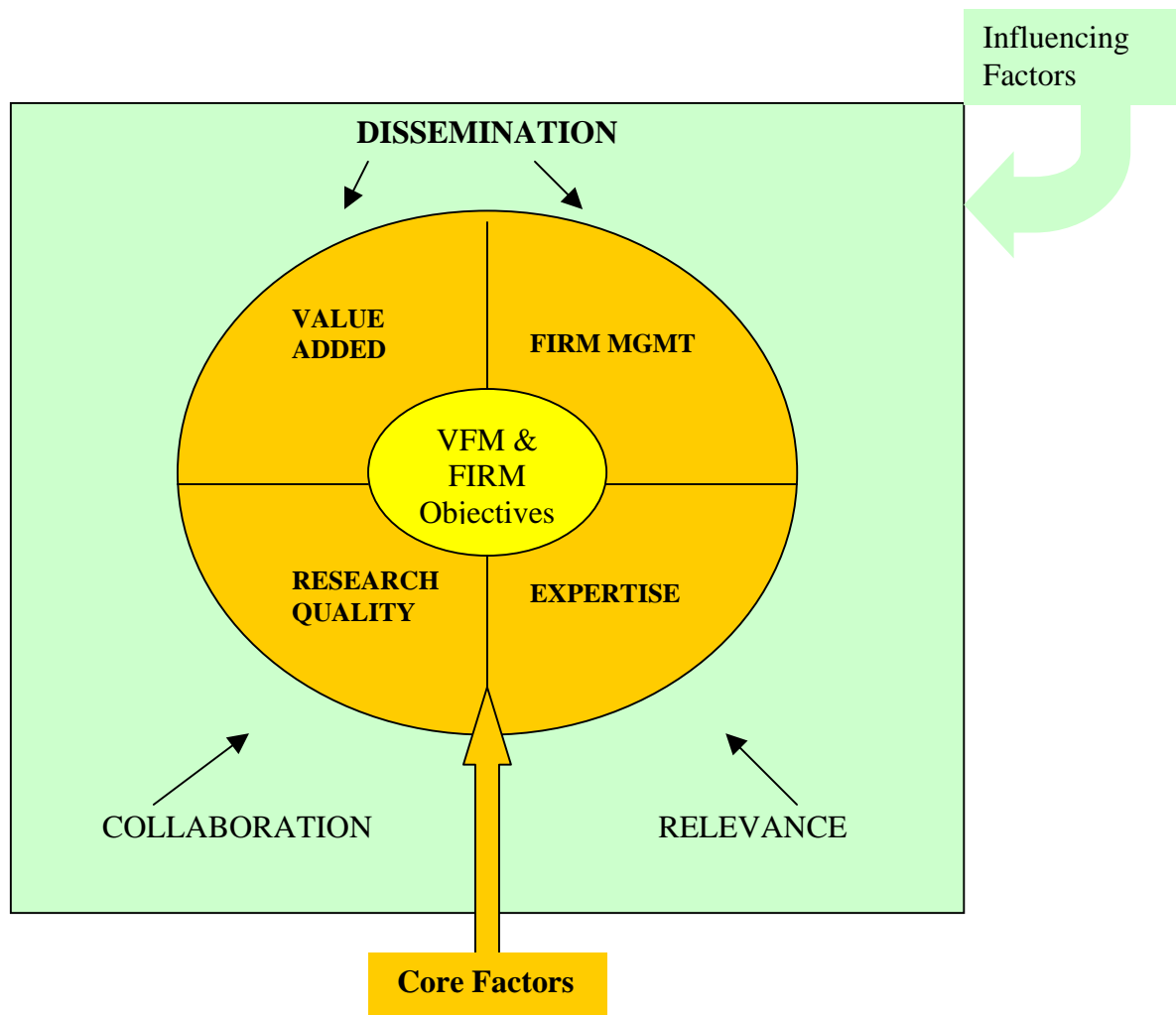
Chapter 9 proposes performance indicators for the FIRM which will facilitate more effective measurement of the extent to which the Department is providing value for money and the extent to which the programme itself is meeting its objectives.

9.1 Performance Indicators – utilising the Research VFM Framework

Performance indicators are quantifiable measurements that enable the success of an organisation, unit, individual or programme to be judged. In this review, these indicators are framed in terms of the criteria used in the “Research VFM Framework” below. They are a combination of quantitative and qualitative indicators based on both the linear and institutional approaches identified in chapters 3 & 4.

It is important to note that the ability to report on many of these indicators will be dependent on the implementation of a number of recommendations viz. the development of a database, ex-post evaluation of projects and follow up on research after completion of final report.

Figure 9.1 FIRM Performance Indicator Framework



9.2 Indicators associated with Research VFM Framework Core Factors

Programme Management

Table 9.1 Indicators relating to FIRM management

Indicator	Source of Data
Total cost of delivery	Internal records
Average % difference in budgeted and actual project costs	Project reports
Average time to process applications	Internal records
Average time to evaluate reports and make payments	Internal records
% number of projects completed on time	Project reports
Average length of project overruns	Project reports

Research Quality

Table 9.2 Indicators relating to quality of research

Indicator	Source of Data
Quality rating given to completed projects	External assessment process
Average no. of refereed papers in international journals	Project reports
Average no. of open days, workshops, seminars at which reports were presented	Project reports
Average no. of practical/popular publications	Project reports

Research Value-Added

Table 9.3 Indicators relating to value-added of research

Indicator	Source of Data
Research value-added rating given to completed projects	External assessment process
Number of projects with outputs with commercial/economic potential	Project reports
Nature of commercial/economic outputs (<i>new products, process, technology or industrially relevant information</i>)	Project reports
Number of projects with outputs with National policy/social/environmental potential	Project reports
Number of projects with industry uptake/changed industry behaviour	Project reports/ post completion follow-up
Number of projects with associated patents	Project reports
Sectoral Innovation activity	Forfas Innovation Survey
Levels of food borne pathogens	FSAI

Development of Expertise

Table 9.4 Indicators relating to development of expertise

Indicator	Source of Data
Expertise rating given to completed projects	External assessment process
No. of PhDs produced	Project reports
No. of MScs produced	Project reports
No. engaged in graduate development programme	Project reports
No. of researchers supported	Project reports
No. of institutions participating in programme	Internal records
No of PhDs, MScs and students from graduate development programme entering food industry/food safety employment	Post completion follow-up

9.3 Indicators associated with Research VFM Framework Influencing factors

Collaboration

Table 9.5 Indicators relating to levels of collaboration

Indicator	Source of Data
No. of projects with industry involvement at outset	Application
No. of projects with industry involvement overall	Project reports
Nature of industry involvement (resources, expertise, facilities etc.)	Project reports
No. of projects with academic collaboration	Application/ Project reports
Average number of institutions involved per project	Project reports

Relevance of Research

Table 9.6 Indicators relating to the relevance of the research

Indicator	Source of Data
Number of stakeholder meetings	Internal records
Number of meetings of Agri-Food Research Subgroup	Internal records
Number of other events bringing industry together to define strategic priorities	Internal records

Dissemination of Results

Performance indicators used for the dissemination element are those associated with the RELAY project and which are reported on a 6-monthly basis. This is a comprehensive list of indicators under each of the task deliverables for FIRM e.g. number of company visits, email alerts, media coverage, project updates etc. These will be revised as part of any new dissemination contracts agreed after the current one is concluded on 30th April 2008.

CHAPTER 10

CONCLUSIONS AND RECOMMENDATIONS

This tenth and final chapter summarises much of that which has gone before, particularly as regards the conclusions and recommendations formed in chapters 5-9. The primary aim of this chapter is to give the reader a more concise and accessible catalogue of the results flowing from the analysis heretofore. The structure of this synopsis follows that of the preceding analysis.

10.1 Programme Management, Outputs & Outcomes

10.1.1 Programme Management

FIRM is managed by an inter-divisional team, which includes professional scientific staff qualified to Masters and Doctorate level. The survey of researchers demonstrated a relatively high level of satisfaction with the management of FIRM. The Steering Group acknowledges that the FIRM is managed in an efficient manner, particularly as regards throughput, timeliness, monitoring, evaluation, and resource allocation.

The staff costs for managing the FIRM amount to 3.9% of total expenditure. This rises to 4.3% when travel, subsistence and evaluation costs are included. No suitable benchmark for considering these figures was available. Nonetheless, the Steering Group is satisfied that 4.3% represents an efficient cost for managing the programme, particularly given the “hands-on” approach required for all projects. At the very least, the costs identified in this review will form a useful basis for comparison and analysis in future years.

10.1.2 Outputs & Outcomes

The reporting mechanisms built into the FIRM have resulted in a vast bank of information within DAF detailing the quantitative outputs and outcomes associated with the FIRM.

The results illustrated in chapter 6 show a strong performance in most areas, particularly as regards the number of refereed papers in international journals, the number of workshops at which reports were presented and the amount of PhDs and MScs provided. In spite of FIRM’s public good dimension, its focus on fundamental research, and the inherent difficulty of any R&D, the Steering Group considers the achievements in terms of outputs with commercial potential and the level of industry uptake to be very good. Of course, the appetite for more success in these areas is also apparent. The Steering Group observes that those projects, which score better in terms of outputs, also tend to result in greater industry uptake. Intuitively, this makes sense. So too does the finding that early collaboration between industry and researchers increases the chances of research impacting on the food industry.

Of course, in relying on these quantitative indicators based on the intermediary and final reports submitted by research co-coordinators, the Steering Group were conscious of the fact that DAF is not formally aware of what happens to the research

results after the final report has been submitted. This is not usually “the end of the road” for the research and so shouldn’t be the end point for examining what FIRM funding achieves. Hence the following recommendation:

Recommendation 1: That DAF puts procedures in place to capture what happens to research results in the months and years after completion of the contract. This would also give feedback on the movement of researchers into food industry/food safety employment. This may involve the researcher completing a simple form one and three years after submission of the final report.

The analysis referred to above involved a considerable trawl of project reports held on individual files. This vast information resource is not readily accessible to those managing the programme. The Steering Group believes that the more efficient management and co-ordination of this information can be achieved through the use of information technology. This would provide management with a better understanding of what is being achieved and would aid decisions on resource allocation.

Recommendation 2: The development of a FIRM database, which would be used to capture some of the information contained in project applications and reports. This could be utilised for managing, monitoring and reporting on FIRM.

10.2 Objectives and Approach

The survey and consultation process confirmed that the two objectives outlined for FIRM are appropriate and correct. The review process also supported the Steering Group’s third recommendation:

*Recommendation 3: To include a third FIRM objective;
Information Dissemination Objective: To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies and innovations by Irish food companies.*

While an array of additional objectives was suggested during the review, we feel that they are, in the main, inherent within the existing objectives. Furthermore, in light of the continuously evolving trends and requirements in the food industry, the Steering Group feels it would be unhelpful to further define funding areas and narrow the remit of FIRM.

The review group also concludes that none of the areas identified through surveys or consultation suggest that fundamental alterations in the FIRM methodology should be employed. However, and as is explored throughout the report, some modifications to the programme are required. One such modification is differentiating between fundamental and applied research when analyzing the outputs and outcomes from the programme.

Recommendation 4: Consider the feasibility of categorising research projects/programmes between fundamental and applied. In this way the balance between each can be more closely monitored and the appropriateness of different performance indicators can be considered

10.3 Research Quality, Expertise and Value-Added

10.3.1 Research Quality

The view of the Steering Group is that the quality of the research is very high and compares favourably to work being undertaken internationally. This is supported by the analysis. Nonetheless, there is a need to provide a more definitive measure of the quality of this research so that it can be benchmarked against other countries. Bibliometric analysis is the universally accepted method of doing this and the Steering Group recommends that DAF commission such an analysis.

Recommendation 5: Commission a bibliometric analysis of FIRM funded research so as to inform decision makers of the quality of the work produced.

The above recommendation is just the first step – it will provide an indication of where we are now in terms of quality. Going forward, there should be a means of routinely evaluating the quality of the research undertaken. The FIRM currently uses independent assessment teams to evaluate FIRM applications; we recommend that similar teams be used to evaluate FIRM research upon completion. This evaluation would not only be in terms of quality, but would also consider issues like development of expertise and the level of industry value-added.

Recommendation 6: Adopt procedures for the expost evaluation of completed FIRM projects by an independent assessment team, giving grading for research quality, contribution to building expertise and level of value-added.

10.3.2 Development of Expertise

The FIRM has supported the build-up of a strong informational resource within research institutions; this is being regularly tapped by the food industry. The food industry itself does not readily equate FIRM with this outcome. FIRM is also developing considerable numbers of postgraduates in the food area; the 58 completed projects completed to-date have resulted in 53 MScs and 83 PhDs. The only concern is the level of movement of these individuals into the food industry, which appears to be increasing, albeit from a low base.

In this regard, the Steering Group feel it is important to note that FIRM is a research led programme, founded in the concept of the “knowledge economy”. At the same time, it is not confined to research training and should be supporting innovation within food companies. As such, the Steering Group welcomes DAF’s support for graduate development programmes and recommends that the impact of these programmes be evaluated so as to gauge their impact and determine if more is required.

Recommendation 7: Measure the returns from the investment in graduate development programmes; this analysis will inform strategic decisions regarding the necessity for continued investment in this area.

10.3.3 Research Value-added

Research Value-Added looks at the wider impact of the programme on the food industry and wider environment. The recurring theme from the survey was that a lot had been achieved but there was the potential for more.

FIRM aims to lay the platform from which to commission industrially relevant technologies, products and processes rather than actually deliver them. This tempers the Steering Group's conclusions in this area. Even so, researchers must be encouraged to seek out possible commercial opportunities or other potential avenues for their research outputs. We feel that the incentive structure for researchers should be addressed in consultation with the research institutions, who are perhaps better placed to deal with this issue.

Recommendation 8: Consider ways to ensure researchers identify potential future opportunities for research outputs upon completion of projects

In addition, there is a large appetite among all stakeholders for improving the technology transfer process. Actively participating in the technology transfer process is not within DAF's remit. However, DAF does have a role to play in ensuring a strong link between FIRM funded research and those opportunities provided by Enterprise Ireland.

The review also identifies some tension between the views of industry and researchers as to what is, and what can be, achieved in this area. Researchers in the main are more positive of the ability of FIRM to add value, increase innovation, and improve food safety than are the members of the food industry. The industry are not so cognisant of FIRM's role in providing the industry with a high level of institutional expertise and highly skilled postgraduates, and in undertaking the fundamental research which underpins a lot of the innovation in the food industry. The Steering Group feel that there is much to be gained from improving the perceptions of FIRM in this regard.

Recommendation 9: The outputs and outcomes of the FIRM must be publicised and the benefits to the food industry further highlighted through some form of informational campaign – RELAY may be a useful conduit for such activity.

10.4 Research Relevance, Collaboration and Dissemination

10.4.1 Research Relevance

The review showed that stakeholders are generally satisfied with the theme areas being addressed and the relevance of the research being undertaken. On the other hand, stakeholders (industry in particular) were less satisfied with the level of input afforded to them. The Steering Group is satisfied that considerable effort has been made to involve all stakeholders in setting the research agenda. Getting the food industry to articulate their needs in a collaborative, public good setting presents many challenges. The task for DAF is to meet these challenges through a more innovative approach.

Recommendation 10: New ways of bringing the various food companies (and research institutions) together need to be identified so as to define common research areas and shared strategic priorities.

In addition, we recommend that the relevance of FIRM research can be better assured if considered in the context of a research portfolio. Following widespread consultation, a multi-annual strategic plan would be developed for this portfolio, with detailed appraisal of the portfolio carried out at defined intervals.

Recommendation 11: The Agri-Food Research Subgroup should be asked to consider possibilities for reviewing the research portfolio developed in Ireland and informing the future strategic direction of this portfolio.

10.4.2 Collaboration

Given Ireland's size relative to our competitors, it is vital that we exploit the linkages and synergies that exist between institutions. The Steering Group acknowledges that collaboration in food research, within and between research institutions, is widely considered to have increased under FIRM.

Collaboration between research institutions and food companies is the second major form of collaboration identified. Joint applications between industry and researchers can lead to an improved commercial awareness in research institutions while simultaneously building a culture of innovation in food companies. While not all public good research is amenable to such collaboration, there are areas where a joint approach would be beneficial to both parties. The Steering Group recognises that there is some confusion as to the types of collaboration that may be possible and that efforts should be made to clarify the position.

Recommendation 12: DAF should provide greater clarity as to the forms of collaboration that are permitted under FIRM and inform all stakeholders of the benefits of collaboration - RELAY may have a role to play here.

The final axis of collaboration identified in this review is the link between DAF, State agencies and other stakeholders. The importance of the EI link has been noted previously. Undertaking research in crosscutting areas, as is currently being done through the Marine Functional Foods Initiative and the Food for Health Research Initiative, is a growing area of importance under FIRM and should continue to be supported in the future. Regular interaction with key stakeholders, so as to set the strategic direction of FIRM, is also vital for the effective operation of the programme.

Recommendation 13: To continue to explore opportunities for crosscutting areas of research and to formalise an annual exchange of views with key stakeholders (the research institutions, EI, FSAI and IBEC) on a one-one basis

10.4.3 Dissemination

This review shows that the dissemination of research results has been a very successful component of the FIRM programme – RELAY, in particular, is seen to have performed very well. Securing and defining the future role of RELAY within the FIRM infrastructure must be addressed. There is an argument for widening the role of RELAY so as to broaden its remit beyond the current dissemination objective,

particularly in building greater links between industry and researcher institutions and aligning with the technology transfer capability in research institutions.

-Recommendation 14: Consideration should be given to aligning the RELAY service with the developing and expanding technology transfer capability in the Third Levels sector, through a technology transfer mechanism in Teagasc.

Some stakeholders perceive a conflict between the need to disseminate information as a public good and the need to protect the Intellectual Property generated through the research. The Steering Group point out that the public good nature of FIRM has not been a barrier to securing IP in the past. Researchers need to be aware of the issues surrounding the management of IP.

Recommendation 15: Work with research institutions, and possibly RELAY, to clarify procedures surrounding the management of IP.

10.5 Deadweight, Displacement and Continued Relevance

The evidence does not suggest that the FIRM gives rise to issues of deadweight or displacement.

The stakeholder consultation provided a definitive response that FIRM is worthwhile and necessary, subject to the changes and alteration discussed in this review. FIRM is a vital component in developing the knowledge economy as it relates to one of our most important indigenous industries. The Steering Group are firmly convinced that the outputs and outcomes highlighted in this review illustrate not only the value for money achieved heretofore, but provide the justification for continued investment under FIRM.

10.6 Next Steps

The Department of Agriculture and Food should implement the recommendations of this review over the coming year.

The performance of the FIRM in the coming years should be monitored using the performance indicators identified in chapter 9. These performance indicators should be reviewed periodically in light of changes to the programme and changing external factors impacting on the programme.

Appendix 1: Summary of FIRM Inputs, Outputs Outcomes

FRAMEWORK AREA >		ADMINISTRATION			COLLABORATION		ADMINISTRATION			EXPERTISE		RESEARCH QUALITY		RESEARCH VALUE-ADDED		
PROGRAMME LOGIC >		INPUT	INPUT	INPUT	INPUT	INPUT	ACTIVITY			OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTCOME	
PROJECT REF	PROJECT TITLE	Total Award	Total Paid	Difference	Industry involved at outset	Industry involved overall	Months: Budget	Months: Actual	Difference	PhD 's	MSc's	No of refereed papers in International journals	Workshops at which reports were presented	Outputs with Commercial potential	Industry uptake	Note
00/R&D/G/4	Surveillance and epidemiology of antibiotic resistance in campylobacter, salmonella and E coli 0157:H7.	411,360	351,473	59,887	No	No	36	40	4	2	0	2	5	0	No	
00/R&D/C/6	Contribution of stress responses to the virulence potential of listeria monocytogenes in Irish foods.	545,987	543,094	2,893	No	No	36	45	9	3	0	19	4	0	No	Further development required.
00/R&D/TN/13	HACCP implementation in Irish beef abattoirs	426,322	409,083	17,239	Yes	Yes	36	48	12	0	0	4	5	1	Yes	
00/R&D/C/15	Phytosterols and Oxyphytosterols in foods.	253,948	253,948	0	No	No	36	45	9	0	2.5	4	9	0	No	Further development required.
00/R&D/G/22	Detection and survival of Mycobacterium avium subsp Paratuberculosis. (M. ptb).	570,877	528,289	42,588	Yes	Yes	36	36	0	0	2	5	20	0	No	Further development required. Project assisted DAF in revising policy on John's Disease
00/R&D/TCD/26	Analysis of the Irish Universities Nutrition Alliance food consumption database for issues relating to food safety and nutrition.	888,817	888,276	541	No	No	36	42	6	7	7	25	3	4	Yes	Also led to provision of advice for FSAI, Dept. of Health and Children, FSPB, EFSA and ILSI Europe
00/R&D/C/27	Dissemination and exploitation of results from the "Food Institutional Research Measure" to the Irish Food Industry.	1714614	1495457	219157	Yes	Yes	36	50	14	0	0	0	30	0	Yes	
00/R&D/D/32	Investigation of factors affecting salmonella control programmes in pork.	456,788	436,752	20036	No	No	42	48	6	1	0	6	6	0	No	Assisted in evaluating National Salmonella Control programme in Pork Also assisted in discussions between DAF and DARDNI
00/R&D/D/34	Optimising freeze chill technology for a range of ready to eat meal components.	355,526	333,414	22,112	Yes	Yes	36	36	0	0	3	11	8	6	Yes	
00/R&D/C/37	BACTOOL: Bacteriocins as biological tools for food improvement	634,869	589,135	45,734	No	No	36	42	6	3	0	18	3	4	Yes	
00/R&D/C/42	High pressure processing application for dairy products.	379,929	379,929	0	No	Yes	36	36	0	3	1	25	36	0		Funding from Enterprise Ireland secured to develop processes further.
00/R&D/C/51	Development of gluten free cereal based convenience foods.	507,895	490,178	17,717	Yes	Yes	45	45	0	4	0	26	45	8	Yes	
00/R&D/C/52	BACSAFE: elimination of foodborne pathogens using bacteriocins.	634,869	625,749	9,120	No	Yes	36	36	0	0	0	12	11	3	Yes	

Appendix 1: Summary of FIRM Inputs, Outputs Outcomes

FRAMEWORK AREA >		ADMINISTRATION			COLLABORATION		ADMINISTRATION			EXPERTISE		RESEARCH QUALITY		RESEARCH VALUE-ADDED		
PROGRAMME LOGIC >		INPUT	INPUT	INPUT	INPUT	INPUT	ACTIVITY			OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTCOME	
PROJECT REF	PROJECT TITLE	Total Award	Total Paid	Difference	<i>Industry involved at outset</i>	<i>Industry involved overall</i>	Months: Budget	Months: Actual	Difference	<i>PhD 's</i>	<i>MSc's</i>	<i>No of refereed papers in International journals</i>	<i>Workshops at which reports were presented</i>	<i>Outputs with Commercial potential</i>	<i>Industry uptake</i>	Note
00/R&D/C/53	Evaluation and application of lactic acid bacteria to improve the quality and safety of the malting and brewing process.	761,843	761,843	0	Yes	Yes	36	36	0	4	4	16	11	8	Yes	
00/R&D/UL/55	Integrated minimal processing and packaging solutions for optimisation of sensory quality of ready-to-use fruits and vegetables.	256,155	250,704	5,451	No	Yes	36	42	6	3	0	8	1	0	Yes	
00/R&D/TD/57	The association of whey proteins and casein during the development of novel milk proteinate/protein concentrate type ingredients for use in consumer foods.	417,966	399,361	18,605	No	Yes	40	46	6	0	0	2	2	13		Process patented.
00/R&D/TD/59	The use of novel methods and new processing technologies for the development of heat stable dairy ingredients.	380,922	313,399	67,523	No	Yes	36	48	12	1	0	8	21	8	Yes	
00/R&D/TD/63	Process improvements in cheese manufacture through rapid measurement of moisture, texture and composition.	627,251	590,289	36,962	No	Yes	36	44	8	0	2	15	5	0	Yes	
00/R&D/TD/66	Role of lipolysis in the biogenesis of cheese flavour.	613,283	581,292	31,991	No	Yes	36	45	9	2	2	14	15	0	Yes	
00/R&D/TD/67	Cheese efficiency.	203,158	124,428	78,730	No	No	36	36	0	0	0	0	2	4	Yes	Development of a high moisture-cheddar type cheese products being evaluated by Dairy company
00/R&D/TD/69	Reduced fat cheese for pizza.	152,368	152,368	0	No	No	36	36	0	0	0	6	5	3	No	
00/R&D/TD/70	Biodiversity of cheese microflora and its role in cheese flavour development.	634,869	612,409	22,460	No	Yes	36	39	3	2	2	4	1	2	Yes	
00/R&D/TD/71	CLA in dairy functional foods.	634,869	628,116	6,753	No	Yes	36	42	6	4	1	12	15	1	No	Patent was received on CLA production by bifidobacteria.
00/R&D/TD/72	Probiotic functional foods.	634,869	606,996	27,873	No	Yes	36	45	9	0	0	30	25	5	Yes	
00/R&D/TD/73	Novel nutritional approaches to salmonella reduction in pigs.	761,843	722,359	39,484	No	No	36	42	6	0	0	13	0	2	No	Further development required.
00/R&D/C/77	Eating quality and consumer perception of organic and conventionally reared muscle foods.	266,642	262,443	4,199	No	No	36	45	9	0	0	5	0	0	No	
00/R&D/C/78	Sensory specification: providing direction for innovative new product development.	445,335	445,335	0	No	Yes	36	40	4	0	0	26	5	0	Yes	
00/R&D/C/79	Conjugated linoleic acid: evaluation of health benefits in humans.	761,800	761,800	0	Yes	Yes	36	36	0	6	1	32	16	0	No	May have be taken up in intervening period

Appendix 1: Summary of FIRM Inputs, Outputs Outcomes

FRAMEWORK AREA >		ADMINISTRATION			COLLABORATION		ADMINISTRATION			EXPERTISE		RESEARCH QUALITY		RESEARCH VALUE-ADDED		
PROGRAMME LOGIC >		INPUT	INPUT	INPUT	INPUT	INPUT	ACTIVITY			OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTCOME	
PROJECT REF	PROJECT TITLE	Total Award	Total Paid	Difference	Industry involved at outset	Industry involved overall	Months: Budget	Months: Actual	Difference	PhD 's	MSc's	No of refereed papers in International journals	Workshops at which reports were presented	Outputs with Commercial potential	Industry uptake	Note
00/R&D/C/80	Impact assessment of PSE on pigmeat quality from Irish factories and development of new technologies for the rapid determination of this condition following slaughter.	381,020	369,666	11,354	Yes	Yes	24	24	0	0	0	5	5	2	No	Requires further development.
00/R&D/C/82	Application and further development of non-destructive oxygen sensing technology within the Irish food and food packaging industry.	380,952	380,952	0	Yes	Yes	36	36	0	1	0	7	1	3	Yes	Requires further development.
00/R&D/C/84	Development of novel functional ingredients for use in the manufacture of convenience type meat / food systems.	491,084	461,197	29,887	No	Yes	36	48	12	0	2	0	6	1	Yes	Findings have been applied by company
00/R&D/C/85	Edible films and coatings for foods.	711,020	685,176	25,844	No	Yes	36	60	24	1	9	14	19	0	No	Output has potential to reduce packaging waste
00/R&D/TN/89	Screening techniques for authenticity and safety confirmation in raw materials and food products.	364,323	318,778	45,545	No	No	42	42	0	0	0	9	10	0	No	Research has led to the development of new technologies for test methodologies.
00/R&D/TN/93	Developing sous vide/freezing systems for ready meals.	444,355	431,812	12,543	Yes	Yes	36	39	3	2	0	15	25	5	Yes	60 companies were in receipt of the project results
00/R&D/TN/99	Adapting the Danish "food related lifestyle consumer model" (FRL) for market segmentation and predicting consumer trends on markets for prepared consumer foods in Ireland.	435,014	428,560	6,454	No	No	36	41	5	0	2	7	4	2	Yes	
00/R&D/TN/100	Establishment of functionality and processability of individual muscles from Irish beef carcasses towards development of convenience type beef products from forequarter and some hindquarter beef.	469,707	439,372	30,335	Yes	Yes	36	45	9	0	0	3	3	3	Yes	
00/R&D/TN/103	Rapid methods for beef industry.	266,110	198,946	67,164	No	Yes	36	36	0	0	0	1	7	0	No	Results relevant to beef industry but some issues with process
00/R&D/TN/105	New fresh beef processing procedures to ensure consistent eating quality.	355,527	344,534	10,993	No	Yes	36	36	0	1	1	3	2	1	No	Meat processor is actively pursuing an E.I grant to develop this process.

Appendix 1: Summary of FIRM Inputs, Outputs Outcomes

FRAMEWORK AREA >		ADMINISTRATION			COLLABORATION		ADMINISTRATION			EXPERTISE		RESEARCH QUALITY		RESEARCH VALUE-ADDED		
PROGRAMME LOGIC >		INPUT	INPUT	INPUT	INPUT	INPUT	ACTIVITY			OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTCOME	
PROJECT REF	PROJECT TITLE	Total Award	Total Paid	Difference	Industry involved at outset	Industry involved overall	Months: Budget	Months: Actual	Difference	PhD 's	MSc's	No of refereed papers in International journals	Workshops at which reports were presented	Outputs with Commercial potential	Industry uptake	Note
00/R&D/TN/106	Enhancing healthiness, shelf life and flavour of Irish fresh packaged beef.	471,858	430,494	41,365	No	No	36	36	0	0	1	2	8	0	No	3 Irish companies have expressed interest in the technique to analyse fatty acid in detail.
00/R&D/TN/108	Active packaging systems for enhanced quality safety and shelf life of exported fresh beef retail cuts packed in Ireland.	355,527	328,131	27,396	No	No	36	36	0	0	0	3	3	0	No	Resulted in new methodologies for measuring the oxygen transmission rate of packaging films.
00/R&D/TN/111	Redevelopment of cooked meat facility at the National Food Centre.	317,435	317,435	0	No	No	15	15	0	0	0	0	0	0	No	
00/R&D/TN/112	Defining the critical limits for the use of chilling as a critical control point in a beef HACCP plan.	526,633	487,830	38,803	Yes	Yes	36	36	0	2	0	8	7	1	No	3 expressions of interest
00/R&D/TN/115	A risk assessment on verocytotoxigenic E coli (including E coli 0157:H7) in processed beef products.	685,458	614,539	70,919	No	Yes	36	36	0	2	0	8	7	1	No	FDA(USA), FSANational Disease Surveillance Centre involved
00/R&D/T/121	Agri-Food Foresight: forward looking analysis with economic models.	100,733	100,733	0	No	No	24	24	0	1	0	1	0	0	No	
00/R&D/D/123	Evaluating the potential of Ohmic and radio frequency heating technologies for the production of high quality meat based consumer foods.	554,882	534,124	20,758	Yes	Yes	36	42	6	3	1	15	4	0	No	UCD investigating the possibility of funding an Irish company to develop Radio Frequency Equipment
00/R&D/D/126	Development of ingredient technology for a healthy flavoursome snack food.	304,841	304,841	0	Yes	Yes	36	42	6	1	2	14	11	5	Yes	
00/R&D/D/130	Efficient cooling of ready meals and ready meal components to improve safety quality and competitiveness.	380,919	358,981	21,938	No	Yes	36	36	0	4	0	1	1	0	No	Further development required
00/R&D/D/132	Impact of sheep genotype and TSE strain type on development and diagnosis of TSE in sheep: will genetic selection for resistance eliminate PrPsc.	368,224	319,070	49,154	No	No	48	48	0	2	1	4	0	0	No	2 companies have expressed interest. Improved national info on scrapie sheep
00/R&D/G/137	Investigation of the modes of transmission of thermophilic campylobacter in commercially produced broiler flocks and strategies for their prevention and control.	520,274	483,727	36,547	Yes	Yes	36	39	3	2	0	2	3	0	Yes	
01/R&D/TC/15	The development of a National Food Consumption database for children for risk assessment of food-borne chemicals.	742,884	740,629	2,255	No	No	36	36	0	7	3	1	5	0	Yes	
01/R&D/C/159	Optibiotics.	500,000	490,643	9,357	No	Yes	36	42	6	0	0	18	1	2	Yes	

Appendix 1: Summary of FIRM Inputs, Outputs Outcomes

FRAMEWORK AREA >		ADMINISTRATION			COLLABORATION		ADMINISTRATION			EXPERTISE		RESEARCH QUALITY		RESEARCH VALUE-ADDED		
PROGRAMME LOGIC >		INPUT	INPUT	INPUT	INPUT	INPUT	ACTIVITY			OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTCOME	
PROJECT REF	PROJECT TITLE	Total Award	Total Paid	Difference	Industry involved at outset	Industry involved overall	Months: Budget	Months: Actual	Difference	PhD 's	MSc's	No of refereed papers in International journals	Workshops at which reports were presented	Outputs with Commercial potential	Industry uptake	Note
01/R&D/D/160	Temporal and spatial distribution of PrP ^{sc} in BSE infected transgenic mice expressing bovine PrP and experimentally infected cattle and its potential for diagnosis.	798,764	748,739	50,025	No	No	42	42	0	0	0	1	0	0	No	Test produced that can detect BSE prion earlier in infected cattle
01/R&D/D/169	Novel physical chemical methodologies for the detection of transmissible spongiform encephalopathies.	399,561	366,055	33,506	No	No	36	38	2	1	0	4	2	2	No	Antibody identified for interaction with proteins of interest to the company producing the specific antibody
01/R&D/D/176	Consumer orientated development of new functional drinks: meal replacements and supplements.	707,444	694,477	12,967	No	No	36	42	6	4	3	10	1	6	No	2 companies have analysed the products in great detail & one expressed renewed interest in meal replacement.
01/R&D/D/181	Development of very tender and extremely juicy large cooked meat joints.	350,000	344,692	5,308	No	No	36	42	6	4	0	12	1	0	No	2 national and 1 non-national companies expressed interest.
01/R&D/TD/191	Complete genetic makeup of lactobacillus helveticus DPC 4571: A strain for improved cheese flavour.	365,286	327,999	37,287	Yes	Yes	20	32	12	0	0	2	0	1	No	Further development reqd.
01/R&D/TCD/193	A rapid robust DNA assay for detecting prohibited animal materials in feedstuffs.	132,156	130,835	1,321	Yes	Yes	18	18	0	0	0	0	0	1	Yes	
03/R&D/TN/204	Research factors influencing the formation of acrylamide in foods.	136,544	133,471	3,073	Yes	Yes	18	18	0	0	1	8	2	0	No	Experience gained helped UCD in obtaining an EU 6th Framework Project.
Total		28353509	26854356	1499153	Y=18/58	Y=36/58				83	53.5	526	447	108	Y=26/58	
Avg per project		488,854	463,006	25,847			35	39	4	1.43	0.92	9.07	7.71	1.86		

Note: Projects can have no output with commercial potential but still result in industry uptake - this is where the project results in changes in industry behaviour without actually producing new commercial outputs. Similarly a project can result in outputs with commercial potential which have not yet been utilised by industry.

Appendix 2 – FIRM Committee (2006)

NAME	ORGANISATION
Martin Heraghty	Chairperson DAF.
Martin Varley	Irish Co-Operative Organisation Society.
Bill Paterson	Tesco Ireland.
Michael Kilcoyne	Consumers Association of Ireland.
Derek Breen	Enterprise Ireland.
Alan Reilly	Food Safety Authority of Ireland.
Helen Walsh	Environmental Protection Agency.
Tara McCarthy	An Bord Bia.
Neil McGowan	Irish Business & Employers Confederation.
Margaret McGeough	Irish Business & Employers Confederation.
Joe O'Sullivan	General Manager, Drinagh Co-Op.
Una Fitzgibbon	Food Marketing Consultant.
Martin O'Sullivan	Deputy Chief Veterinary Officer, DAF.
Tony Smith	Senior Inspector, DAF.

Appendix 3 – Survey Methodology

A self-administered web-based questionnaire was issued to the complete population of research managers/project leaders who have been involved in FIRM since 2000 – the population size was 94 (although only 89 were contacted due to email difficulties). A copy of this questionnaire is available at Appendix 4. It was felt that no additional information would be forthcoming from surveying additional members of project teams. Furthermore, the population includes individuals who have been refused funding in the past. 72 of the 89 researchers completed the survey – an 81% response rate.

Another self-administered web-based questionnaire was issued to a non-statistical sample of 55 food industry personnel (from 50 food companies) who were purposively chosen by DAF in conjunction with RELAY. A copy of this questionnaire is available at Appendix 5. The food companies were chosen on the basis of the likelihood of reply and general interest in R&D and innovation. Efforts were made to ensure a diverse spread of companies in terms of geographic location, size and positive/negative perceptions of FIRM.

PricewaterhouseCoopers conducted a similar survey as part of their 2004 evaluation of RELAY; they invited 2,500 of RELAY's industry contacts to participate in a survey. 240 responses (10% response rate) were received after considerable resources were deployed to encourage participation. It was felt that a more targeted approach to selecting respondents would result in a better return for the volume of resources required. 34 of the 55 industry personnel completed the survey – a 62% response rate. It should be noted that 8 of these were not familiar with FIRM research and did not complete questions 5 – 23.

Both questionnaires are the same except for an additional 4 introductory questions on the industry questionnaire. Also, the industry questionnaire does not contain the question on administration which appears for researchers.

All of those selected were emailed in advance to inform them of the survey. Subsequently, the link to the survey was emailed. An individual personalised email was issued to all those who had not completed the survey after one week.

Following:

Appendix 4 – Researcher Questionnaire

Appendix 5 – Industry Questionnaire

FIRM RESEARCHER QUESTIONNAIRE

1. FIRM OBJECTIVES

The Food Institutional Research Measure (FIRM) of the Department of Agriculture and Food is the primary national funding mechanism for food research in third level colleges (Universities and Institutes of Technology) and Teagasc food research centres. The FIRM funds basic or fundamental research in the area of food quality, safety and nutrition while also contributing to product and process technology development.

The following questionnaire forms part of an internal evaluation of the FIRM looking at issues of efficiency, effectiveness and value for money

OBJECTIVES

The ultimate objectives of the Food Institutional Research Measure (FIRM) are as follows:

- a) FOOD INDUSTRY OBJECTIVE: To provide a base of information and expertise in generic technologies that will support innovation and product development in the food industry;
- b) FOOD SAFETY OBJECTIVE: To assist in assuring consumer protection and in ensuring that product/process development is underpinned by attention to food safety and quality issues;
- c) INFORMATION DISSEMINATION OBJECTIVE: To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies by Irish food companies.

1. Please rank these objectives in order of importance: 1 is the most important objective and 3 is the least important objective.

(a) Food Industry	<input type="text"/>
(b) Food Safety	<input type="text"/>
(c) Information Dissemination	<input type="text"/>

2. Do you consider these objectives to be appropriate?

- Yes
- No
- No opinion

3. How would you rate the contribution FIRM makes to each of these objectives?

	Very good	Good	Average	Poor	Very poor
Food Industry Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Food Safety Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Information Dissemination Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

4. Do you think the above objectives could be achieved in a better way i.e. other than funding public good research through FIRM?

- Yes
- No
- No opinion

If YES, please briefly identify (in the box below) the alternative approach envisaged

FIRM RESEARCHER QUESTIONNAIRE

5. Do you think that the FIRM contributes to other objectives that are not covered by the three referred to above?

Yes

No

No opinion

If YES, please identify any alternative objectives you consider appropriate

2. EFFICIENCY

The following questions are designed to ascertain the level of satisfaction with the service provided by the Department of Agriculture and Food in the administration of the FIRM and to identify areas where improvements could be made.

6. FIRM Administration:

Please rate your level of satisfaction with the following aspects of the administration of the FIRM by the Department of Agriculture and Food (DAF)

	Very Satisfied	Satisfied	Neither one nor the other	Dissatisfied	Very dissatisfied
Application Process - ease of application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Application process - guidance from DAF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Procedure for evaluation of proposals by DAF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time taken by DAF to evaluate proposals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Administration of ongoing projects by DAF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Scientific management of ongoing projects by DAF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reporting requirements for ongoing programmes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part (b) If you feel any particular aspect of the administration of FIRM requires attention, please identify in the box below.

7. How suitable are the theme areas (e.g. consumer foods, meat, dairy, food nutrition, food residues etc.) selected for funding?

Very suitable

Suitable

Neither one nor the other

Unsuitable

Very unsuitable

If you believe different areas require funding, please list below:

FIRM RESEARCHER QUESTIONNAIRE

8. Are you satisfied with the level of input which the research community has in deciding research theme areas?

- Very satisfied
- Satisfied
- Neither one nor the other
- Dissatisfied
- Very dissatisfied

3. EFFECTIVENESS

The following questions examine the effectiveness of the FIRM in meeting its objectives and contributing to the achievement of quality outputs.

9. How would you rate the quality of the FIRM funded research with which you are familiar?

- Very good
- Good
- Average
- Poor
- Very poor

10. How would you rate the following:

	Very good	Good	Average	Poor	Very poor
Level of industry participation in FIRM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Links between industry and research institutions developed as a result of FIRM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial potential of FIRM outputs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of use of FIRM outputs by food industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support amongst industry for FIRM research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. How would you rate the FIRM's contribution to human capital development in terms of:

	Very good	Good	Average	Poor	Very Poor
Development of new skills and expertise within your organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of suitable postgraduates for the food industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of movement of postgraduates into food industry R&D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of movement of postgraduates into food safety related employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. In your opinion, how much of FIRM funded research completed or currently underway would be undertaken in the absence of FIRM?

- 100%
- More than 75%
- More than 50%
- More than 25%
- between 1% and 25%
- 0%

FIRM RESEARCHER QUESTIONNAIRE

13. In your opinion, how much of FIRM funded research is of benefit to the food industry? Benefit can be considered in terms of improved food safety, new technologies or additional expertise

- 100%
- More than 75%
- More than 50%
- More than 25%
- Between 1% and 25%
- 0%

14. Do you think that funding public good research under FIRM is diverting research from more beneficial areas?

- Yes
- No
- No opinion

If yes, please specify

15. How would you rate the dissemination of FIRM research results to the food industry?

- Very good
- Good
- Average
- Poor
- Very poor

16. How would you rate the contribution of RELAY to:

	Very good	Good	Average	Poor	Very poor
Disseminating information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing links between industry and research institutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you believe there a better alternative to RELAY, please describe below:

4. IMPACT

This final section considers the wider impact of FIRM funded research.

17. Does the FIRM provide the Irish food industry with a source of competitive advantage?

- Yes
- No
- No opinion

18. How would you rate the contribution of FIRM to INNOVATION and R&D in the Irish food industry?

- Very good
- Good
- Average
- Poor
- Very poor

19. How would you rate the contribution of FIRM to FOOD SAFETY in the Irish food industry?

- Very good
- Good
- Average
- Poor
- Very poor

20. How would you rate the FIRM in terms of providing "value for money"?

- Very good
- Good
- Average
- Poor
- Very poor

21. How would you categorise the trend in levels of R&D in the Irish food industry since 2000?

- Increased significantly
- Increased slightly
- Stayed the same
- Declined slightly
- Declined significantly

22. How would you categorise the trend in levels of food safety in the Irish food industry since 2000?

- Increased significantly
- Increased slightly
- Stayed the same

jñ Decreased slightly

jñ Decreased significantly

23. To conclude the survey, please include your name and the name of your company/organisation. The information included in this survey will be treated in the strictest confidence and the identity of respondents will not be released. Your name is requested so that the optimum response rate can be achieved - those who have not completed the survey will be contacted again.

Name:

Company:

1. FIRM AWARENESS

The Food Institutional Research Measure (FIRM) of the Department of Agriculture and Food is the primary national funding mechanism for food research in third level colleges (Universities and Institutes of Technology) and Teagasc food research centres. The FIRM funds basic or fundamental research in the area of food quality, safety and nutrition while also contributing to product and process technology development.

The following questionnaire forms part of an internal evaluation of the FIRM looking at issues of efficiency, effectiveness and value for money.

1. Do you think the level of R&D in the Irish Food industry is sufficient?

- Yes
- No
- No opinion

2. Do you think that the PRIMARY responsibility for funding R&D in the food sector lies with the industry itself, the Government or through a combination of both?

- Industry
- Government
- Combination of both
- Other

3. As noted above, the Department of Agriculture & Food funds basic/fundamental research in the area of food quality, safety and nutrition while also contributing to product and process technology development. Do you think this is worthwhile?

- Yes
- No
- No opinion

4. Are you familiar with public good research funded through the Food Institutional Research Measure (FIRM), which is administered by the Department of Agriculture and Food?

- YES
- NO

If you answered no to Question 4 above, then selecting "NEXT>>" will redirect you to the final two questions. If you answered yes, selecting "NEXT>>" will bring you through the rest of the questionnaire.

2. OBJECTIVES

The ultimate objectives of the Food Institutional Research Measure (FIRM) are as follows:

- a) **FOOD INDUSTRY OBJECTIVE:** To provide a base of information and expertise in generic technologies that will support innovation and product development in the food industry;
- b) **FOOD SAFETY OBJECTIVE:** To assist in assuring consumer protection and in ensuring that product/process development is underpinned by attention to food safety and quality issues;
- c) **INFORMATION DISSEMINATION OBJECTIVE:** To communicate the results of publicly funded food research so as to ensure maximum uptake of new technologies by Irish food companies.

5. Please rank these objectives in order of importance: 1 being the most important objective and 3 being the least important objective

(a) Food Industry

(b) Food Safety

(c) Information Dissemination

6. Do you consider these objectives to be appropriate?

- Yes
- No
- No opinion

7. How would you rate the contribution FIRM makes to each of these objectives?

	Very good	Good	Average	Poor	Very poor
Food Industry Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Food Safety Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Information Dissemination Objective	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

8. Do you think the above objectives could be achieved in a better way i.e. other than funding public good research through FIRM

- Yes
- No
- No opinion

If YES, please briefly identify (in the box below) the alternative approach envisaged

9. Do you think that the FIRM contributes to other objectives that are not covered by the three referred to above?

- Yes
- No
- No opinion

FIRM INDUSTRY QUESTIONNAIRE

If YES, please identify any alternative objectives you consider appropriate

10. How suitable are the theme areas (e.g. consumer foods, meat, dairy, food nutrition, food residues etc.) selected for funding?

- Very suitable
- Suitable
- Neither one nor the other
- Unsuitable
- Very unsuitable

If you believe different areas require funding, please list below:

11. Are you satisfied with the level of input which the food industry has in deciding research theme areas?

- Very satisfied
- Satisfied
- Neither one nor the other
- Dissatisfied
- Very dissatisfied

3. EFFECTIVENESS

The following questions examine the effectiveness of the FIRM in meeting its objectives and contributing to the achievement of quality outputs.

12. How would you rate the quality of the FIRM funded research with which you are familiar?

- Very good
- Good
- Average
- Poor
- Very poor

13. How would you rate the following:

	Very good	Good	Average	Poor	Very poor
Level of industry participation in FIRM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Links between industry and research institutions developed as a result of FIRM	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commercial potential of FIRM outputs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of use of FIRM outputs by food industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support amongst industry for FIRM research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. How would you rate the FIRM's contribution to human capital development in terms of:

	Very good	Good	Average	Poor	Very Poor
Development of new skills and expertise within your organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of suitable postgraduates for the food industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of movement of postgraduates into food industry R&D	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Level of movement of postgraduates into food safety related employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. In your opinion, how much of FIRM funded research completed or currently underway would be undertaken in the absence of FIRM?

- 100%
- More than 75%
- More than 50%
- More than 25%
- Between 1% and 25%
- 0%

16. In your opinion, how much of FIRM funded research is of benefit to the food industry? Benefit can be considered in terms of improved food safety, new technologies or additional expertise.

- 100%
- More than 75%
- More than 50%
- More than 25%
- Between 1% and 25%

FIRM INDUSTRY QUESTIONNAIRE

jn 0%

17. Do you think that funding public good research under FIRM is diverting research from more beneficial areas?

jn Yes

jn No

jn No opinion

If yes, please specify

18. How would you rate the dissemination of FIRM research results to the food industry?

jn Very good

jn Good

jn Average

jn Poor

jn Very poor

19. How would you rate the contribution of RELAY to:

	Very good	Good	Average	Poor	Very poor
Disseminating information	jn	jn	jn	jn	jn
Developing links between industry and research institutions	jn	jn	jn	jn	jn

If you believe there is a better alternative to RELAY, please describe below:

4. IMPACT

This section considers the wider impact of FIRM funded research.

20. Does the FIRM provide the Irish food industry with a source of competitive advantage?

- Yes
- No
- No opinion

21. How would you rate the contribution of FIRM to INNOVATION and R&D in the Irish food industry?

- Very good
- Good
- Average
- Poor
- Very poor

22. How would you rate the contribution of FIRM to FOOD SAFETY in the Irish food industry?

- Very good
- Good
- Average
- Poor
- Very poor

23. How would you rate the FIRM in terms of providing "value for money"?

- Very good
- Good
- Average
- Poor
- Very poor

5. CONCLUSION: GENERAL TRENDS

24. How would you categorise the trend in levels of R&D in the Irish food industry since 2000?

- Increased significantly
- Increased slightly
- Stayed the same
- Declined slightly
- Declined significantly

25. How would you categorise the trend in levels of FOOD SAFETY in the Irish food industry since 2000?

- Increased significantly
- Increased slightly
- Stayed the same
- Decreased slightly
- Decreased significantly

26. To conclude the survey, please include your name and the name of your company/organisation. The information included in this survey will be treated in the strictest confidence and the identity of respondents will not be released.

Your name is requested so that the optimum response rate can be achieved - those who have not completed the survey will be contacted again.

Name:

Company:

Appendix 6 - Key Findings of the Independent Evaluator

- The Steering Group is comprised, appropriately, of representatives from the Departments of Agriculture & Food and Finance.
- The planning, approach and management of this review is robust and has resulted in a thorough, well-structured, easy-reading report.
- The Terms of Reference are appropriate for a Value for Money Review; and the analysis follows them in a systematic, comprehensive way.
- The report shows a very good understanding of the issues, and the clarity and quality of the analysis is also very good. The combination of a Programme Logic Model and VFM Research Framework are valuable for making a quantitative and qualitative assessment of the FIRM.
- The analysis supports the logic and rationale of the recommendations.
- The conclusions about value for money are supported by the analysis.
- The proposed Performance Indicators seek to make greater use of the information gathered and reported over the lifecycle of projects.
- The recommendations for an electronic database, and post-completion questionnaire to capture the impact of research further down the road, are worthwhile devices for monitoring and further investigation.
- The key findings on each of the main issues, and the results of the questionnaire and consultation (where relevant), could be summarised in bullet form at the beginning of the chapters to give a high-level view of performance, current and emerging issues, and future options.

Comment: The Steering Group are satisfied that the core issues are summarised in the Executive Summary and the Conclusions & Recommendations chapter. Any additional efforts in this regard would only add to the length of the report.

- It may be problematic to measure 33 Performance Indicators, so there could be a case for reducing and refining them, or focusing on new areas as a result of the learning gained from this review, or indeed to reflect new strategic priorities identified with the stakeholders.

Comment: The Steering Group agrees that the use of 33 Performance Indicators may be problematic – the ability to report on them is dependent on the implementation of various recommendations, particularly the development of an electronic database. Rather than reducing them at this stage, the steering group suggests a review of their usefulness when DAFF has had some experience in their use and when this report's recommendations have been implemented.