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Agriculture and Food Development Authority

# Improving Technology Transfer and Research Commercialisation in the Irish Food Innovation System

Ashtown Food Research Centre

RESEARCH & TRAINING FOR THE FOOD INDUSTRY

# Improving Technology Transfer and Research Commercialisation in the Irish Food Innovation System

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# *Summary*

The process by which knowledge generated by publicly-funded research is transferred to industry – technology transfer – has been criticised as being inefficient and having limited success. This research project aimed to obtain a better understanding of the technology transfer process and thereby contribute to policy development and provide guidance for researchers to improve the process. Through a series of focus groups, surveys, case studies and depth interviews, the research identified five key challenges that exist in the context of the Irish food innovation system. These relate to communication, industry capabilities, research capabilities, strategic management and socialisation. To address these challenges, a selection of tools, illustrative case studies and recommendations for a range of stakeholders on how to deal with each of these challenges is provided on the project website *(www.dit.ie/toolbox/)*.

# *Introduction*

Research conducted in universities and public sector research organisations can be an important knowledge source for companies seeking to innovate and improve competitiveness. However there is a perception that publicly-funded research results are not being used to their maximum potential and thus the possible benefits are not being entirely realised. The process by which such knowledge is transferred to potential users – technology transfer - has also been criticised as being inefficient and having limited success. Obtaining a better understanding of the technology transfer process, and improving it, is thus necessary for industry and society to reap the benefits of tax-payers' investment in publicly-funded science.

This research aimed to enhance the level of commercialisation and technology transfer from publicly-funded food research in Ireland by providing a range of techniques, approaches and management frameworks that would support researchers and research centres in their attempts to transfer technologies to industry. In addition, the project was intended to contribute to policy development at national and research centre level and provide guidance for researchers to ensure greater uptake of their research findings by industry.

Key themes addressed within the research included current levels of interaction between industry and researchers, barriers to and incentives for technology transfer, industry absorption capacity, success and failure factors, and international best practice.

# *Methodology*

Beyond mandatory literature reviews, initial exploratory focus groups (3) and depth interviews (8) with key stakeholders from the Irish food innovation system, detailed quantitative and qualitative research was conducted. Quantitative surveys, directed towards researchers and relevant industry personnel explored; levels, nature and extent of interaction between researchers and industry, attitudes and motivations of researchers and industry towards involvement in technology transfer and barriers to technology transfer. The researcher postal survey was sent to 324 researchers while the industry survey was distributed to 267 companies. The surveys achieved a 46% and 25% response rate respectively, which is reasonable for surveys of this nature. The industry survey was targeted at the Managing Director, General Manager, R&D/NPD Manager, Production Manager or Quality Control Manager, depending on company size. This industry list was compiled in accordance with specific inclusion criteria in relation to company size (companies employing more than 10 people) and the presence of some processing and research and development decision capabilities within the Republic of Ireland.

Twenty Irish case studies, documenting publicly-funded research projects that achieved both technology transfer and had no/limited technology transfer were undertaken for the purpose of obtaining a greater understanding of the micro-level factors that affected and influenced transfer of technology from the publicly-funded arena to the commercial sector. Semi-structured in-depth interviews with Irish food researchers supplemented secondary data and literature to document these case studies.

At international level, semi-structured depth interviews were held with key personnel from public research organisations that were identified based on notable capabilities in the area of technology transfer related to structure, culture, management and performance measurements. Interviewees were from research organisations in Australia, Finland, the UK, the Netherlands, New Zealand and the United States of America.

# Results

**Researcher and industry survey**

Findings indicated that (a) researchers generally interacted with each other (reflecting funding mechanisms) and (b) interaction between researchers and industry needs to improve. They also showed that companies use a variety of external knowledge sources for their innovation activities but public science providers are not directly acknowledged as an important source of innovation. The latter is significant because, while public research is important in the absolute sense, its direct impact is often much less than other sources of knowledge, the positions of which within the supply chain lend themselves to making more direct and instant contributions.

The results also showed that researchers and industry use different communication activities i.e. some of the knowledge transfer activities used frequently by researchers may not be the activities used frequently or regarded as particularly effective by industry. Greater alignment of these activities could improve knowledge transfer. Informal courses and training courses were recognised by both groups as being of value for technology transfer.

Industry interacted with researchers mainly to access new ideas and technologies, achieve technical development of their own staff, and access government funding for company R&D activities. These findings suggest that industry believes that public research is a strategic resource. The main reasons researchers interacted with industry were to secure funds for research, gain insight into scientific research and promote diffusion of research findings. This indicates they were not highly motivated by financial reward but more so by research-related objectives to involve themselves in technology transfer initiatives. It also suggests that researchers perhaps recognised that it was not realistic to assume that public sector research can be successfully commercialised without developing a relationship with the private sector.

The main barriers to engaging with public science providers from an industry perspective were: high level of R&D budget required, limited commercial application of publicly-funded research, and limited commercial awareness of researchers. The main barriers from a researcher perspective were: not enough time, lack of information regarding company research activities and low R&D budgets within industry. These barriers emphasise the need for researchers to play a more active role in their interaction with industry and to improve commercial awareness and develop skills amongst researchers.

Differences in perspectives regarding their roles in the national innovation system also highlighted challenges.

- Researchers believed both sides play equal parts in setting the research agenda while industry believed that public science providers set the agenda.
- Researchers believed their primary mission was to generate high quality science while industry believed they should be equally committed to application of results.
- Researchers believed that both sides should be responsible for communication while industry believed it is the responsibility of the researcher to communicate information to them.
- Researchers did not consider the primary responsibility for collaborating with industry and transferring research lay with them.

**Case studies**

Findings from the case studies highlighted the fact that researchers achieving technology transfer are more likely to have better relationships with industry than those researchers who have not achieved technology transfer. Those who achieved technology transfer also seemed to see the establishment and management of relationships as an ongoing process, with some researchers involved in forming new relationships currently. Personal relationships were seen as a very important condition for having good relationships with industry. Having high levels of interaction, which is intrinsically linked to the presence of casual personal relationships, was also seen to be important.

Industry involvement was seen as vital to technology transfer. When asked about the purpose for interacting with industry within the context of the specific research project being discussed, researchers indicated that obtaining general information and feedback relating to overall research objectives, specific research tasks or broader information about issues affecting the industry itself were key objectives. These findings illustrate the necessity to engage with industry to ensure that research being undertaken is relevant and that research tasks are being approached in the most efficient and industrially-relevant manner. Encouragingly, it also showed that those with limited/no technology transfer were aware of the potential role and contribution of industry interaction in their research projects.

The findings suggest that conceiving an idea based on a validated industry need and considering the end-user or beneficiary is more likely to result in effective technology transfer. When asked about the origins of the project, the biggest difference in responses between those who those who did and those who did not have successful technology transfer was in relation to research projects arising from a market opportunity validated by industry. In this regard, those researchers who achieved successful technology transfer were much more likely to have derived their research projects from such foundations, indicating their relevance and accuracy in terms of dealing with genuine industry needs. Similarly, projects aimed at a specific end-user were more likely than not to have achieved technology transfer while those projects that were broad in focus were equally likely to achieve or not achieve technology transfer.

These interviews also confirmed the survey results that researchers are not motivated by direct personal financial incentives but that more altruistic motives prevail. However, they showed differences in motivations between those who had successful technology transfer and those who did not. 'Personal satisfaction' and seeing an 'end commercial product' were primary motivators for those who had achieved technology transfer. Additionally, they were motivated by building 'links with industry' and believed the work to be 'interesting' while also feeling a 'sense of commitment' to the research itself. On the other hand, researchers who had not achieved technology transfer demonstrated two things. Firstly, as a group they were far less unified by a common motivator and secondly, they did not place emphasis on industry-oriented motivators.

The absence of real differences in the use of dissemination mechanisms between researchers who achieved technology and those who had limited or no technology transfer suggests that a poor dissemination approach is not a barrier. However, this is not to say that dissemination is not an important consideration for achieving technology transfer. Rather, it is seen by all researchers as a necessary element of their work.

**International best practice**

The findings of the international case studies highlighted a number of examples that may be of relevance to Ireland in the areas of funding approaches, industry-researcher interaction, cross-sectoral partnerships, developing an enabling culture, researcher incentive mechanisms and identifying paths to commercialisation

They also highlighted a number of key features that may be transferable to an Irish context. For example, in the case of New Zealand it was found that:

- **An enabling culture is important:** It is important to enable (through training) and reward (through promotion) researchers to recognise and achieve key performance indicators of relevance to achieving technology transfer and industry impact.
- **Portfolio of funding and range of staff roles:** Availability of a portfolio of funding mechanisms and staff with a range of roles with research conducted on the continuum from basic to applied supports an innovation pipeline and promotes sustainability.
- **Strong relationships require time and investment:** Strong relationships need to be developed using a number of approaches and actively managed over time. These relationships do not always need to be direct relationships between researcher and industry. They can be facilitated through intermediaries and representative agencies.
- **Relationships are about people:** Certain individuals act as catalysts to initiating relationships/interactions and the right people are fundamental to maintain the relationship over time.
- **...but other factors help:** Having close geographical proximity for example supports the development of strong relationships. Cognitive and social proximity through student (research projects) and staff (alumni) mobility also help.

Reports on the other international case studies are available on *www.dit.ie/toolbox/*.

**Discussion and recommendations**

Taken together, all the research findings served to identify five key challenges that exist in the context of the Irish food innovation system.

1. **Communication:** There is a need for increased and improved communication and interaction between researchers and industry.
2. **Industry capabilities:** Industry needs to develop capabilities to make strategic use of and leverage publicly-funded research while research organisations need to recognise the diversity of capabilities that exist within the industry.
3. **Enabling researchers:** There is a need to enhance organisational supports in public science providers to enable technology transfer and industry collaboration.
4. **Strategic management:** There is a need for increased strategic management of research project programmes.
5. **Socialisation:** There are significant boundaries between the public researcher and food industry communities that inhibit knowledge sharing, collaboration and, ultimately, technology transfer.

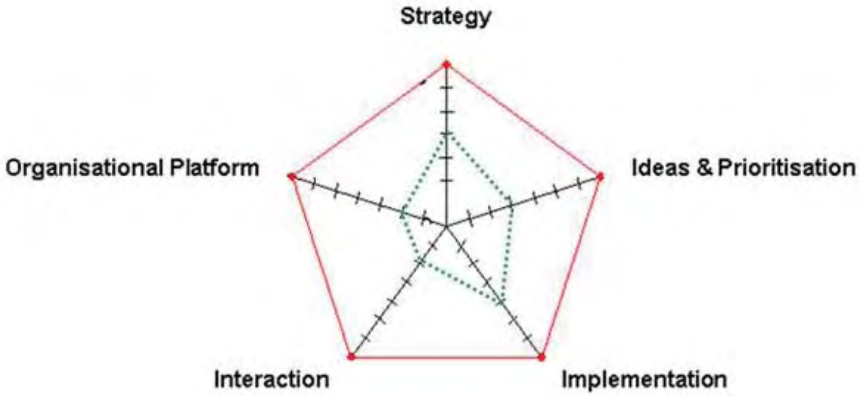
This project website presents tools, illustrative case studies and recommendations for a range of stakeholders on how to deal with each of these challenges *(www.dit.ie/toolbox/)*. For illustrative purposes, Exhibits 1 and 2 present samples of research project tools that have been developed for enabling researchers and strategic management challenges respectively.

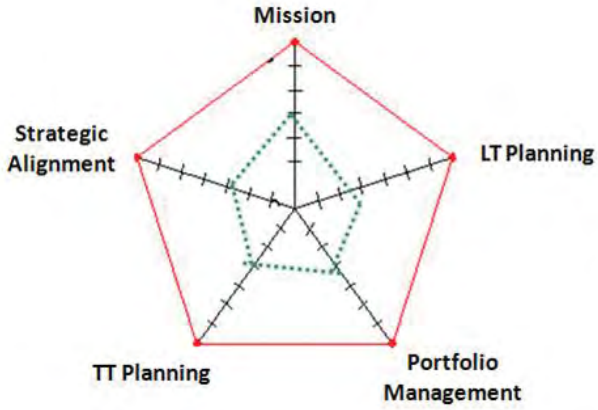
Exhibit 1 presents a Technology Transfer Readiness Audit Tool that can be adapted for use at research centre, research group or researcher level. The tool breaks down the technology transfer platform into five dimensions – (i) strategy; (ii) ideas and prioritisation; (iii) implementation; (iv) organisation platform, and (v) interaction. Each of these aspects are linked to research findings e.g. ideas and prioritisation should be based on a validated industry need as much as possible, possibly through lead-user workshops to generate ideas and industry interaction programmes. Qualitative or quantitative approaches can be deployed to assess the readiness of each of these dimensions and the outcome can be demonstrated graphically using a spider's web diagram. This tool can be applied at different levels but also over time so that an organisation can benchmark the development of its readiness to engage in technology transfer or industry interaction activities. Exhibit 1 provides examples of how this might be done for the strategy and interaction dimensions.

Exhibit 2 provides an outline of a Research Portfolio Management Framework that can be used to support project portfolio management. Based on the findings of the research it was observable that there is a need to formally plan for technology transfer both at the project level and at the portfolio level. This framework provides a stage gate type approach that begins with long term forecasting supported by a structured industry and scientific community interaction programme and, where available, lead user idea creation. The framework provides for initial screening of proposals and a proposal assessment checklist. It accepts that technology transfer outcomes are rarely achieved from a single project but are more likely to arise from a series of projects that provide for the development of the technology towards a commercialisation stage. Therefore, stage gates are built that provide for a Technology Market Legal Assessment (TML) and application of a Commercial Readiness Matrix. These tools have also been developed to support operation of the Research Portfolio Management Framework.

Some of the tools were developed by research team, some adapted from existing tools while others were used as available. However, all are based on the research results of this specific project. In using the tools it is important to set them within wider strategic contexts be they at centre, organisation or national level. They are designed to be used in a very flexible manner. For example, some tools can be used at different levels e.g. project and programme levels, and some can be used by different users within same organisation e.g. researchers vs. research managers. Often the process of using some tools is as important as the outputs of the tool.

**Exhibit 1: Technology Transfer Readiness Audit**



*Example (i): Assessment of Strategy Dimension*

| *Criteria* | *Qualitative Approach* | *Quantitative Approach Score 1 = Not true at all to 7 = Very True* |
|---|---|---|
| Mission | Is technology transfer a fundamental part of our organisation's mission, philosophy and values? | Technology transfer is a fundamental part of our organisation's mission, philosophy and values. |
| Long Term Planning | Does the organisation look ahead in a structured way using explanatory techniques (e.g. road-mapping)? | The organisation looks ahead in a structured way using explanatory techniques to determine research programme directions. |
| Portfolio Management | Does the organisation actively and strategically monitor and manage the portfolio of research projects? | The organisation actively and strategically monitor and manage the portfolio of research projects. |
| Strategic Alignment | Are the organisational technology transfer objectives demonstrated in operational plans? | The organisational technology transfer objectives demonstrated in operational plans. |
| Technology Transfer Planning | Are committed and realistic technology transfer objectives and tasks included in research project proposals? | Committed and realistic technology transfer objectives and tasks included in research project proposals. |

*Example (ii): Assessment of Interaction Dimension*

| *Criteria* | *Qualitative Approach* | *Quantitative Approach Score 1 = Not true at all to 7 = Very True* |
|---|---|---|
| Formal Interaction | Does the organisation have effective formal interactions with industry? | The organisation has effective formal interactions with industry. |
| Informal Linkages | Do we have strong informal linkages with industry at all levels? | We have strong informal linkages with industry at all levels. |
| Cognitive Proximity | Is there a working cognitive proximity between researchers and industry? | There is a working cognitive proximity between researchers and industry. |
| Interaction Mechanisms & Supports | Do we have effective mechanisms, policies and supports to allow researchers to interact with industry? | We have effective mechanisms, policies and supports in place to allow researchers to interact with industry. |
| Researcher Accessibility | Do we have effective mechanisms, policies and supports in place to allow industry to access our researchers? | We have effective mechanisms, policies and supports in place to allow industry to access our researchers. |

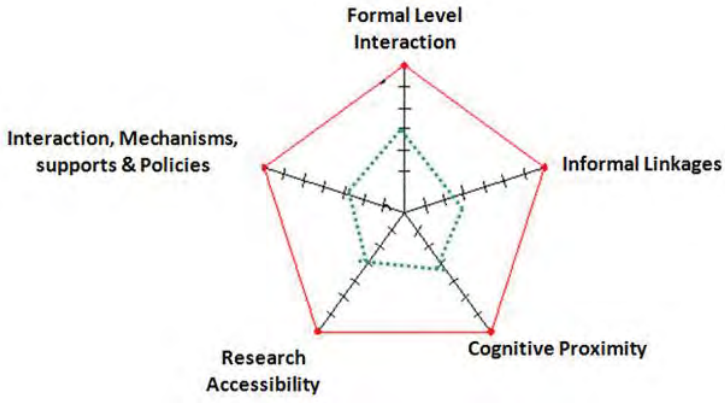
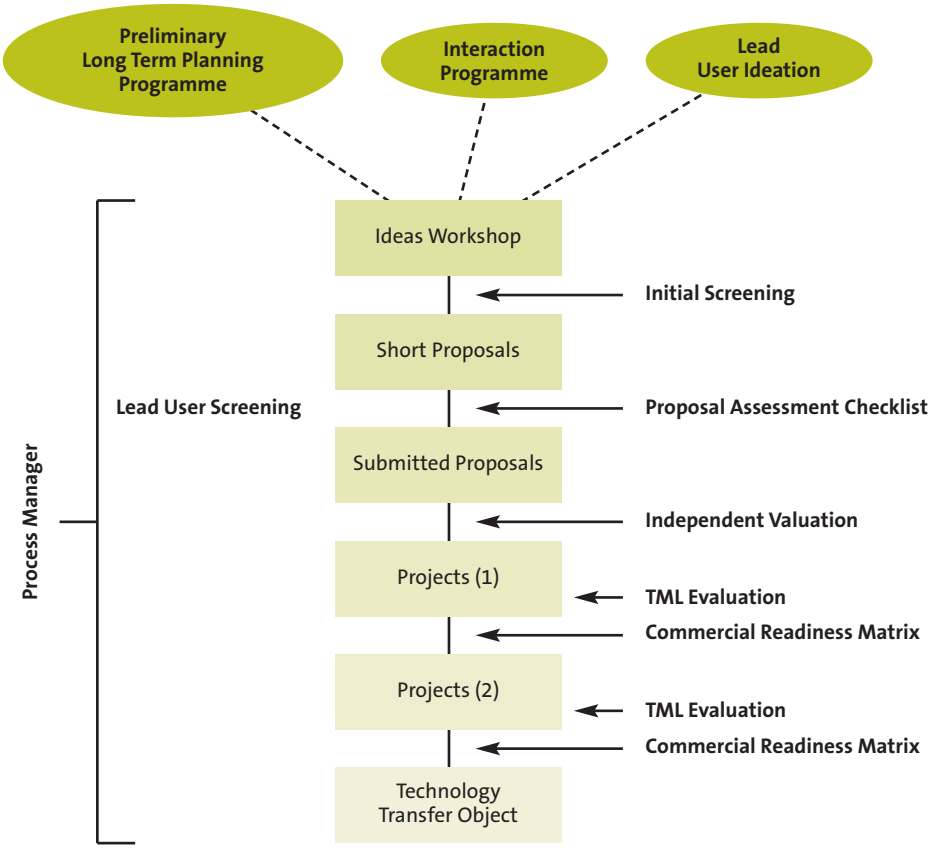


**Exhibit 2: Research Portfolio Management Framework**



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