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Consumer and industry acceptance of novel food technologies

Key external stakeholders:
Food companies, researchers, research funders, industry support agencies, consumer representative bodies

Practical implications for stakeholders:
New food technologies (NFTs) are required to help food companies address challenges such as increased competitive pressures, globalisation, and dynamic and diverse consumer demands. They are also required to enable global food systems change and adapt to become more efficient and resilient. However, developing NFTs is a costly and risky business for academia and industry. Furthermore, converting investments in this area into financial reward requires overcoming at least 2 hurdles, i.e. industry uptake and consumer acceptance. The research highlights the need to consider these hurdles, and have a clear understanding of the key factors influencing them, at an early stage in the development pathway of NFTs.

Main results:
- Factors determining acceptance of NFTs at industry and consumer levels are complex as (a) all technologies are not the same; (b) all companies are not the same, (c) all consumers are not the same.
- Consumer attitudes towards various technologies range from concern and fear to apathetic and blasé.
- Different segments exist in the population in terms of how accepting they are of new food technologies; the number and size of these segments varies by technology application.
- Irish food companies can be divided into three (approximately equal) capability levels ranging from those that possess the required profile to commercialise advanced technologies to those with virtually no ability to assimilate knowledge and commercialise outputs from a typical FIRM-funded project.

Opportunity / Benefit:
Overall this research shows that consumer acceptance and industry uptake cannot be assumed for NFTs. It illustrates clear challenges for technology developers seeking widespread adoption. Deeper understanding of the reactions of stakeholders to the development and application of new and emerging technologies, as well as the factors influencing adoption and acceptance, are provided. Such knowledge is crucial to any organisation aiming to develop innovation efficiently, effectively and democratically. From a practical perspective, it demonstrates the value of segmenting consumers, as they are not uniformly anti-technology. Whilst the research reports that segmenting consumers based on demographic variables is of limited use in attempting to developed targeted strategies to influence acceptance, an alternative method of segmenting consumers based on general attitudes to nature, the environment and science and technology is proposed. On the industry side, it highlights technological complexity, and associated industry capacity, as a barrier to uptake. To help address this, it identifies a method of classifying companies based on their capacity to adopt NFTs; this could be useful for support agencies seeking to provide targeted supports to companies to promote higher levels of innovation in the industry.

The main recommendation arising from this research is: *The development trajectory of new technologies needs to be considered well in advance of market launch with specific strategies required for different stages of the development trajectory. Openness and transparency should be fostered by all stakeholders during this process.*

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1. Project background:

Despite significant investment in novel technology research, these technologies will not yield desired returns unless adopted by industry and accepted by consumers. It is therefore important to determine:

- how consumers evaluate NFTs.
- the factors supporting and impeding industry uptake of novel food technologies (NFTs).

This research helps inform and guide industry strategies and government policies to support a knowledge based bio-economy. It provides relevant information to support greater industry uptake of NFTs and highlights the need to take account of sources of public concerns.

2. Questions addressed by the project:

The project sought to gain understanding from both the consumer and industry perspective on likely acceptance/adoption of NTFs. From the consumer perspective, it aimed to:

- understand how individuals construct meaning around and interpret information about NFTs.
- consider the trade-offs made by individuals when a product offering benefits is produced using a NFT.

From the industry perspective, it aimed to:

- examine drivers/barriers influencing technology investment decisions by industry.
- measure the receptivity of industry to new technology innovation.

3. The experimental studies:

The study employed a mixed methods approach. The consumer research used an innovative qualitative research approach to address 8 NFTs ranging from extremely far from market technologies (e.g. *in vitro* meat) to those already on the market (e.g. functional foods). This was complimented by a nationally representative survey of 1,000 Irish consumers that focused on two applications of nanotechnology; its application to a food product ("nano-inside") and its application to food packaging ("nano-outside"). The industry focused research used executive interviews in the exploratory and confirmatory stages to compliment a national postal survey of 445 Irish food companies (response rate 30%). It is noteworthy that the qualitative research approach was essential when engaging in data collection with both industry stakeholders and consumers to deliver deeper insights into the motivations and drivers influencing technology adoption/acceptance.

4. Main results:

Consumer acceptance varies across technologies, moreover the particular application of a technology can influence acceptance for some consumers. The types and forms of information provided to consumers to aid their evaluation of NFTs influences the process by which they form, and change, attitudes to such technologies. However the extent to which consumers will actively seek and process information depends on characteristics of the technology as well as the consumer. The majority of people, although interested in obtaining information, do not appear to spend too much time or effort trying to form a knowledge-based attitude in their evaluation of NFTs. Given general low levels of awareness of NFTs, consumers frequently rely on intuition, rules of thumb and associative evaluations in assessing technologies.

This research shows the influence of low levels of awareness, and associated high levels of uncertainty, on acceptance of nanotechnology. The role of regulatory authorities, and bodies such as government agencies and GPs, as trusted sources of information in such an environment is highlighted. Whilst different segments can be identified in terms of acceptance of various technologies, demographic variables are of limited value in targeting such segments. Attitudinal variables, such as attitudes to nature, the environment and science and technology provide a better basis for differentiation.

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Irish food companies vary in their ability to exploit NFTs. They also vary in terms of their acknowledgement of the need to invest in such technologies. Characteristics of the technology, particularly in terms of complexity, and also in terms of compatibility with existing products and systems, influence acceptance.

5. Opportunity/Benefit:

Overall, this research shows that consumer acceptance and industry uptake cannot be assumed for novel food technologies. It illustrates clear challenges for technology developers seeking widespread acceptance/adoption of novel food technologies at consumer and industry level. Deeper understanding of the reaction of these stakeholders to the development and application of new and emerging technologies, as well as the factors influencing acceptance, is provided. Such knowledge is crucial to any organisation aiming to develop innovation efficiently, effectively and democratically.

From a practical perspective, it demonstrates the value of segmenting consumers, as they are not uniformly anti-technology. Whilst the research reports that segmenting consumers based on demographic variables is of limited use in attempting to developed targeted strategies to influence acceptance (e.g. in terms of communications strategy) an alternative method of segmenting consumers based on attitudes to constructs such as nature, the environment and science and technologies is proposed. On the industry side, it highlights technological complexity, and associated industry capacity, as a barrier to uptake. To help address this, it identifies a method of classifying companies based on their capacity to adopt new food technologies which could be useful for support agencies seeking to provide targeted supports to individual companies to promote higher levels of innovation in the industry.

The main recommendation arising from this research is as follows:
The development trajectory of new technologies needs to be considered well in advance of market launch with specific strategies required for different stages of the development trajectory. Openness and transparency should be fostered by all stakeholders during this process.

6. Dissemination:

Main publications:

Kavanagh, G. Henchion, M., McCarthy, M, McCarthy, S. and G. Williams (2012). Technological Innovation – A Route Towards Sustainability, *International Journal on Food System Dynamics*, Vol 3, No 1.

Greehy, G., McCarthy, M., Henchion, M., Dillon, E., and S. McCarthy (2012). "Food for Thought: How Citizens Frame and Process Information about Novel Food Technologies" *International Conference on Science Communication*, Nancy, France, 04-07/09/12.

Dillon, E. J., Greehy, G., Henchion, M., McCarthy, M. and S. McCarthy (2011). "Functional foods into the future – examining Irish consumer acceptance", *European Association of Agricultural Economists (EAAE) Congress* , Zurich, Switzerland, 30.08.11-02.09.11

Kavanagh, G. Henchion, M., McCarthy, M, and G. Williams (2011) "Technological innovation – A route towards sustainability in the Irish food industry". "*5th International European Forum on System Dynamics and Innovation in Food Networks*, Igs, Austria, 4.02.11-18.02.11).

Greehy, G. McCarthy, M. Henchion, M. Dillon, E and S. McCarthy (2011). "An Exploration of Irish Consumer Acceptance of Nanotechnology Applications in Food". *5th International European Forum on System Dynamics and Innovation in Food Networks*, Igs, Austria, 4.02.11-18.02.11).

Popular publications:

Dillon, E. Henchion, M., Greehy, G., McCarthy M., McCarthy, S. and Williams G (2012) Could 'lab grown' meat really be on the menu? *TResearch* Vol. 7: No. 4 Winter 2012 pp 26-27, ISSN 1649-8917

Kavanagh G, Henchion, M., McCarthy M and Williams G (2011). Measuring up for innovation. *TResearch* Vol. 6: No. 3 Autumn 2011 pp 30-31, ISSN 1649-8917

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