Northern Ireland Agritech

Case Study Overview

Characteristics and history: Northern Ireland has strong assets in Agritech. However, it is not, as yet, a fully realised cluster. Part of the issue is a long legacy and clear identity in the Agri*food* sector that, while it embraces technology and innovation, is more focused on Agrifood producers and production. Agrifood, which includes food production and processing, is one of Northern Ireland's most significant industries. The sector is focused predominantly on livestock: cattle (beef and dairy), sheep, and poultry. A recent independent strategic review estimated that it accounted for £1.7 billion of value added to the Northern Ireland economy (approximately 3.5% of GVA) and employs over 600,000 workers in the supply chain (Kendell 2021). Consequently, Northern Ireland has developed Agritech research and development capacity in support of the sector and of technologies and practices to support animal welfare, environmental optimisation and sustainability, food and feed quality, and security. There is a significant and growing Agritech sector in Northern Ireland, and Government departments such as the **Department of Agriculture, Environment and Rural Affairs (DAERA)** and **Department for the Economy (DfE)** are increasingly seeking to leverage technologies in agrifood and to prioritise Agritech. The DfE 10x Economy strategy identifies Agritech as one of the Northern Ireland priority clusters ready to adopt enabling technologies, defining it as: "The application of innovation and enabling technologies to build competitive advantage and transition to net zero across the primary and secondary processing sectors, including genomics, traceability of food, advanced packaging, plant and animal health specialisms, and the application of AI to new agricultural methods" (DfE 2021, 22). However, there is a lack of consensus among stakeholders interviewed about what Agritech is and, consequently, the sector lacks a strong identity. That said, there also appears to be a strong appetite amongst stakeholders to change this by developing a stronger vision for an Agritech sector that encompasses actors across the supply chain and research infrastructure to both support internationally competitive Agrifood production and export expertise and technology abroad.

Geography and size: This study explores Agritech across the entire territory of Northern Ireland, but there are important nodes and geographies of activity. Unsurprisingly, the bulk of Agrifood production - farms and food processing - takes place outside of Belfast. The majority of research, innovation, and technology development is centred in universities, research centres, and firms located in the Belfast metropolitan area. Exceptions to this pattern are the **College for Agriculture, Food, and Rural Enterprise (CAFRE)**, which plays an important role in skills provision, industry support, and technology diffusion, and has predominantly rural campuses; and the planned **Agritech Centre** in Craigavon which is envisioned as an innovation hub and investment in Agritech business support (ABC Council 2022). This large geographical area means that agriculture, Agrifood, and Agritech are governed by a patchwork of different regional initiatives and local authorities and strategies at different scales.
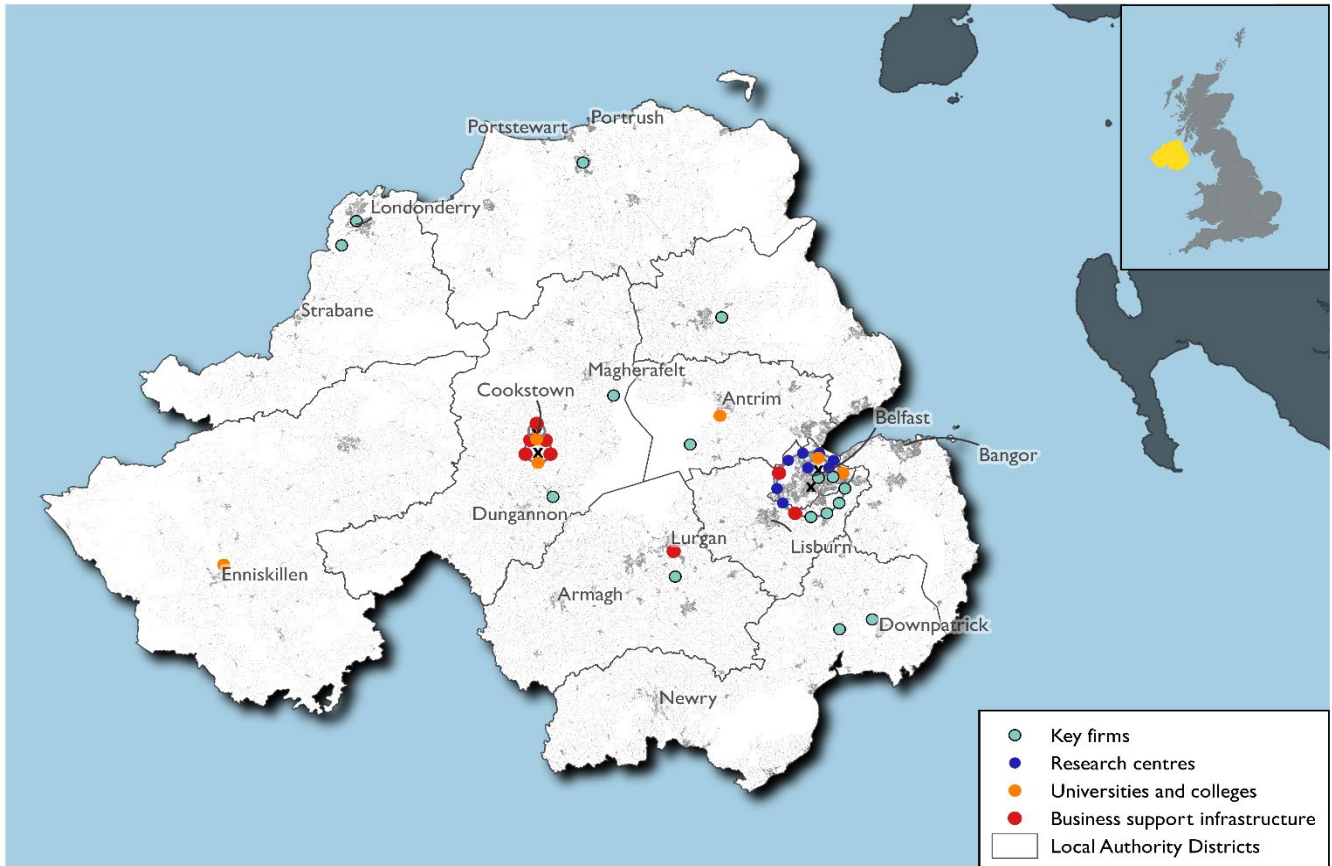
Figure 1: Northern Ireland Agritech map.

Areas of potential future growth: Northern Ireland has existing strengths in several areas of Agritech with potential for future growth. Note that many of these areas of expertise and technologies are already being combined in innovative ways and growth in this sector can be encouraged by leveraging these synergies:

- Data and digitalisation - Northern Ireland has established strength in ICT, cyber security, and data analysis; expertise that is currently being used to digitalise the Agricultural sector. Innovations are emerging in this area to process data to monitor crops and livestock, assess animal health, optimise nutrition from feed to final product, manage energy and fuel use, monitor the security and integrity of the food supply chain, and ensure environmental sustainability.
- Earth observation - Increasingly, satellites are being used to produce imaging of crops, livestock, and landscapes. The sector continues to benefit from advances in satellite networks, quality, and latency of images and on the data processing and translation required to interpret and apply insights from these images.
- AI-enabled technologies - The use of artificial intelligence and automation is also increasing in the Agrifood sector. AI is being used to detect and predict animal health issues and monitor animal welfare, as a tool to enable dynamic approaches to feeding, resource management, and to enhance sustainability. There is also increasing scope for innovation in automation of agricultural equipment.
- Optics and sensors - Earth-based video, imaging, and activity tracking technologies provide more targeted monitoring of agricultural assets, supply chains, and processing.

- Nutrition, health, and food quality - Bio- and nutritional sciences are being used to understand the nutritional implications of animal and crop care practices through to the consumer and in terms of environmental impact. Northern Ireland has also developed world-class food testing and quality assurance systems to detect and reduce contamination and counterfeiting in the feed and food supply chain.
- Agriengineering - Modern farming and food processing requires appropriate facilities. There is an emerging expertise in agricultural building design, engineering, and materials to optimise productivity and animal welfare and reduce environmental impact.
- Farm equipment manufacturing - Northern Ireland is a world leading manufacturer of equipment such as slurry tankers and delivery systems, All-terrain vehicle (ATV) equipment, livestock and crop handling equipment, mobile bulk and wet processing equipment with agricultural applications. Innovation in this area involves improving efficiency, adopting automation and utilising data generated, incorporating new materials, and reducing environmental impact.

Reflections: As the rest of this review will show, Agritech in Northern Ireland has many of the right ingredients to be a successful cluster but has not, as yet, coalesced as such. While there are strong capabilities, and industrial identities, around agriculture, food and beverage, and Agri*food* there is not yet clear leadership or vision in Agritech. The sector can build on strong foundations of expertise in ICT, data, and digitalisation, which is bringing new innovations and increasing productivity in traditional agriculture and food processing sectors. As in other clusters, enabling technologies such as satellite, autonomation, and AI are being applied to generate insights and improve outcomes. Growth potential lies at the intersection of these technologies and areas of expertise, to create technologies and practices to improve Agrifood production in Northern Ireland and feed into global markets.

Core Assets

Market structure and anchor firms: The structure of the Northern Ireland agricultural sector creates an interesting opportunity landscape for innovation. Certain segments of the market - most notably, poultry and pork - are very vertically integrated, which means that there is greater transparency and control over the supply chain. Beef and dairy have been described as quite fragmented, although these sectors are united by large cooperatives in which farmers own the processors. There are also lots of smaller and lifestyle farming operations that fragment the landscape. These structures create both barriers and opportunities for innovation and adoption of Agritech.

There were few large anchor firms mentioned in the Agritech space, most notably because the most innovative companies tended to be SMEs. The one major exception was Moy Park, a large food processing company that was frequently mentioned as adopting cutting edge technologies in relation to precision feeding, animal welfare, and reducing environmental impact.

Firms mentioned by interviewees include the following, although a more comprehensive list can be found in the InvestNI "Northern Ireland Agri-Tech: Creating the Future Through Farming" summary document (InvestNI 2018):

Data analytics and AI
- o Analytics Engines
- o Foods Connected
- o CropSafe
- o Unitas Software

- o Farm Compare
  - Sensors and optics
    - o Crop Hound
    - o CattleEye
  - Machinery and agriengineering
    - o SlurryKat
    - o Moore Concrete
    - o Erth Engineering
    - o Machine Eye
    - o Fleming
  - Biology, food/feed quality, and testing
    - o Randox Food Diagnostics
    - o Devenish Nutrition
    - o Finnebrogue
    - o McDon Substrates

These firms are among the most visible actors in the Agritech sector because of either strong local adoption, international market penetration, or both. Several interviewees noted that it was difficult to create a comprehensive list of notable companies because of silos and differences between agricultural markets that mean that there are few actors with a clear vision of the entire sector.

Higher education and training institutions: Northern Ireland has a relatively small number of higher and further education institutions involved in researching and providing skills in Agritech. However, these are very active and world-renowned programmes.

- **Queen's University Belfast** offers numerous Agritech related educational programmes that produce expertise in biosciences, data, and nutrition. It also hosts globally-recognised research centres, such as the *Institute for Global Food Security*, which investigates climate change, food production, supply chains, and fraud. The *Institute of Electronics, Communication and Information Technology* (ECIT) focuses on big data, cybersecurity, and scaleable computing. These two initiatives are among the partners in a new *Global Innovation Institute*, which combines expertise in data and food science and health to generate innovative solutions for health, food production, and the environment. The *Northern Ireland Technology Centre* (NITC) also contributes to the Agritech economy through work on advanced manufacturing, packaging, and design. A new *Advanced Manufacturing Innovation Centre* (AMIC) is also being established at the university in partnership with **CAFRE** and with investment from the Belfast City Deal. The university also houses *AgriFood Quest*, a membership organisation supporting the Agritech sector (see support structures).
- **Ulster University** hosts the *Food and Drink Business Development Centre*, which offers specialist programming and training for food and drink businesses and supports them in research and innovation. It has related course offerings such as advanced certificate in Management Practice (Developing Leaders in Agri-Food) designed to equip farmers with cutting edge business management skills. It also has strong programmes in nutritional education and environmental science.
- **College for Agriculture, Food, and Rural Enterprise** (**CAFRE**) is one of the most important sources of skills and training in Northern Ireland Agritech. It is a further education college that also performs numerous other important convening and industrial support functions (see support structures). The entire college offering is geared around agriculture, horticulture, food processing, and equine. The college has specialised *Agricultural Education Facilities* delivering training, specialised facilities, and knowledge transfer activities in dairy, beef and sheep, machinery, and veterinary nursing. It also hosts *Food Educational Facilities*

that include the Food Innovation Centre, Food Technology Centre, Food Packaging Centre, Food Business Incubation Centre, and Science Laboratories.

- **South West College** hosts the *InnoTech Centre*, which provides business services to agricultural businesses.

Other research and anchor organisations: There are several research and knowledge-generating anchor organisations in Northern Ireland that have either an Agritech focus or include Agritech development among their areas of expertise. These are also quite internationally active and are well-connected with the higher education research networks described above.

- **Agriculture Food Biosciences Institute (AFBI),** sponsored by DAERA, is a leading provider of scientific research and services to government, non-governmental organisations and commercial organisations. It is a founding member of the UK-wide network of *Centre of Excellence in Livestock (CIEL)* and participant in international research initiatives from EU Horizon projects and beyond.
- **Centre for Advanced Sustainable Energy Research** (CASE) - is an industry-led sustainable energy research centre. It does Agritech research related to anaerobic digestion and alternative energy. It is a partnership between Queen's University Belfast, Ulster University, AFBI, and InvestNI.

Support structures and infrastructure: There are several organisations that support Agritech and innovation in agriculture more generally. Here it is difficult to overstate the significance of **CAFRE** and its wide portfolio of programmes and business support offerings. So while the list of support structures here is not long, those initiatives that do exist are very well-established, respected, and effective.

- **College for Agriculture, Food, and Rural Enterprise** (**CAFRE**) is technically a further education college, but is funded by DAERA to deliver education and training as well as a vehicle to deliver agricultural programmes and policy. Among these missions is to support Agrifood and Agritech businesses with innovation and business development, which it does through a suite of support services, specialised facilities, specialist teams, technology demonstration programmes, as well as farm and business facing networking and knowledge sharing initiatives. One respondent at **CAFRE** reported that they maintain regular contact with over 3,000 farms in Northern Ireland, many of which are involved in business development groups that support peer to peer learning.
- **AgriFood Quest** is a membership-based, industry-led innovation centre that supports the Agri-food sector in Northern Ireland. It has more than 30 industry members, who work with universities and other organisations in the region to drive innovation.
- **Centre of Excellence in Livestock** (CIEL) is a network of centres of excellence based in GB that has a presence within AFBI. While to date its engagement with the sector has been limited to specific projects, its services, expertise, and networks of universities are available to companies in Northern Ireland.
- **InnoTech Centre** provides research, development and innovation services to businesses, with the agricultural sector a major focus. The centre is part of the South West College, where it is based on the Cookstown Campus. It carries out a range of knowledge transfer, CPD and education activities and supports Agritech companies within the Knowledge Transfer Partnerships (KTP) and Innovation Boost programmes through which companies employ graduates to develop new products under the supervision of College academic staff.
- **InvestNI**, the economic development arm of the Department for the Economy (DfE) was also identified as playing a significant role in business development through funding (see finance), industrial promotion efforts, and other business support programmes.

Finance: The future of the public funding and finance landscape for Agritech in Northern Ireland was described as "bleak" and as "a challenging environment" by one respondent because of political complexities and government financial constraints. However, those interviewed complimented investment in research and innovation, education and training offerings, and business support by Government to date - particularly DAERA and InvestNI. Similarly, there has been relatively steady public support for technology adoption and innovation. Some interviewees commented that firms did not always have the expertise or time necessary to complete funding applications but that knowledge about available resources was relatively high due in part to the support and information clearing role that **CAFRE** plays. Commentators suggested that there were several sources of private business finance but that the sector prefers grants and other non-repayable sources of funding - something they referred to as a "grant culture". As one noted: "I think there needs to be a little bit of resetting of industry expectations, that it can't always be a grant, and that sometimes the more beneficial support is non-financial or repayable". There are therefore potential opportunities to use the strong business development influence of **CAFRE** and InvestNI to try to shift this culture, where appropriate.

Reflections: Agritech in Northern Ireland is building on a very strong set of assets. While the research infrastructure and support streams are not as numerous as in some other Agritech clusters, it is well-established, well-resourced, and developing and supporting world-leading innovations. One advantage of this smaller pool of assets is that actors tend to be well connected and information flows relatively well. While higher education and publicly funded research are spearheading important knowledge generating projects, the role of **CAFRE** in providing skills, training, business support, knowledge exchange, and promoting innovation adoption should not be overlooked.

Skills

Talent pool: The Agrifood sector in Northern Ireland is growing, with attendant implications for talent and skills. DfE estimates that the demand for new workers in the sector could grow by 1,000 annually, with up to 10,000 new workers required in the next decade (DfE 2021, 24). A 2018 report noted that Agrifood has relied heavily on migrant workers (NIFDA 2018) while the recent independent review of the sector affirms that access to labour remains a crucial vulnerability, stating bluntly that "There is a real risk that Agri-food will end up limited, not by lack of product development but by the number of workers it can recruit" (Kendall 2021, 13).

There is growing demand for digital skills. As one respondent commented:

> One of the things we've found we don't have the skills for is digitalisation. We don't have the skills for digital manufacturing. And that covers the whole of Agritech. So, you know, we've got efficient agriculture, Agrifood industry, lots of entrepreneurs, good technically competent people who know their products and processes. But in terms of applying digital technology, or advanced technology, though, we're not there. We're not there.

This need is certainly not unique to the Agritech industry and digital skills figure prominently in the 10X industrial strategy (DfE 2021).

Local skills provision: Northern Ireland has a strong Agritech skills pipeline in Agrifood through **CAFRE**, Agribusiness through **Ulster University**, and in digital skills, data, and technology through **Queen's University Belfast**. Together, these fill the bulk of the mid- to high-skills needs. Each of these institutions is aware of emerging and future skills challenges and are developing and adapting programmes to enhance digital and data capabilities. **CAFRE** is aware of this need and is in the process

of incorporating digital and innovation skills components to ongoing course refreshes. However, it recognises that it does not have the near, or even medium, term capacity to pivot its programming quickly. One respondent suggested that strengthening skills and training collaboration between **CAFRE** and the universities could help to fill some of these gaps. This is also consistent with the 10X strategy, which suggests that meeting these needs will require working collaboratively across Government and making a joined-up approach to (digital) skills a central part of its talent strategy.

Reflections: Very few of the interviewees stressed that skills were a crucial limitation to Agritech growth. This is in part because labour force contraction has primarily affected the supply of lower-skill migrant workers and not the more innovative segments of the economy. The Northern Ireland skills provision ecosystem for higher skilled workers in Agritech and Agrifood was very highly regarded. That said, interviewees did flag concerns about the availability of digital skills and a need to coordinate efforts to ensure that these skills needs do not constrain the growth of the sector.

Knowledge Exchange

Firm research and development practices: Agritech firms in Northern Ireland were regarded as quite innovative, with many globally-recognised names in their markets. For instance, the large food and feed processing firm Moy Park was frequently mentioned as very actively engaged in horizon scanning and new technology adoption. That many of the firms listed above incorporate cutting edge technologies - such as AI - into their products and services speaks to vibrant R&D practices.

Knowledge sharing and flows: interviewees reported really strong relationships between higher and further education institutions in the region. Several initiatives, such as the **Centre for Advanced Sustainable Energy Research,** are the result of partnerships between the universities and research organisations. While existing research partnerships testify to the existence of knowledge flows between higher and further education institutions, one respondent reported that the universities were sometimes perceived as more competitive than cooperative. Both universities reported strong relationships with industry, however characterised these as predominantly bilateral rather than networks through which knowledge created was shared more broadly.

Knowledge exchange from research and business to farms and farmer is quite strong due to **CAFRE**'s strong networks and brokerage role, which was thought to enhance and increase technology adoption. The mechanism of these flows was described by one actor:

> *The universities do a lot of research, they come up with ideas, or commercial businesses launch new products and then **CAFRE** takes these, we apply it and see if they work. And if they work we show the farmers or approve the applications. So we're actually just doing sort of a knowledge transfer rather than the research. Yeah. So it goes two ways, either from universities or from commercial businesses, and we're trying to translate.*

The role that **CAFRE** plays in mediating between technology and equipment firms and Agrifood production entities is relatively unique. While it does not do blue sky research, it does engage in technology and product testing at its demonstration facilities and consults on business and product development.

Knowledge flows between businesses in Agritech generally are difficult to gauge. However, knowledge exchange is strong on the Agrifood side. **CAFRE**'s business development group (BDG) model, which is based around facilitated peer-to-peer learning, engages over 3,000 farmers. A recent paper tracked performance of participants in the sheep and dairy BDGs and found that BDGs increased their gross

margin by £109.10 and £17.10 per head respectively compared to farmers that are non-members of the BDGs (Adenuga et al. 2021, 949).

Knowledge access and cultures: As described above, **CAFRE** is instrumental in facilitating knowledge sharing and championing peer-to-peer learning, both locally and abroad. Some secrecy and reluctance to share technology and practices was reported in larger food and feed processing firms. However, it is unclear whether these are widely held attitudes that are blocking innovation potential, or whether these practices sensibly protect competitive advantage.

Firm network relationships: While a relatively strong ecosystem of firm interaction seems to have developed around **CAFRE** and its activities on the Agrifood side, the links between firms involved in technology development in Agritech are more difficult to assess. Interviewees described a few isolated attempts to bring these firms together that were thought to have generated some interest in developing specialised tech-focused groups; however, without an animator momentum stalled.

> **Reflections:** Agritech in Northern Ireland is characterised by some very strong and robust knowledge exchange networks and practices between firms and research on the Agrifood side, primarily animated by **CAFRE**. Universities reported frequent connections and knowledge exchange and collaboration with industry, although these were more likely to be bilateral, thereby potentially limiting diffusion. Networks between technology firms appear to be weaker overall than in food production and processing, although it is difficult to confirm by how much. There is an opportunity to build and strengthen networks outside of the Agrifood part of the sector.

Networks of Coordination

While there are several networks active *within* the Agritech sector in Northern Ireland, there is not (yet) one that covers, develops strategy for, and connects the entire sector. A common theme is that advocacy networks in Agrifood are quite well-developed, but that there is no analogous group uniting technology companies. Agrifood actors include the **Ulster Farmers Union**, the **Northern Ireland Food and Drink Association** (NIFDA), **Animal Health and Welfare NI (AHWNI)**, and the **Northern Ireland Grain Trade Alliance**. Many of these bring together farmers, processors, vets (where applicable), and relevant government departments.

The Kendall report (2021) outlined a "Dutch diamond" strategy, jointly developed by **Queen's University Belfast** and **AFBI**, which emphasises the importance of bringing together stakeholders - from government, research, the knowledge base, and civil society. Working together across divisions was seen as particularly important for Government, where responsibility for supporting various dimensions of Agrifood and Agritech is split between **DAERA** and **DfE** with little coordination between activities.

The diamond model was widely cited in our interviews and there is strong support for an initiative that would put the proposal into action. However, there was less agreement about who should lead it and whether a leader would, in fact, step forward.

> *There's no obvious candidate. That's not a role for governments. I mean, I don't think the universities would tolerate one being elevated to that level over the other, you know, we're not gonna have that. I don't see any [prominent business actors] stepping up.*

Initiatives such as **Agrifood Quest Competence Centre** - which unites 30 businesses with researchers at **Queen's University**, **Ulster University** and the **Agricultural and Food**

Biosciences Institute (AFBI) - facilitate and enable innovation and are potentially well-positioned to span the Agrifood/Agritech divide and bring together diverse stakeholders. **CAFRE's** role as a broker has been well-documented in this report and its already deep networks could potentially be broadened even further to facilitate a convening and strategic role. However, neither organisation has expressed an interest in being the leading cluster organisation. One respondent suggested that the diamond should be interpreted more as a "way of working" and not something that needs to be led by or embodied in a legal entity.

> **Reflections:** The lack of a central convening entity has diluted the effective development of a genuine Agritech cluster. While Agrifood has a relatively strong identity and set of linking networks, by contrast Agritech suffers from an identity crisis. One solution is to abandon the idea of Agritech as an organising principle, and build out the diamond practice through Agrifood organisation (or network) that would expand to encompass a broader technology community. Another is to develop a cluster organisation to strategise, convene, and advocate for the broader community of Agritech firms and research institutions. In either case, the cluster champion will have to be cohesive and enjoy enough support to effectively bridge the **DAERA-DfE** divide. Until the question of cluster coordination, leadership, and direction is resolved, the sector will continue to be fragmented and innovative potential restrained.

Discussion: Innovation opportunities and support needs

Evolution and market opportunities: The Agritech sector in Northern Ireland is likely to continue to grow, leveraging its strong research base and diverse group of innovative firms. Firms across the spectrum are likely to continue to integrate expertise in AI, digital and data analytics, and materials and manufacturing to increase the effectiveness of machinery and processes and to optimise animal welfare and reduce environmental impact. In the medium-term, there will be opportunities to continue to link up regional ambitions to lead on Net Zero through Agritech development and implementation.

Resilience: Brexit has had a high-profile impact on the Northern Ireland economy and will continue to affect all sectors, including Agritech. This is most likely to affect Agrifood production and is not having significant direct labour impacts on innovation. Indirectly, labour shortages and increased labour costs may reduce firms' abilities to invest in innovation but may accelerate their openness to adopting automation and other labour reducing technologies. The removal of European funding and free circulation of research and innovation professionals may constrain knowledge creation and exchange. Climate change is less of a threat to this livestock-based ecosystem, although regulations to curb carbon emissions from agriculture could further stimulate Agritech innovation if encouraged with public funding. Relatedly, as the impact of food supply chains on climate change becomes more evident, individuals are beginning to adapt their diets to consume fewer animal products. While it is difficult to predict the impact of these changes on demand in the medium and long term, these trends may constrain growth in Northern Ireland's predominantly meat- and dairy-based Agrifood sector.

Areas of potential support and intervention:

- Establish a cluster identity and leadership: Northern Ireland has almost all of the pieces in place to boast an Agritech cluster, but lacks clear leadership, governance, and most crucially, a shared identity. This research revealed a consistent theme that while the region has well-established strengths in research, knowledge diffusion, support structures and infrastructure, its identity is stronger in the Agrifood space than in Agri*tech*. However, the

tech side of Agritech is a growing part of the scene and could potentially thrive more with better connections, clear visioning, and development strategy. This will potentially be very important for the sector to respond to and leverage likely growing investment in Net Zero initiatives and food supply chain resilience.

- Develop a clearer understanding of the local Agritech supply chain and impact in international markets: Similarly, the agrifood sector has a better grasp on its local and international supply chain and potential opportunities and challenges for market development. The Agritech sector as a whole does not. The development of international markets was identified as an issue for the cybersecurity industry in Belfast and the Agritech sector likely faces similar challenges. An initiative to map and strategise around increasing international market penetration for Agritech solutions (and not just agrifood products) may multiply growth potential.
- Develop international markets: Going beyond mapping and strategy, resources might be effectively used to support international market development, increase global partnerships, and enhance knowledge exchange.
- Strongly support innovations towards Net Zero agriculture and consider diversification scenarios: Securing the resilience of such a vital sector should be a central concern for Government and for industry bodies. These actors would ideally work together to determine how to collectively achieve environmental sustainability goals without dampening existing growth.

Reflections: The group of activities that constitute the Northern Ireland Agritech sector has a lot of strengths and the sector as a whole is likely to experience significant growth. There is an emerging consensus that the single most impactful intervention to accelerate cluster development would be the creation of a cluster leadership organisation - or the adaptation of an existing structure - to strategise beyond agrifood, advocate more effectively within the fragmented Government structure, increase international visibility, and establish a shared identity for the sector. Discussions suggest that actors within the region would strongly support such an initiative but that defining the collective goals and identity around which to do strategic planning will not be simple.

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Research note

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About the Innovation Caucus

The Innovation Caucus supports sustainable innovation-led growth by promoting engagement between the social sciences and the innovation ecosystem. Our members are leading academics from across the social science community, who are engaged in different aspects of innovation research. We connect the social sciences, Innovate UK and the Economic and Social Research Council (ESRC), by providing research insights to inform policy and practice. Professor Tim Vorley is the Academic Lead. The initiative is funded and co-developed by the ESRC and Innovate UK, part of UK Research and Innovation (UKRI). The support of the funders is acknowledged. The views expressed in this piece are those of the authors and do not necessarily represent those of the funders.