

Foresight  
Study

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Evaluation  
of sector  
opportunities  
for AI in NI

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*Executive  
Summary*



**matrix.**

Northern Ireland  
Science Industry Panel

KATVR

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# **Foresight Study - Evaluation of sector opportunities for AI in NI**

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**foreword**

# Foreword

Since the publication of the “AI Research in Northern Ireland” report in 2019, we have continued to observe accelerated growth of AI enabled technologies and data driven system innovation across prominent sectors such as Advanced Manufacturing and Financial Services.

The recent pandemic has had an undoubted global impact and the long term effects will be felt by society and industry for many years. However, it is evident that technology and AI in particular will play an integral role in post Covid-19 economic recovery and cross sector innovation. In short, the need for accessible AI excellence has been fast tracked.

However, there are many application challenges to be overcome if we are to realise the full social and economic benefits of this key enabling technology. Adoption of AI is not consistent across various sectors due to a number of factors including the availability of digital skills and infrastructure, absorption capability of industry and the maturity of localised research and innovation ecosystems.

We in Northern Ireland find ourselves with a once in a lifetime opportunity with considerable public sector investments on the horizon. The Belfast City and Derry City and Strabane region and growth deals propose projects which will start to address some of the technology adoption challenges while developing further clusters of excellence across the region.

It is exciting to see the prospects that these investments will make to Advanced Manufacturing, Creative Industries and Health / Life Sciences economic growth. However, it is clear and as stated in the 2019 AI report, that the development of a Northern Ireland AI cluster can further enhance these investments providing support for the widespread adoption of AI.

It has been a privilege for Digital Catapult NI to lead on a key recommendation of the 2019 AI report focusing on the action plan for the establishment of an AI collaboration centre for Northern Ireland. It is clear that any AI cluster should be industry focused to eradicate the adoption challenges currently limiting productivity growth in many businesses and organisations.

However, we must also take this opportunity to evaluate the medium and long term sector growth for the NI economy associated with the adoption of AI technology. With the correct alignment of the City and Growth deals, the AI collaboration centre and the focus on UK government “Levelling Up” proposals, Northern Ireland can accelerate its innovation capability.

With that in mind, I was pleased to chair this foresight study to evaluate opportunities arising from AI adoption for existing Northern Ireland sectors. It is key that we identify how sectors will benefit from the adoption of AI and the impact this will have on employment and future growth.

In addition, we must understand the long term benefits for the NI economy through the development of new AI based businesses utilising industry and academic strengths. This has been evaluated within the report and I welcome the recommendations and economic insights from the Firetail team across 14 key sectors. These include traditional and high growth sectors for NI ranging from Human Health and Social Care, Biomedical and Pharmaceutical manufacturing to Energy systems and Agriculture.

I particularly welcome the report highlighting that the development of a flexible and responsive AI cluster in Northern Ireland positions the region perfectly to avail of both all-island and UK wide AI collaborations in emerging areas of sectoral strength.

Previous Matrix reports have demonstrated that Northern Ireland has the component parts to successfully scale and grow its AI capabilities. We must now act to ensure that these public investments in AI are met with focused industry adoption, the support to commercialise innovation and the ambition to reach the regions AI potential.

**Dr Adrian Johnston MBE**



**executive  
summary**

## **Executive summary**

This report brings together the findings of a sectoral foresight study of current and future opportunities of Artificial Intelligence (AI) in Northern Ireland (NI). It was commissioned by Matrix to inform the AI Competence Centre (AICC) business case.

The Department for the Economy is currently finalising the business case for this Centre, which will be a hub for industry, academia and government. To inform decisions about the AICC's approach to key sectors of Northern Ireland's economy, Matrix commissioned this study with the aim to *"help support the development of NI's AI Sector and maximise future research and commercialisation opportunities"*.

This findings report builds on a high-level briefing that was submitted to the Department for the Economy and the industry-led expert panel Matrix on September 17, 2020. The briefing provided an overview of the foresight exercise, an initial assessment of key sectors, and the framework against which the relative sector opportunities have been evaluated in the second project phase.

## **Relevance and objectives of this study**

In setting up the AICC, the Department for the Economy explored a sectoral focus as one potential route to support the impact of the centre's small team and to differentiate the AICC from similar institutions in other parts of the UK.

The objectives of this foresight study are to provide an evidence base with regards to opportunities and challenges for AI across key sectors of NI's economy, and to develop recommendations with regards to the sectoral approach of the AICC.

The study assesses the relative attractiveness of key sectors of the economy of Northern Ireland through a three-step evaluation framework that examines:

- the state of the current research base for AI in Northern Ireland,
- key sectors' roles in the Northern Ireland economy and
- the opportunities for AI to have a distinct impact across these.



## Context

The development of the AICC comes at a time where AI technologies are developing rapidly. With the potential to deliver almost £10tn to the global economy by 2030<sup>1</sup>, around 70% of companies globally are set to adopt some type of AI technology over the next decade.<sup>2</sup> As such, AI will affect a significant share of jobs, in terms of the nature and volume of jobs across different sectors and the skill requirement for these.

AI in Northern Ireland is an emerging field. The region lags behind the UK average in terms of attainable economic impact of AI<sup>3</sup> and has a high and increasing proportion of tech vacancies in comparison to other regions in the UK.<sup>4</sup> Interviewees highlight that AI research in Northern Ireland is present, but is less tightly focused or differentiated than in some other UK clusters. Current venture capital investment in NI in emerging tech and AI specifically is also lower than in other regions.<sup>5</sup>

Nevertheless, stakeholders interviewed for this research point to the significant potential for AI to develop in NI to foster sustained economic growth. Current research capabilities as well as the Belfast Region City Deal<sup>6</sup> and the Derry / Londonderry City Deal<sup>7</sup> aim to leverage the existing research and industry base to drive further adoption of AI and unlock AI funding.

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<sup>1</sup> McKinsey Global Institute, 2018, Notes from the AI frontier: Modelling the impact of AI on the world economy. Retrieved from: <https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy#part1>

<sup>2</sup> McKinsey Global Institute, 2018, Artificial intelligence: The next digital frontier? Retrieved from: <https://www.mckinsey.com/~media/mckinsey/industries/advanced%20electronics/our%20insights/how%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/mgi-artificial-intelligence-discussion-paper.ashx>

<sup>3</sup> PricewaterhouseCoopers, 2017, £2.6bn Artificial Intelligence boost for Northern Ireland's GDP by 2030. Retrieved from: <https://www.pwc.co.uk/who-we-are/regional-sites/northern-ireland/press-releases/responsible-AI-report.html>

<sup>4</sup> The Royal Society, 2019, Dynamics of data science skills – How can all sectors benefit from data science talent? Retrieved from <https://royalsociety.org/-/media/policy/projects/dynamics-of-data-science/dynamics-of-data-science-skills-report.pdf> & Carly Minsky (TechNation), 2020, UK tech jobs bounce back after lockdown. Retrieved from: <https://technation.io/news/uk-tech-jobs-growth-data/>

<sup>5</sup> TechNation, 2020, Report 2020. Retrieved from: <https://technation.io/report2020/#northern-ireland>

<sup>6</sup> Belfast Region City Deal - Innovation and Digital, 2020, About the Belfast Region City Deal. Retrieved from: <https://www.brcd-innovation.co.uk/about>

<sup>7</sup> Derry City & Strabane District Council, 2018, Delivering inclusive growth: city deal for the Derry-Londonderry city region. Retrieved from:

Throughout this study, interviewees highlighted considerable growth and excellence across the NI software sector as a significant strength for the region. This Northern Ireland asset, highlighted in the 2016 Matrix Digital ICT report, provides a strong foundation on which NI AI capabilities and skills can be built upon. The symbiotic relationship of AI as a platform technology and the software sector will be required to drive AI excellence, adoption and support skills development in sectors such as advanced manufacturing, financial services, creative industries and the public sector.

This is already paying dividends with leading companies such as Kainos and Allstate utilising its expertise in software engineering to support developments in AI. It should be noted that while the software industry is not evaluated as a standalone sector within this study it is viewed as a critical component which any NI AI Strategy must support to be successful.

## Methodology

The in-depth evaluation of the relative attractiveness of sectors of NI's economy focused on key areas of NI's economy that were identified in the first project phase. These areas included traditional sectors, aligned to the UK's SIC 2007 sector structure, as well as cross-cutting themes with a strong AI component. A full list of all 2-digital SIC categories that the traditional sectors map to can be found in Appendix II of this report.

The evaluation was guided by a three-step evaluation framework, focusing on the following areas:

1. **State of the research base:** What research assets does NI currently have to guide sector focus?
2. **Economic state of sector in NI:** What sectors are most important to NI?
3. **Opportunity for AI:** Where will AI have the biggest impact?

For each category, a number of evaluation questions and indicators guided the analysis of the traditional sectors and cross-cutting perspectives. For the traditional sectors, the assessment was further supplemented by an illustrative economic modelling exercise.

Based on this assessment, each sector received a red / amber / green attractiveness rating for each sub-category of the evaluation framework. From this, an overarching rating for each of the three evaluation categories was derived per sector. In this context, it is important to note that the red / amber / green rating is a

*relative* rating of the sectors, rather than an *absolute* rating on how well placed a sector is in itself or in the international context.

The detailed methodology that has guided this foresight study can be found in Chapter 2.

## **Sectoral analysis: Key findings**

The in-depth sector analysis is outlined in Chapter 3 and provides insights into the strengths and challenges of AI-specific developments per sector. Given their performance across most categories of the evaluation framework, five sectors were identified as relatively attractive in comparison to other sectors subject to this study: Advanced manufacturing, materials and engineering, biomedical R&D and pharmaceutical manufacturing, cryptocurrency and cyber security, finance incl. FinTech, and human health and social work. While no sector received the highest rating across all categories, these five stood out due to their relatively strong performance across most indicators of the evaluation framework. This is in addition to the 'ICT and Telco' sector, which also received a relatively positive rating which however was driven by the fact that AI technologies are inherent to the sector.

Opportunities and challenges with regards to the adoption of AI across those five sectors are briefly summarised below.

- **AMME:** The sector is one of the significant drivers of NI's economy. AI offers significant potential to reshape the sector in areas such as robotics and 3D printing. Relative to other sectors, interviewees saw a potential for the sector to have a distinct impact, as it is one of NI's key export sectors with some large companies already active in the space. This is further exemplified in the range of complementary initiatives supporting innovation in the sector, including the Belfast Region and Derry / Londonderry City Deals. To leverage its transformative potential, it will be key for sector leaders to embrace AI solutions and to focus on the sub-sectors where NI's expertise is highly specialised and exportable, such as in the area of machinery and transport equipment.
- **Biomedical R&D and pharmaceutical manufacturing:** In comparison to other sectors, a positive assessment across many evaluation categories highlights the potential for the adoption of AI in the life sciences. While a small sector in NI's economy, there are already a range of complementary initiatives in NI, and the UK more broadly, to expand the impact of AI in the sector. There is opportunity to build on existing local strengths, e.g. around diagnostics. However, given the multitude of existing initiatives, it would be challenging for new initiatives to have a distinct impact at a national and international level.
- **Cryptocurrency and cyber security:** NI has a well-established cyber security cluster that combines academic excellence with cyber security innovation in large and smaller, specialised companies. Stakeholders made the connection

between the academic cyber cluster and the emergence of the FinTech cluster. However, it is currently too small in terms of investment capital and the number of companies to compete distinctively nationally and regionally.

- **Finance, incl FinTech:** In comparison to other sectors, this sector is characterised by high AI maturity, both globally and in NI specifically. Given its strength in NI, there is some opportunity for distinct impact. This is also recognised by several interviewees who also point to the well-established cyber cluster as an area from which this sector will benefit. To build on its opportunity for distinct impact, it will be crucial that NI leverages the sector's largest players and start-ups, and builds on its expertise in building software.
- **Human health and social work:** Relative to other sectors subject to this study, this sector offers a wide range of opportunities for the adoption of AI. It is one of the largest sectors of NI's economy, with many cross-cutting initiatives and companies active in the field. There is some distinct value within NI's centralised healthcare data. However, a key challenge for impact is the current lack of industry readiness in healthcare settings.

An overview of the relative attractiveness rating and the detailed assessment of all sectors can be found in Chapter 3 of this study.

## **Sectoral analysis: Challenges of sector focus**

The five sectors that emerge from the analysis are the most attractive sectors for focus in relative terms, considering the current state of the NI economy, its research and the likely impact of AI. However, the foresight exercise and many of the stakeholders consulted reveal that in absolute terms, these sectors may not provide a sufficiently robust or distinct platform for the AICC to deliver impact at scale for Northern Ireland.

This becomes apparent when looking at the general state of the research base in NI, the economic context and the current ability of these sectors to leverage the transformative potential of AI to have a distinct impact:

- **Research:** Across the high performing sectors, research activities are being undertaken, and the City Deals have recognised this research activities as well as the opportunities for improving collaboration across research clusters in these areas. However, the amount of sector-specific research is limited and AI research clusters are still of comparatively small scale. Research is generally less differentiated than in some other AI research clusters across the UK and the question of distinctiveness in AI was raised as a *"hugely difficult question for NI"*<sup>8</sup>.

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<sup>8</sup> Stakeholder interview

Successful translational partnerships to date have been cross-sectoral, with sector skills and competences provided by commercial partners.

- **Economy:** The largest sectors of the NI economy by GVA are labour intensive with limited potential for AI. For the health and social care sector this holds true when looking at the industry readiness at the end of the supply chain in healthcare settings. Northern Ireland is an SME driven economy, which is challenging for the adoption of AI. Together, these factors mean that *“the absorptive capacity of the local economy is low”*<sup>9</sup> when it comes to AI according to some interviewees. In each of the high performing sectors, whilst there are one or two large and recognised players with in-house AI capacity, there may not be enough scale to sustain a sector-led approach.
- **AI transformation:** The five sectors identified as relatively attractive are characterised by generally high AI maturity on a global scale. Yet globally, *“for almost every industry, there are well established precedents of machine learning”*<sup>10</sup> and a sectoral approach risks *“targeting an already saturated marketplace”*.<sup>11</sup> These high performing sectors in NI face strong global competition which will make it difficult for them to achieve impact at scale. Beyond this, these sectors are already being supported in NI through a variety of initiatives and partnerships, most notably the Belfast Region<sup>12</sup> and Derry/Londonderry City Deals<sup>13</sup>, which aim to deliver sustainable growth to the region. There is an opportunity for the AICC to support and enhance existing initiatives across these sectors. The case for a distinct, AICC-owned sector focus is less clear.

## **Sectoral analysis: Implications for the AICC’s approach**

The objective of this study was to conduct a foresight exercise designed to provide an evidence base about the future to inform policy-makers’ decision-making around the AICC’s approach to key sectors of NI’s economy.

There are different approaches that the AICC could take towards sectors of NI’s economy:

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<sup>9</sup> Stakeholder interview

<sup>10</sup> Stakeholder interview

<sup>11</sup> Stakeholder interview

<sup>12</sup> Belfast Region City Deal - Innovation and Digital, 2020, *About the Belfast Region City Deal*. Retrieved from: <https://www.brcd-innovation.co.uk/about>

<sup>13</sup> Derry City & Strabane District Council, 2018, *Delivering inclusive growth: city deal for the Derry-Londonderry city region*. Retrieved from: [https://www.derrystrabane.com/getmedia/14715373-d8cd-44de-957a-e806234a3dac/6525\\_DCSDC\\_GrowthDeal\\_A4\\_Sept\\_Amended\\_PRINT-\(1\).pdf](https://www.derrystrabane.com/getmedia/14715373-d8cd-44de-957a-e806234a3dac/6525_DCSDC_GrowthDeal_A4_Sept_Amended_PRINT-(1).pdf)

- **Proactive:** The AICC would select 2-3 of the high performing sectors and proactively focus its activities from the onset on developing specific sector-expertise. This would have the advantage that the AICC could develop strong ties with a few key players in the selected sectors through focusing the majority of its engagement on these stakeholders. However, this would come at the cost of limited engagement with actors from other sectors. The AICC would be less able to facilitate the transfer of cross-sectoral technologies and skills beyond the 2-3 selected sectors. Another disadvantage of this sectoral approach is that the AICC would be less able to foster co-production and learning beyond the limited set of actors engaged in the selected sectors.
- **Responsive:** The AICC would launch without a specific sector focus. Rather, it would initially focus its activities on building an AI focused cluster that is open to all sectors. Using foresighting, it would assess emerging opportunities as they arise. If promising niche opportunities come up that offer potential for NI to have impact at scale, the AICC could adapt its activities to actively support AI growth in this area. This approach has the advantage that the AICC would not have to narrow its focus in its early stages, given that AI is still emerging across sectors in NI. The AICC would not focus its activities on developing strong ties with specific key players in 2-3 sectors. Instead, the AICC could facilitate the transfer of knowledge and skills across a wider range of sectors, thus effectively fostering cross-sectoral collaboration and mutual learning. This could for instance take the form of supporting several seed projects that foster transferable skills. The responsive approach would build on one of the key strengths of NI which is the interconnectedness of its communities. The AICC could support activities that ensure effective community building in areas where there is opportunity to further strengthen community ties, for instance across universities. This sector approach has the additional advantage that the AICC could enhance activities of already existing initiatives, such as the Belfast Region and Derry/Londonderry City Deals. It would also allow the AICC to remain responsive to supporting the priorities for a post-COVID-19 economic recovery of NI.
- **Neutral:** The AICC would not launch with a specific sector focus and would not foresee adapting its open approach to sectors in the future, rather aiming to remain a hub that brings stakeholders from all sectors with an interest in AI together. Initially, this approach has the same practical advantages as the responsive approach, namely that the AICC would not restrict its activities to a few selected actors, but could instead support cross-sectoral exchange and learning, as well as the transfer of skills and technologies. However, a neutral approach could come at the cost of missing out on emerging opportunities as they develop. If the AICC would pursue this approach, it would not adapt its activities based on new developments, thus making it less responsive to new technological developments that may warrant focused support in the future. It would also make it less responsive to supporting the priorities for a post-COVID-19 recovery as these priorities emerge.

**The in-depth assessment identifies five sectors that are relatively attractive in comparison to other sectors. However, stakeholders consulted and the analysis lead us to conclude that it is not advisable at the onset of the AICC to adopt a proactive sector approach.**

It was the view of a number of stakeholders, especially those closest to the research base and global cutting-edge practice that a more desirable model would be to focus on areas of global underinvestment in AI research and practice. This led these stakeholders to a variety of ideas, including a focus on sustainability, smart agriculture, regtech and autonomy verification/validation.

**These were narrower conceptions of a “sector focus” that drew less on local research, skills and experience and more on claiming the remaining “white space” in the AI landscape.** In this analysis, the local context is less relevant. Success with this approach would require partnerships with global firms, academic leadership and regulatory sandboxing. Whilst this approach may be more attractive, it is also seen as higher risk. The AICC may be better served by establishing itself before pursuing a global niche like this.

If the AICC were to take on a proactive sector approach, this study suggests that the added advantage for the development of AI in NI would be limited. Given the currently emerging research base and the economic context of being a small SME economy with the larger sectors not being the ones with the highest AI potential, taking a focused sectoral approach would make it very difficult for the AICC to drive impact at scale.

This is particularly relevant as one of the key strengths identified in this study is the interconnectedness of NI's communities across sectors. In addition, most AI skills are largely sector-agnostic and transferable. A responsive sector approach thus offers the opportunity to strengthen skills that can be applied in a wide range of sectors. This could for instance be achieved by supporting several seed projects that focus on the development of transferable skills that can then be applied across sectors. Similarly, many AI technologies can be applied across sectors. These reflections further align with the findings of research conducted by the Department for the Economy to inform the development of the business case for the AICC.

Instead of restricting its activities to a number of sectors at this point, a responsive approach has the advantage of allowing the AICC to focus its activities on building a strong AI focused cluster that supports actors in the local economy, strengthens the skills base and enhances collaboration. Through this, a wider set of sectors will be able to learn from one another and benefit from the development of transferable skills. This approach also aligns with the suggested pillars of the AICC, as outlined in its business case, including the pillar focused on feeding and improving the current and future workforce capabilities and the pillar on building a world class AI community through collaboration. It further allows the AICC to be responsive to priorities of economic recovery in the aftermath of COVID-19.

As AI growth will happen organically across sectors, the decision to prioritise particular sectors is best taken once there is established momentum behind niches that provide NI with an opportunity for impact at scale. Considering that key programmes that will provide investment in innovation, such as the Belfast and Derry / Londonderry City Deals, have only recently been announced, this approach also offers the opportunity to respond to developments resulting from the City Deals and to link the AICC's activities to opportunities that emerge from these initiatives.



## Recommendations

- **Build an AI focused cluster with a responsive approach to sectors:** Build an AI cluster focused on strengthening the AI community as a whole, accelerating growth and facilitating technological developments. By building this cluster on an open-call basis, the AICC will be able to focus its activities on promoting sector cohesion, co-production and learning across all sectors. As AI is an enabling technology, this open and responsive approach will support the development of an AI-enabled environment in NI where specific focus areas and leadership can emerge over time. This approach further recognises the interconnectedness of NI's communities as a key strength with untapped potential. This will allow the AICC to support the development of transferable skills and technologies that have the potential to spur innovation across a wide set of sectors, for instance through supporting seed projects that foster the development of transferable skills. By pursuing this approach, the AICC will also be responsive to the priorities of the post-COVID-19 economic recovery and it will be able to align its activities to the City Deals, while keeping the AICC open to sector-specific opportunities should these emerge over time.
- **Strengthen collaboration across actors, sectors and borders:** Given the diversity of existing initiatives and partnerships, the AICC should enhance AI collaboration across academia and industry, in NI and across the island of Ireland. Through this, the AICC could support activities that aim to foster effective community building in areas where this is currently limited. By strengthening collaboration across sectors and actors, different sectors will be able to learn from one another and skills will be easier transferrable. A responsive sector approach will ensure that the AICC will be aligned to and able to support developments under the City Deals. Several interviewees highlight particular opportunities in strengthening ties with AI players in the Republic of Ireland (RoI), given the similar geographical and economic context, the opportunities and appetite for partnerships and the fact that many global companies in attractive sectors have a presence in the RoI.
- **Build on the 'levelling up' agenda:** While specific priorities for this agenda have not yet been established, there is opportunity to strengthen NI's voice in the UK wide AI conversation. Focusing on this will also allow the AICC to respond more flexibly to funding opportunities arising through the 'levelling up' agenda and to align its activities with the economic priorities of the post-COVID-19 recovery.
- **Align activities to national strategies and the AI Council:** The UK's AI Council, an independent expert committee, provides advice to Government and high-level leadership of the AI ecosystem. Its members include the Alan Turing Institute Chief Executive, Professor Adrian Smith, as well as Professor Máire O'Neill from Queen's University Belfast in Northern Ireland. Building on this, aligning the AICC's activities to the AI Council and national strategies will ensure that the AICC can effectively take part in wider conversations around the strategic direction of AI developments. It will also be better able to respond to funding opportunities that emerge from these strategies.



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