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1 Introduction
The goal of the BDVe project is the further development of the European data ecosystem as a data-driven economy. One objective of the project is to foster collaboration and promote sharing of best practices and know-how among Big Data Centres of Excellence (CoE) and national initiatives, and to provide expert guidance and (non-financial) support to member states looking to establish new National CoE for Big Data and Artificial Intelligence (BDAICoE). As part of this work, we present this case study on the Insight Centre for Data Analytics.

Insight is Ireland’s national research Centre for data analytics which explores fundamental topics in the core of the discipline, such as statistical models and constraint programming, as well as applications and commercial projects with over 80+ industrial partners. Insight brings together leading researchers and groups from higher education institutions across Ireland, in a single, coherent research centre. The Centre orchestrates and coordinates shared research across university, research and industry/academic boundaries, to bring the optimum skill-sets to bear on important challenges, and to deliver innovation and commercial benefit.

This case study covers the first period of Insight from its formation in 2013 until 2019. It outlines the activities and operations of Insight as it takes its mission of excellent research, industry benefit, capacity building, outreach and delivering an excellent research environment. The case study details the key objectives and priorities, and the strategic actions undertaken to achieve them, from core research to industrial collaboration, from public engagement to communication, from securing funding to providing an excellent environment in which to do research.

### 1.1. Big Data and AI CoE Best Practice Framework

The BDAICoE framework is a best practice guide for use in promoting value generation and sharing of ideas within the Big Data and AI innovation ecosystem. The framework was developed following a phased design science process, starting from a literature review to create an initial framework which was enhanced with the findings.

![Figure 1: BDAICoE Framework](image-url)
of a multi-case study of existing successful CoEs. Each case study involved an in-depth analysis and a series of in-depth interviews with CoE leadership.

The BDAICoE framework has three components, and each of these is designed to cover each of the three elements defined in open systems theory that comprises of Input (Environment), Transformation (BDAICoE) and Output (Impact). Figure 1 shows the main components of the framework. Within the framework, there is a process flow in the form of a value chain starting from the Environment (which supplies input) through the Core BDAICoE capabilities (which processes the input) to the Output represented by the impact of the output received by the society under various categories; economic, scientific and societal. There is a backward flow (feedback) of value from the Impact of a CoE back to the research centre and to the Environment in which the centre operates. For example, a CoE may hire personnel it trained as a postgraduate or receive income from services rendered to a partner, which can return value to the CoE. Similarly, the impact created can influence the environment in which it operates, particularly regarding policymaking and funding decisions. The quality of output from a research centre is often the most significant determinant of funding decisions by the funding agencies.

1.1.1. Environment

The context of a CoE is heavily influenced by the external forces that demand a response from the centre; these external environmental forces can be divided into three areas:

- **Industry**: Industry is defined as the ecosystem of companies surrounding a BDAICoE, that is associated with the creation of economic value at both national and European levels.

- **Policy**: Policy is defined as the set of public laws, regulations, and policies that govern research and innovation activities at national and European level, as well as dictate the access, manipulation, and distribution of data.

- **Societal**: The societal environment of a BDAICoE comprises of state of human development as measured by composite statistics and indexes, and the national priorities for human development in terms of the United Nations Sustainable Development Goals and H2020 Societal Challenges.

1.1.2. Core Organisational Model

The main element within the BDAICoE core model are:

- **Strategy**: Strategy represents how a CoE intends to achieve its overall mission and goals.

- **Governance**: Governance in a CoE refers to the level of decision-making about strategy and operations.

- **Structure**: The structure is how a CoE is designed (i.e., levels, roles, units, decisions, rights, and accountability).

- **Funding**: Funding refers to the availability, diversity, and sustainability of the monetary support for carrying out research and educational activities in a CoE.

- **People**: People are the human capital required to carry out specific tasks towards the goals of the organisation.

- **Culture**: Culture represents the underlying values, beliefs, and norms that drive the teams and the CoE as a whole.

1.1.3. Capabilities

The framework identifies a set of operational capabilities that are needed to operate a CoE.

- **People** – People are the human capital required to carry out specific tasks towards the goals of the organisation.
• **Process** - Process is the knowledge of procedures and tasks for the achievement of the goals of the CoE.

• **Infrastructure** - Infrastructure is the systems, practices, and tools that facilitate and reinforce the work within the organisation.

• **Outreach**: Outreach is the collection of information dissemination activities with which a research centre informs the public about the science and technology developments in the centre. The aim is to enable the public to appreciate science and technology.

• **Collaboration**: Universities-industry collaboration (UIC) refers to the formal and informal engagement and interaction between a higher educational institution and an industry partner to facilitate knowledge and technology exchange as well as to provide ad-hoc advice and networking opportunity for the professionals. This can be national through the establishment of activities such as collaborative and contract research and the provision of consulting services.

Capabilities are analysed more in Table 1.

### 1.1.4. Impact

The direct and indirect ‘influence’ of research or its ‘effect on’ an individual, a community, or society as a whole, including benefits to the economic, social, human, and natural capital.

• **Economic**: The economic impact is the effect on commerce, employment, or incomes generated from big data research in general and by the CoE in particular.

• **Scientific**: This relates to the influence a research centre has on the entire science and technology communities around the world. It includes the contributions it makes to the invention of novel ideas or concepts and the

<table>
<thead>
<tr>
<th>Operational Capability</th>
<th>Definition</th>
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<tr>
<td>Business Development</td>
<td>How the centre develops new business opportunities and manages its partnerships</td>
</tr>
<tr>
<td>Collaboration</td>
<td>How the centre enhances Academic to Academic and Academic to Industrial Interactions</td>
</tr>
<tr>
<td>Research Support Services</td>
<td>The local research support services implemented by the centre</td>
</tr>
<tr>
<td>Technical Infrastructure</td>
<td>Computing resources used to support the research and innovation activities of the centre</td>
</tr>
<tr>
<td>Experimentation/Demonstration Platforms</td>
<td>The platforms that support the scientific and innovation activities of the centre</td>
</tr>
<tr>
<td>Intellectual Property (IP) and Data Protection (DP)</td>
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<td>Education and Public Engagement (EPE)</td>
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<tr>
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<td>How the centre identifies and tracks its performance and impact</td>
</tr>
</tbody>
</table>
development of general science and technology principles.

- **Societal**: This relates to the beneficial impact of the result of a research centre on the entire human society, including the impact on awareness about science and technology development, better life (improved living standard, health, and lifestyle), societal behaviour, improved organisational capabilities, and environmental care.
Case Study: Insight Centre for Data Analytics
The Insight Centre for Data Analytics is a joint initiative between researchers at University College Dublin (UCD), National University of Ireland Galway (NUIG), University College Cork (UCC), Dublin City University (DCU), and other partner institutions. These universities were previously attached to four of the earlier five national world-class research programmes including CLARITY, DERI, 4C, CLIQUE and TRIL. The unification brings together a critical mass of more than 401 researchers from Ireland’s leading ICT centres to develop a new generation of data analytics technologies in some key application areas. Each of these centres of the Insight Centre has a record of Data Analytics research before they were amalgamated in 2013 under the Science Foundation of Ireland (SFI) which is one of the Funding Agencies. The new arrangement enables better collaboration which facilitates funding opportunities. The Insight Centre is funded mainly by SFI.

Insight is the largest of the SFI Research Centres, which is dedicated to Data Analytics; Insight engages in collaboration projects with prominent research groups across Europe participating in EU-funded research projects such as H2020, and FP7. It also pursues opportunities for collaborative projects with industry partners and other organisations in Ireland and overseas. As an academic-based institution, the Insight Centre is mandated to train candidates in postgraduate courses (Master’s degree and PhD.) and to promote science as a career and to improve public awareness and appreciation of science through its Education and Public Engagement activities which are to be operationalised with KPIs from 2019 onwards.

2.1. **Research Focus**

The Insight Centre’s priority research focus includes Machine Learning and Statistics, Semantic Web, Linked Data, Media Analytics, Optimisation and Decision Analysis, Personal Sensing and Recommender Systems. While the institute is involved in the above research areas, it also aims to find solutions to problems in the areas of connected health and the discovery economy through participation in research projects whose outcomes benefit the following fields: Chronic Disease Management and Rehabilitation, Novel Personal Sensing, Connecting Health and Life Sciences, Smart Enterprise, News and Media, the Analytical Society and Discovery Analytics.
3 Environment
The environment of the Insight Centre is primarily defined according to its geographic location in Ireland and respect of its active involvement in European research and innovation programmes. The environment of the Insight Centre covers industry, policy and societal aspects.

3.1. Industry

Five sectors dominate the industrial production in Ireland: Pharmaceutical, Finance/Fintech, Food, Computers and Chemical. According to the Central Statistics Office (CSO) of Ireland, these four sectors combined accounted for 82.8% or €110.4 billion of total net selling value\(^1\) in Ireland in 2016. Enterprise Ireland (EI) spent more than €2.2bn on Research and Development (R&D) activities in 2015 out of which roughly two-thirds of expenditure was by foreign-owned enterprises\(^2\). These statistics highlight the considerable focus on research and innovation in the Irish economy.

Ireland has a well-established industrial ecosystem in software and data analytics with a significant industrial cluster of large multinational technology companies including Amazon, Accenture, Facebook, Google, and Teradata. There is a vibrant technology start-up scene with hubs developing in Dublin, Galway, and Cork. The Irish Government has committed to funding world-class research establishments in these areas by making considerable investments in two major research centres – the Insight Centre for Data Analytics (www.insight-centre.org) and the Irish Software Research Centre (LERO) (www.lero.ie).

3.2. Policy

The research and innovation policy in Ireland is primarily driven by the Department of Business, Enterprise and Innovation (DBEI). Through the report of the Research Prioritisation Steering Group (RPSG) in 2012\(^3\), Ireland has set out a specialisation strategy by recommending 14 areas of opportunity, as well as underpinning technologies and infrastructure, which should receive the majority of competitive public investment in Science, Technology and Innovation (STI) over the following domains until 2017. The 14 priority areas are:

1. Future Networks and Communications
2. Data Analytics Management, Security and Privacy
3. Digital Platforms, Content and Applications
4. Connected Health and Independent Living
5. Medical Devices
6. Diagnostics
7. Therapeutics – synthesis formulation, processing and drug delivery
8. Food for Health
9. Sustainable Food Production and Processing
10. Marine Renewable Energy
11. Smart Grids and Smart Cities
12. Manufacturing Competitiveness
13. Processing Technologies & Novel Materials

This investment decision was complemented by the launch of the *Innovation 2020*\(^4\) programme that defines Ireland’s vision of establishing itself as a global innovation leader focusing on excellence,

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talent, and impact. The programme aims to achieve a gross expenditure of 2.5% of GNP on R&D by 2020 through increased:

- Public investment in research base;
- Investment in programmes that support enterprise RDI and improved leverage of private investment;
- Number of significant enterprise R&D performers by 15%
- Private funding of publicly performed R&D to €48m per annum

DBEI implements the Innovation 2020 programme through three organisations, namely Science Foundation Ireland (SFI), Enterprise Ireland (EI), and Industrial Development Authority (IDA). Figure 2 shows how each of these organisations provides support for research and innovation at different levels of maturity.

SFI primarily funds the Insight Centre through its research centres funding model in a programme that has the following goals:

- Achieve, maintain and enhance research excellence and leadership
- Deliver significant economic and societal impact
- Increase the level of industrial and commercial impact in R&D activities with existing Ireland-based companies
- Attract large Foreign Direct Investment (FDI) in corporate R&D centres
- Spin-out new, high-tech start-ups
- Transfer technology and expertise to Irish-based Multinational Companies MNCs and Small and Medium Enterprises (SMEs)
- Undertake joint research projects with industry partners
- Educate the next generation of engineers and scientists for Irish MNCs and SMEs
- Leverage of non-Exchequer funding

Figure 2: Three main organisations funding research & innovation in Ireland (Source: Science Foundation Ireland)
## 3.3. Societal

The Irish society in general ranks very high in composite statistics which reveals the support societies around the world offer to the development of science and technology industry. Compared with the rest of the world:

- Ireland is ranked 8th on the United Nations (UN) Human Development Index
- Ireland is ranked 23rd on the Global Competitiveness Index (GCI) of World Economic Forum and scores particularly high on technological readiness, business sophistication and innovation.
- Ireland is ranked 10th on the Global Innovation Index (GII). Specifically, Ireland holds a leadership position regarding two key outputs of innovation: knowledge impact (2nd) and knowledge fusion (1st).

In a recent report on the Irish perspective on the 9th EU Framework Programme, Ireland was reported to have supported the alignment of national strategies with the United Nations Sustainable Development Goals (UNSDGs). Table 2 below contains a summary of the environmental factors affecting the Insight Centre operations.

<table>
<thead>
<tr>
<th>Area</th>
<th>Practice</th>
<th>Keywords</th>
</tr>
</thead>
</table>
| Industry | • Irish industry is dominated by four sectors – Pharmaceuticals, Food, Computing and Chemicals  
• An established industrial ecosystem with tech MNCs that invest significantly in R&D  
• Emerging start-up community                                                                                                               | 8th on UN UNHDI                                                        |
| Policy   | • DBEI, a dedicated agency, provides research policies;  
• 14 areas of research are identified as national priorities;  
• Innovation 2020 sets 2.5% of GNP on R&D till 2020;  
• SFI, EI & IDA are focused on research initiatives  
• Government funding supports are provided  
• Government policy focuses on industry-academic collaboration with R&I  
• Focus on increasing enterprise R&D                                                                                                         | 23rd on GCI                                                           |
| Societal | • Ireland is ranked 8th on the UN Human Development Index  
• 23rd on Global Competitiveness Index  
• 10th on the Global Innovation Index.  
• Leads on Knowledge Impact (KI) and Knowledge Fusion rankings (KF)  | 8th on UNHDI; 23rd on GCI;10th on GII;KI (2nd) & KF (1st)             |
4 BDVCoE Core Model
This section provides a detailed analysis of the Insight Centre according to the core elements of BDVCoE model.

4.1. Strategy

Insight mission: “At Insight, we undertake high impact research in data analytics that has significant benefits for the individual, industry and society by enabling better decision making.”


As an overview of the strategic direction, the Insight Centre focuses its research efforts mainly on two basic areas: Data Science and Data Analytics. Data Science is a multi-disciplinary research domain which draws expertise from Mathematics, Statistics, Machine Learning, Data Mining, Image Analysis, Multi-modal Data Analytics, Semantic Theories, Data Engineering and Data Management, Pattern Recognition, Uncertainty Modelling, Artificial Intelligence, Optimisation Solutions, and High-Performance Computing. Data Analytics, although requiring the same range of expertise, deals with Decision Support, Knowledge Discovery and the development of new technologies in a range of scientific and technological application domains, such as Health and Human Performance, Smart Communities and Internet of Things, Enterprises and Services, and Sustainability and Operations.

The Insight Centre assumes the responsibility to assemble researchers and other related talents in these two broad domain aspects from worldwide sources to develop technologies, data infrastructures and systems applicable in four major domain thematic areas namely (1) Health and Human Performance, incorporating Connected Health, Sports Science, Pharmaceutical and Healthcare systems; (2) Smart Communities and the Internet of Things, incorporating Smart Cities, Smart Networks, Connected Mobility and public services; (3) Enterprises and Services incorporating Smart Enterprises, financial services, news and media, retail and customer engagement and (4) Sustainability and Operations, including Smart Manufacturing (industry 4.0: logistics, agriculture/food analytics, marine analytics and the environment).

Research Strategy

The Insight Centre’s long-term strategy combines scientific excellence in delivering social and economic impacts. To a large extent, this strategy that relies on the leadership, expertise and hard work of its leading researchers has been successful in plotting a course for achieving these ambitious targets. In addition to leading and partnering in multiple EU projects over the period 2013-2017, the Insight Centre’s researchers have taken up leadership roles in key national and European initiatives; developed a coherent and effective method for influencing EU research priorities and helped in pushing for Ireland’s engagement in large research infrastructures.

Strategic Goals

- To pursue scientific excellence in data analytics and its applications
- To pursue excellent research and innovation as a single integrated national centre with critical mass and scale
- To deliver a beneficial impact on our industrial partners and the Irish economy and society
- To create and grow strategic partnerships with other research institutions, in Ireland and overseas.
- To foster a new generation of data scientists in Ireland, equipped to pursue the opportunities of Data Analytics in science, industry and beyond
- To attract and retain the best researchers, by providing a supportive, collegiate and stimulating environment that rewards excellence
• To inform and enthuse the general public, and students in particular, about data science and its value to society

• To facilitate discussion and understanding of Data Analytics, its applications and limitations, its ethical aspects and societal value, in the public arena.

• To grow our profile as a world-renowned centre in Data Analytics and its applications

• To grow and diversify funding to sustain the long-term development of the centre.

Research Areas

As shown in Figure 3, Insight has identified and stated seven priority areas of research: Linked Data, Semantic Web, Machine Learning and Statistics, Media Analytics, Optimisation and Decision Analytics, Personal Sensing, and Recommender Systems. The outcomes of various research projects conducted in the Insight Centre are expected to benefit the following fields:

• Chronic Disease Management & Rehabilitation
• Novel Personal Sensing
• Connecting Health & Life Sciences
• Smart Enterprise
• The Future of News and Media
• The Analytical Society
• Discovery Analytics

4.1.1. Strategy Formulation

The formulation of strategies goes beyond the senior management group; it is down to everyone working in the centre, including researchers and students. The process of soliciting contributions to strategy design is inclusive. For example, Insight Galway holds annual general strategy meetings to gather ideas from everyone on how to advance the institute. The Centre engages in a dialogue with industry stakeholders and the host universities (or as “partners”). A wide level of dialogue is necessary to design robust strategies for the Insight Centre for Data Analytics. Similarly, the need to dialogue with the wider stakeholders, including industry and researchers from the Data Analytics ecosystem, for strategic issues is also an important part of the strategy formulation process.

In terms of the importance or priority of the strategies of the Insight Centre, the need to have set out strategies and dialogue with stakeholders is regarded as very crucial for future success. This is because other strategies are based on these two main strategic goals; for example, some stakeholders recommend other important issues or areas of research endeavours that are worthy of exploitation or development of relevant capabilities. Some stakeholders may prefer the development of an international profile, while others suggest the development of national and local priorities.

In general, the Insight Centre has identified and stated its priority research areas and their applications domains that are being focused on. To prioritise, the Executive Committee and Senior Management team regularly hold consultative
meetings with staff and external stakeholders to reassess, redefine and refine the centre’s priorities to meet changing circumstances.

4.1.2. Alignment of Key Performance Indicators with Strategy

The Insight Centre measures KPIs bi-annually, annually and every two years, according to SFI recommendations\(^5\) regarding stated strategic areas using the KPIs. A set of strong KPIs has been imposed by the centre’s financial sponsor (SFI). The Insight Centre’s KPIs, which have been operationalised, cover a lot of the impact areas, such as economic, commercialisation, academic, etc.

Table 3 contains a summary of the Strategy of the Insight Centre.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearly stated research strategy with goals, objectives, and research areas</td>
<td>Strategy and objective</td>
</tr>
<tr>
<td>Aligned with national and European research and innovation priorities</td>
<td>Aligned with national and European priorities</td>
</tr>
<tr>
<td>Seeks to influence national and European research and innovation priorities</td>
<td>Influence national and European priorities</td>
</tr>
<tr>
<td>Senior Management formulates strategy and objectives</td>
<td>Strategy/objectives formulation</td>
</tr>
<tr>
<td>Widespread consultation for the formulation of strategies including dialogue with stakeholders in the research ecosystem</td>
<td>Widespread consultation</td>
</tr>
<tr>
<td>Centre uses KPIs for measurement of its performances regarding objectives, goals, mission and vision</td>
<td>Strategy / KPIs alignment</td>
</tr>
<tr>
<td>Centre KPIs cover impact areas including economic, commercialisation, and academic with some KPIs imposed by main funder SFI</td>
<td>KPIs aligned with funders’ agenda</td>
</tr>
<tr>
<td>Operationalised plans are aligned with KPIs</td>
<td>Operationalise KPIs</td>
</tr>
</tbody>
</table>

4.2. Governance & Structure

4.2.1 Governance

The Insight Centre has established and followed a governance model that emphasises accountability and openness. A Governance Committee (Figure 4) has strategic oversight of all centre activities and is formed, predominantly, of non-academic members, chaired by an external industry representative. The centre has a clear set of objectives and KPIs, which are monitored to gauge progress continually.

The Governance Committee (GC) is the cornerstone of Governance of the centre and reports to the four Presidents. The GC is primarily responsible for the governance and operational oversight of the Insight Centre, and it reports to the Presidents of all the co-lead universities. The Senior Management of the centre reports to the

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\(^5\) Roche, S. et al. (2013) ‘Science Foundation of Ireland Research Centres Programme: Overview of Research Centres Programmes’.
Governance Committee (GC) that is further supported by the Industry Advisory Committee (IAC), Scientific Advisory Committee (SAC), and Inter-institutional Committee. Each of these committees comprises of relevant experts from industry and academia.

A total of 22 GC meetings have been held since the inception of the centre, demonstrating the level of commitment of its members. The GC met on a monthly basis during the Insight Centre’s start-up phase, moving to quarterly meetings, and now the GC meets at least twice per year. The meetings include a review of the centre’s progress with the CEO and members of the EC, and covers topics relevant to its bi-annual Governance Committee report for SFI, including strategy, operational management and governance, financial management, research programme, industry partner engagement, NE-NC funding, technology transfer, risk management, Education and Public Engagement (EPE) and communication.

The Industry Advisory Committee (IAC) has also met on a bi-annual basis, since its inception. It has 13 members with a mixture of Irish and international, MNCs and SME members. It has positions for a chairperson and a vice-chairperson, with the remaining members selected from industry partners of the centre. The IAC reviews the Insight Centre’s industry partner engagement and commercialisation strategies and advises the CEO and EC accordingly. Following its meetings, it submits a report to the CEO and the Governance Committee.

The Scientific Advisory Committee (SAC) has 11 internationally renowned scientists and also meets on a bi-annual basis. It holds joint meetings with the IAC to provide cross-fertilisation of ideas and strategies for the EC. It is a chairperson and a vice-chairperson. Other members of this committee are from renowned academic institutions such as Rensselaer Polytechnic Institute, New York, Carnegie Mellon University, Pittsburgh, Glasgow University, and Scotland. The SAC advises on the development of research strategy and reviews the research progress of the centre, and also produces reports for the CEO and Governance Committee.

The Inter-institutional Committee (IIC) has provided valuable assistance to the CEO in resolving any inter-institutional issues that have arisen and meets quarterly at a minimum. Its membership consists of the Vice Presidents of Research (VPR) from the four co-lead institutions and their CEOs.

4.2.2 The Functioning of Governance Hierarchy

The Information interview of the Insight Centre confirms how the governance hierarchy works as indicated in the paragraphs above regarding the various committees’ support to the GC. However, there is frequent feedback from the GC through the centre executives (including the Insight NUIG Director) to update the rest of the centre members – researchers, administrative staff and students. Feedback dissemination is normally done through weekly general meetings and the weekly newsletter produced by the Insight Centre CEO. The feedback dissemination demonstrates the fulfilment of accountability and openness upon which the centre’s governance policies and
structure are based. It also introduces transparency in reporting and management commitments to the stakeholders of the centre.

Table 4 contains a summary of the Governance practices of the Insight Centre.

### 4.2.3 Organisational Structure

The Insight Centre’s organisational structure (Figure 5) adheres to SFI’s guidelines for the management and governance of research centres. The Insight Centre is managed by the Executive Committee (EC), which is chaired by the Chief Executive Officer (CEO) and includes four Site Directors from the co-lead institutions (DCU, NUI Galway, UCC and UCD), the Business Development (BD) Manager and the Chief Operating Officer (COO), each of whom has their own group roles and responsibilities. The EC is advised by the IAC and SAC, and the Inter-institutional Committee (IIC) as it fulfils its mandate to manage the centre on a day-to-day basis. The CEO reports to the GC, which in turn reports to the Presidents of the four co-lead institutions, who report to SFI, and are ultimately responsible for ensuring that the Insight Centre fulfils its contractual obligations to SFI.

The management structure at Insight has served the centre well – it ensures representation of all of the four co-lead institutions at the EC level. Similarly, it allows for BD, management and other functions at each site, while providing centralised coordination and integration of the activities across sites for consistency and synergy across the centre.

From a research-structure perspective, this organisational structure facilitates collaboration at the level of discipline-specific research groups through skill-sharing and intra-unit collaboration. The research group model is agnostic regarding the site – researchers can be associated with any research group, regardless of their place of work. Some research groups have their majority of members from a single site. This reflects the specific interests and long-term strengths of that particular institution. From an impact perspective, this structure is also very appropriate and enables the centre to work as a national-level entity in pursuing new industry collaborations, contributing to policy, and developing outreach programmes while remaining locally accessible, flexible and agile in response to specific relationships and opportunities.

**Executive Committee (EC):** The EC includes the CEO, COO, four Site Directors (representing DCU, NUI Galway, UCC and UCD) and the BD Manager. The CEO chairs the EC and is the final decision-making authority. The EC meets in person on a monthly basis to discuss matters including:

<table>
<thead>
<tr>
<th>Practice</th>
<th>Keyword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance that emphasises accountability and openness.</td>
<td>Accountability/openness.</td>
</tr>
<tr>
<td>GC members are mainly non-academic and chaired by an external industry representative. GC meets CEO and EC on a quarterly basis for strategic oversight of all activities.</td>
<td>GC’s responsibilities</td>
</tr>
<tr>
<td>A Bi-annual reporting on strategy, operations, financial &amp; risk management, research programme, industry partners, NE-NC funding, technology transfer, EPE &amp; communications</td>
<td>Bi-annual reporting arrangement plan</td>
</tr>
<tr>
<td>The IAC, SAC and IIC – all are composed of academic and industry experts. They support the GC, but each committee a specific role</td>
<td>IAC, SAC &amp; IIC support GC</td>
</tr>
<tr>
<td>Feedback demonstrates to the stakeholders the fulfilment of accountability, openness and transparency. Regular feedback meetings are hosted.</td>
<td>Feedback loop</td>
</tr>
</tbody>
</table>
• Strategic developments
• Research and industry partner collaborations
• New opportunities
• Interactions with the GC, IAC, SAC, IIC and SFI
• Future plans
• Human resources and finance

• EPE and communications,
• Risk management

Scientific Leadership Group (SLG): To effectively manage the broad spectrum of complementary science at the Insight Centre, the centre has a Scientific Leadership Group (SLG), chaired by the CEO, which brings together the research group leaders, Principal Investigators (PIs) and Funded Investigators. The members of
the SLG are the co-PI's, Research Group Leaders (RGL) and their deputies, where appointed. However, the SLG is open to all the Insight Centre-funded PIs and FIs, and other Insight Centre researchers invited at each Site Director’s discretion. The SLG prepares proposals on scientific matters for the EC.

The Site Directors are members of the EC and are responsible for managing all aspects of the Insight Centre at their respective sites, including research and operations, with duties that include the management of the relationship between the Insight Centre and their respective institutions, recruitment, personnel, finance, space and facilities, and so on. The Site Directors are the local budget holders for the Insight Centre SFI grant. Each Site Director is responsible for their relevant institute for all aspects of local institutional governance and management.

The central operations, run by the COO, provide operational support services across the Insight Centre. The roles include financial management, IP management, reports coordination, administrative support, grants support, website management and the (outsourced) communications team.

The BD Manager has overall responsibility for the business development function of the centre, including managing the implementation of the centre’s business development strategy and ensuring achievement of the centre’s industry cost-share and commercialisation targets, goals and objectives.

The governance structure recognises a level of independence in operations and management of the various sites. However, the structure also strongly facilitates collaboration among sites which is important for the centre to function properly.

Table 5 contains a summary of the Structure practices of the Insight Centre.

4.3. Funding

Insight follows a Shared Cost Model, as defined by SFI since 2013, where SFI provides 70% of the funding while industry must contribute the remaining 30%. The industry’s contribution should be at least 10% in cash funding, and the balance 20% can be contribution in-kind. All research centres funded by SFI are structured using a Hub-and-Spoke model (Figure 7). In this model, platform research in the hub addresses longer-term research goals of benefit to the wider centre membership. The spokes are Targeted Projects involving one or more of the industry partners that are focused on delivering technology and intellectual property tailored to the company’s needs.
In addition to its core funding of €88 million from SFI, the Insight Centre has a diversified profile of funding sources which is a reflection of the move towards a mixed model of diverse funding sources: National, Industrial and European funding (Exchequer and Non-Exchequer):

- **Non-Exchequer-Non-Commercial (NE-NC) sources:** The Insight Centre has been awarded research income for 44 European research awards. To further increase this in-flow, the Insight Centre is actively participating in future proposals and expects to improve the number of awards by the end of 2017. These research awards include projects from the Horizon 2020 programme and the European Research Council (ERC).

- **Commercial Sources:** The Insight Centre receives income from the industry in the form of cash in the bank and in-kind contributions from contracts that are fully funded by industry partners. The centre aims to cover 30% of its total funding through such commercial sources.

- **Spin Out Companies:** The Insight Centre has eight spinout companies formed since its inception.

- **Commercialisation Awards:** The Insight Centre researchers have secured 80 Enterprise Ireland (EI) feasibility and commercialisation grants for early-stage, pre-incorporation work. The Insight Centre’s use of EI funding schemes for feasibility and commercialisation studies has played a significant role in enabling a

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**Table 6: Summary of Funding for the Insight Centre**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>The funding model is for a 6-year cycle and addresses long-term objectives, e.g. Core research services that provide industry partners’ technology and Intellectual Property (IP) needs</td>
<td>Long-term funding</td>
</tr>
<tr>
<td>Targets a mixed model of diverse funding sources: national, industrial and European funding (Exchequer and Non-Exchequer)</td>
<td>Funding diversification</td>
</tr>
<tr>
<td>Pursues research commercialisation opportunities including licensing and spinouts</td>
<td>Commercialisation opportunities</td>
</tr>
<tr>
<td>The Insight Centre participates in projects from various categories of EU sponsored initiatives such as H2020 and FP7 programmes from which it earns a considerable sum of money and research reputation</td>
<td>EU projects</td>
</tr>
<tr>
<td>The Insight Centre participates in collaborative projects with industry partners usually sponsored by the partner. This provides sources of direct industry funding and can lead to IP transfer.</td>
<td>Collaborative contract</td>
</tr>
</tbody>
</table>
culture of entrepreneurship within the Insight Centre as an organisation.

- **Licence Agreements (LAs):** A total of 54 licences have been granted to the Centre which reflects the applicability and impact of the Insight Centre’s research output.

SFI is moving towards a model that requires more industry contributions and EU projects. Consequently, this has caused an increase in industry proportion as part of funding sources. Direct industry funding is a source being pursued more aggressively because it leads to collaboration with industry participants on important projects that benefit both the partner and the Insight Centre. The Insight Centre highly values such projects involving Fujitsu, Elsevier and RTE. Another important point to note is that if an industry partner funds a project in its entirety, then the industry partner owns the IP. In contrast, if the industry partner funds part of a project (e.g. a targeted project) where the other part of the funding comes from SFI, then the University owns the IP.

### 4.4. People and Culture

#### 4.4.1. People

In terms of human resources, the Insight Centre’s main objective is to get highly skilled and enthusiastic workers into the Centre irrespective of race, gender, and nationality. What matters is the quality of personnel, their suitability for the organisation and passion for Data Analytics. The main people practice of the Insight Centre aiming at improving their welfare and mental state are provided in this section with a summary in Table 7. An important fact is that the main Human Resources policies are provided by the co-led universities of the Insight Centre, which includes NUIG, UCD, DCU and UCC.

- **Diversity of staff:** The Insight Centre employs a diverse range of people at the research and management level. Nearly half of the staff consists of research students at PhD and MSc levels who drive the primary research activities. Nearly one-third of the staff is female, and more than one-third of the personnel have non-

<table>
<thead>
<tr>
<th>Practice</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Insight Centre’s main objective is to get highly skilled and enthusiastic workers irrespective of race, gender, nationality, or religion.</td>
<td>Skill quality</td>
</tr>
<tr>
<td>Core HR policies are provided by the host institutes (NUIG, UCD, DCU and UCC)</td>
<td>People</td>
</tr>
<tr>
<td>Staff diversity – catering for good gender mix among researchers and students and local/international personnel proportions</td>
<td>People</td>
</tr>
<tr>
<td>Young researchers are given opportunities to work on research and industry projects. They are encouraged to apply for grants and become leaders in project work packages</td>
<td>People support</td>
</tr>
<tr>
<td>Female PhD members are offered financial support during maternity leave</td>
<td>Female support</td>
</tr>
<tr>
<td>The Insight Centre looks to attract international researchers and develop the careers of young researchers.</td>
<td>Admin / Operations</td>
</tr>
<tr>
<td>Personal skills development, e.g. public speaking, person-to-person communication</td>
<td>Training</td>
</tr>
<tr>
<td><em>Unconscious Bias</em> training is done in the centre to eliminate preferential treatment</td>
<td>Training</td>
</tr>
<tr>
<td>The Insight Centre advertises a vacant position in both local and international forums</td>
<td>HR sourcing</td>
</tr>
</tbody>
</table>
Irish nationalities. The International staff of the Insight constitutes approximately 40% of Insight’s 400 researchers (including PhD students and professors) who joined from overseas. The Insight Centre maintains a supportive and encouraging environment, where researchers are supported in taking increasing responsibility with career progression in new research directions and building a range of skills within and beyond data science. PhD students are managed and supported in completing their research projects with the help of the Graduate Research Committees.

- **Support for Young Researchers**: Postdoctoral researchers are given ownership of research Work Packages (WPs), and industry Targeted Projects (TP) responsibilities. They are also trained and encouraged to apply for grants, form their research teams and become leaders in their own right.

- **Recruitment excellence**: All of the institutions involved in the Insight Centre have achieved the HR Excellence in Research awards from the EU in recognition of best practice policies and procedures, all of which is implemented by the Insight Centre in the recruitment of its researchers. To recruit high-quality researchers, the Insight Centre advertises open positions in international forums. For example, it recently advertised vacancies in one of the UK forums. It also uses personal contacts to carry out “cross-pollination” of best practices for hiring researchers.

- **Supporting female staff**: The Insight Centre is the first SFI-funded research centre to offer financial support to female PhD students on maternity leave. Furthermore, all co-lead institutions hold the Athena SWAN Bronze award for positive gender practice in higher education.

- **Unconscious Bias Training**: To support specific practices for gender balance, the Insight Centre indulges in a programme named ‘Unconscious Bias’. This is an important training which takes place in the centre intending to eliminate any element that may cause a staff member to treat another differently either positively or negatively based on gender or background.

### 4.4.2. Culture

Culture in the Insight Centre is critical to the success of collaboration practices at the centre at large as an organisation. This is because cultural practices enable people to accept common goals or partnership. It is a part of what makes the Insight Centre what it is today. Otherwise, it would not survive the challenges arising from the fact that members of the Insight Centre are a mixture of multi-ethnic, multicultural, multi-religious and multinational backgrounds. There are several cultural practices at the Insight Centre; however, the various divisions tend to maintain different practices.

Cultural and welfare practices at the Insight Centre are traceable to its success in that culture and welfare practices provide the advantages summarised below. Culture and Welfare practices help the Insight Centre in:

- Getting people (members of Insight) together
- Giving them a sense of common purpose, goal and identity or belonging
- Providing mental and physical health and a feeling of well-being

Without cultural and welfare practices, people will be in the same building, but they may not know themselves very well, or they might lose track of their common goal, interaction and a sense of togetherness. These attributes do not help in achieving common goals. Many of the specific examples of cultural practices provided below are features of the Insight Centre, NUI Galway, but may be replicated in some forms at other sites.

- **Listening Lunches**: Insight promotes family-friendly gatherings to enable staff to balance
their professional with personal commitments, which is of benefit to all staff. Insight initiatives are complemented by institution-led initiatives, such as Listening lunches, providing a forum for Insight staff and students to share their experiences of centre and university culture with the University President and Human Resources Director.

- **Unconscious Bias Training:** Unconscious bias training for all staff that are engaged in recruitment and promotion activities, coaching for Managers on how to manage work-life balance, core hour policies, and returners’ grants for academic staff. The four co-lead institutions are currently rolling out formal Unconscious Bias training for all of their employees.

- **International Day and Inter-cultural Event:** The International Day is a practice of the Insight Centre, NUI Galway and it is not just 'a day', it spans several days where people working in the Centre organise intercultural events to try to get people together as a community. Also, regarding the welfare programmes, the Outreach Officer encourages members of the Insight Centre to participate in social events. For example, cycling and walking activities that bring people out of the office environment into the greater countryside are regularly organised. The objective is to give participants (staff and students) the awareness of the heritage and tradition, as well as the physical landscape, of the country they live in. By contrast, while the multicultural day events are in-door events, cycling and walking trips are outdoors. We consider these outdoor events as part of the cultural practices because people are the bigger part of the culture (of the society) that you live in and these events are good for people to experience at first hand as a community and also are mentally refreshing.

### Table 8: Summary of Cultural Practices of the Insight Centre

<table>
<thead>
<tr>
<th>Practice</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed geographically, the Insight Centre maintains a culture that enables collaboration on works that mutually benefit all sites</td>
<td>Collaboration</td>
</tr>
<tr>
<td>Cultural practices promote awareness, regular contact and teamwork, communication and dissemination activities (meetings, symposia &amp; Centre communication systems, annual intercultural day)</td>
<td>Workforce inclusivity, communication and dissemination</td>
</tr>
<tr>
<td>Staff and student welfare programmes are employed. i.e. Listening lunches</td>
<td>Welfare programmes</td>
</tr>
<tr>
<td>‘Unconscious Bias’ training is done in the centre to eliminate preferential treatment</td>
<td>HR practices</td>
</tr>
<tr>
<td>Encouragement of social events such as cycling or walking tour to provide a sense of awareness about the physical environment and well-being for people</td>
<td>Socials for well-being</td>
</tr>
<tr>
<td>Welfare programmes, e.g. talks on mental health and other issues, like waste recycling and societal health</td>
<td>Welfare &amp; health</td>
</tr>
<tr>
<td>Support for ‘inclusivity’ in recognition of the benefit of diversity</td>
<td>Inclusivity</td>
</tr>
<tr>
<td>Institute weekly meeting promote the spirit of togetherness</td>
<td>Meetings</td>
</tr>
<tr>
<td>Community volunteering: may overlap with EPE but the aim is to be involved in the Community Knowledge Initiative (CKI)</td>
<td>Volunteering</td>
</tr>
<tr>
<td>Gender equality – addressing the gender disparity problem</td>
<td>Equality</td>
</tr>
</tbody>
</table>
Culture is practised in a manner to enhance interrelationship and what the Insight Centre is trying to encourage more, is the development of communication capabilities, both at personal level [person-to-person] and in terms of public speaking and presentation.

- **Staff and student welfare programmes:** Welfare programmes are employed at the Insight Centre, but a lot of them are provided by the host university (i.e. NUI Galway). Regarding the objectives of the programmes, the Insight Centre encourages welfare practices, such as talks on mental health and other issues relating to waste recycling and societal health, but these are on an ad-hoc basis. Furthermore, the Insight Centre NUI Galway organises other programmes that support inclusivity, which entails bringing people together and recognising the benefits of diversity.

- **Institute Weekly Meeting:** The Institute weekly meeting is an important initiative because it creates opportunities for people to come together, relax and listen to the works that have taken place in the Insight Centre. It is also a moment to meet individuals that you would not often meet except at the weekly meeting. The meeting starts with a short presentation on a scientific centre-related topic (i.e. EPE). This is then followed by a group discussion and individual updates on travels for collaborative work or conferences attendance, project-related updates, announcements such as joining or leaving the centre, and any other weekly matters. In the Institute meetings, members are encouraged to deliver talks about their respective countries – a recognition of the centre’s diversity. In this manner, inclusion and diversity can be managed to work together.

This practice creates a family culture, giving people a feeling of belonging, in particular. Moreover, the Institute meetings allow its members to reflect, find out, be updated on what is happening around, and appreciate other activities within the organisation that they may not be aware of.

- **Community Volunteering:** This event overlaps with Education, and Public Engagement (EPE) explained in the next section; however, it is mainly about culture. The idea is about getting involved in the community; the Community Knowledge Initiative (CKI) programme is excellent, which involves working with asylum seekers and in community gardens by planting trees. The aim is to get outdoors, and this is important for mental and physical health, as the people get involved.

- **Gender Equality:** As an entity under NUI Galway, the Insight Centre has started addressing the gender disparity problem to meet the acceptable standard. Gender equality is not the same as gender balance. Whereas gender equality preaches no discrimination against women (in offering opportunities) gender balance, on the other hand, advocates an equal percentage of gender representation.
5 Capabilities
Many definitions of the concept exist without a clear consensus on the nature of the transfer process;

5.1. Business Development

Besides appointing executive officers with industry backgrounds, the Insight Centre has created a dedicated role in Business Development to sustain a continuous engagement process with local and international industries. Although not completely separate from collaboration practices, the role of Business Development is so important that it has to be explained in a dedicated section of its own.

In this context of BDVCoE, Business Development (BD) practices target industry stakeholders to bring them into collaborative research and innovation activities or exclusive funding of a project of mutual benefit to all parties. This may lead to commercialisation agreement in the form of licences (e.g. Intellectual Property) or spin-out funding, and related commercial activities. The Business Development role is primarily responsible for bringing in funded collaborative research projects that could be either fully or partly funded by the company or partially funded by SFI and the company. The role is also responsible for innovation support, but the commercialisation and licensing aspects are now mainly done by the Technology Transfer Office (TTO). Each site of the Insight Centre has a local Business Development executive who is coordinated by a central Business Development function.

The Business Development Officer is highly involved in the progress of the Centre, particularly in helping to facilitate technology transfer from lab to industry. The contributions of BD are enumerated below.

1. The BD Officer can be a single point of contact between the organisation and the industry.

2. The BD role begins a conversation between the centre and an industry partner. This is done in collaboration with the Technology Transfer Office (TTO) at NUI Galway. The BD helps to execute some duties (e.g. legal and IP issues) off the shoulders of researchers to allow them to focus on the development of scientific and innovation activity. Strictly speaking, legal and IP issues are not part of the BD role but the BD role usually interfaces with the people of the university who handle contracts, e.g. Technology Transfer Office at NUI Galway.

3. The BD role provides the Insight Centre with a consistent interface with industry. This is valuable for the research organisation, as it keeps the industry aware of the centre’s outputs and capabilities and brings in collaborative contract projects. It also makes it easier for an industry partner to navigate across a complex organisation with many units, like the Insight Centre.

4. The BD role relays feedback from the industry to the centre on emerging trends of relevance to the former.

5.1.1. Strategic Project Management

The position is occupied by the Strategic Projects Manager (SPM) beginning in April 2018 as a centralised role for the entire Insight Centre. The incumbent is an expert who has a strong background in ICT and a proven experience in dealing with government agencies with experience on management of significant projects within an industrial environment. The Strategic Projects Manager is a key position within Insight to ensure the success of ambitious and complex programs. The strategic project management role is to initiate and develop engagements with key MNCs and SMEs, centring on agreed common focus areas. The purpose of the role is to identify and finalise with the Industry Partners some goals in connection with focus areas such as the recruitment and development of Human Capital, Connected Health, Discovery Economy, Internet of Things (IoT), Smart-Cities, Personal Analytics, Data Protection, Privacy and Security, National Test Beds, or Verticals in Health, Energy, Smart Enterprise, and Smart Agriculture. The engagement process reflects a multi-year-collaborative research partnership, delivering
several projects through Science Foundation Ireland (SFI) and EU funding programmes, and may include other SFI Research Centres as partners. The major duties of this role include:

- In close collaboration with the Research Centre’s CEO and Director(s), the Strategic Projects Manager will provide leadership for the strategic development and implementation of a programme of engagement with existing and potential industry partners.

- Identify and agree with Industry Partners’ common focus areas for project development and best-fit funding models.

- Work with the Leadership team to provide input on strategic policy and processes in the Centre.

- Foster links with and between key personnel in state agencies, the partner HEIs and industry.

- The Strategic Projects Manager will also be responsible for raising the profile of the Centre through enabling of national and international networking activities by appropriate Centre Staff.

- Take a lead role to work in partnership with other groups in Insight across the four partner Universities, and outside to realise opportunities for the Centre.

- Enhance the Centre’s profile as a Centre of Excellence and represent the Centre directly

- Lead the development of project proposals and the growth of national and trans-national industry partnerships at the Centre.

- Liaise with industry, state and international funding agencies and with private donors as appropriate to source project work.

5.1.2. Working with Government Investment Agencies

The arrangement of collaborative projects begins with raising awareness by getting in touch with the industry stakeholders and finding those who are willing to work with the Centre on industry projects. It also involves contacting researchers who are working with agencies such as the Industrial Development Agency (IDA) and Enterprise Ireland (EI). In particular, IDA’s role is to attract companies to Ireland, and it is, in fact, regularly bringing companies on tours of the country to showcase capacity and capability within the national innovation ecosystem that includes Data Analytics. For instance, if somebody contacts IDA with an inquiry on the Data Analytics field, the IDA will include the Insight Centre as part of the case for companies to relocate to Ireland because the Insight Centre produces relevant skills and technologies. The IDA maintains a portfolio of features, such as finance and tax-related policies, environment, skills and workforce to attract companies to Ireland either to establish an own business or to join collaborative research. The Insight Centre gets connected to business partners through the effort and arrangement of IDA. IDA argues that if companies set up their Data Analytics hub in Ireland, they can avail of the skills available in the country because Ireland has a pool of graduates, post-graduates, and post-doctoral experts coming out of the Insight Centre.

Moreover, the companies can also avail of the opportunity to collaborate with world-leading scientists through arrangements for partnership with the Insight Centre. As part of the BD strategy, access to available opportunities and capabilities, including graduate and postgraduate skills is a very significant factor in attracting companies to set up in Ireland.

5.1.3. Industrial Showcases

Research centres occasionally organise events to demonstrate their capabilities and products to their audiences which include local and international participants made up of industry representatives, representatives of other research centres and academics. In such events, research centres seek partners in collaboration demonstrating their technology development capabilities and contributions to the state-of-the-art technologies
which could be leveraged for product development or to support specific competitive advantage in the industry.

For example, the Augmented Human event held in March/April (2017) was a proactive approach. Companies were invited to participate and to provide their input and feedback on the research direction for the Insight Centre’s review and use. All these are geared towards showcasing the centre’s research areas, and they are part of the strategic partnership roles that would have been handled by the Strategic Projects Manager. Applied Innovation is another role at the Insight Centre, which involves working with the internal research groups and companies and feeding their information on problems that the centre cannot address into its research agenda. However, this could also fit into the BD role in that it is an interface of conversation that could turn into further projects. Ordinarily, Business Development should involve studying the research space and turning opportunities into projects.

5.1.4. Customer Relationship Management

Repeat business is easier to achieve than a new one. To ensure as many repeat businesses as possible, the Insight Centre calls for the need to ensure that collaborating partners/companies get a good experience as much as possible to keep them satisfied. Once that objective is achieved, it is a lot easier to extend the existing project into a new one with the same company. This is part of the Business Development role because the academic leader might not see opportunities beyond their direct research areas, whereas a BD Officer should have a wider view of both the company and the capabilities of the entire centre. BD would have built a relationship and understanding with the company earlier on; such customer relationship role could also encompass Programme/Project/Account Management. Functional roles such as Customer Relationship Management help in bridging the gap between research and industry (users) by assisting companies in understanding how science (research) outputs relate to or solve their problems. The Business Development Officer is often the first person a company talks to over any issue, and that shows that the BD role does not end at the signing of a collaborative project.

In a situation, whereby a research centre has several units of different domain interests, like the Insight Centre, the BD Officer might not have sufficient knowledge of the various interests of these units. To be able to showcase the interests of these units to the companies, the BD Officer meets with each unit leader to understand their interests. With this knowledge, the BD Officer can represent the unit leaders well enough when discussing with companies. This is a significant part of the BD role; to be able to make a good connection between research units and potential companies for a project. The Insight Centre maintains a specific Business Development process which is explained in the section below.

5.1.5. Business Development Process

The Process of creating a connection between the Insight Centre and a potential corporate partner is outlined and visualised in Figure 8.

1. **Understand the company**: Get an understanding of what the company cares about; what they want to do, as well as their funding availability.
2. **Introduce the Insight Centre capability**: Introduce the Insight Centre, its capabilities, and its work processes to the potential partner.
3. **Proposal development decision (GO/NO-GO)**: Determine the company’s seriousness to engage in a research project to avoid waste of resources
4. **Funding models**: Clarify the funding options to the partner, e.g.:
   a. Co-funding: the source and implications of using the fund in comparison with
   b. Fully funded options
5. **Articulate the goal**: Have a session with the company (e.g. conference call or a workshop)
to brainstorm on the project subject to produce at least a single page summary of what the company would like to do with the research centre. It is important to invite the most appropriate researchers from the Insight Centre to this session.

6. **Project proposal:** BD and the relevant research group(s) respond to this document with a proposal covering a description of the work packages, deliverables, project team, project governance and cost estimates.

7. **Final decision (GO/NO-GO):** The last stage is the decision point – where the company makes a Go/No-Go decision. In some cases, they might want to amend the document before signing a contract for a collaborative project.

### 5.1.6 The value of the BD Role

The Business Development role is critical to the success of the Insight Centre. This is because the funding organisations want to see how the centre is interfacing with the industry. With the recent increase in the proportion of funding that the Insight Centre should receive from industry collaboration projects, the BD role is seen as very critical to the survival of the centre. The role is important to both the scientific invention and the applied research and innovation activities. It serves as an outlet to support the transfer of research outputs to the industry. The scientific work supports business development, in that it is necessary for attracting industry participants into collaborations because it demonstrates knowledge and capabilities possessed by the centre. Although BD is very important to applied research, it is also relevant to the scientific invention. For example, Insight is engaged in a strategic partnership for collaborative research with Fujitsu Laboratories. Fujitsu is interested in developing IP and related patents, the publication of scientific papers and establishing research leadership in certain areas. The company will subsequently be interested in commercialising the research outputs, but the initial focus is on scientific advancement. The involvement in scientific research provides knowledge capital to support business development negotiations. For example, the
Insight Centre’s BD representative could demonstrate to a company that the centre has a certain capability developed, based on the participation with another partner in a research project, where the know-how is relevant to signing the contract with them.

Generally, doing good BD involves keeping companies aware of the centre’s capabilities and tools. The Insight Centre employs business development capability to engage industry proactively and to provide support to Principal Investigators to pursue research goals (national and international). The BD Officer takes a strategic position and outlines a target, such as going after specific groups of industries, attending events in order to develop leads from there. The BD Officer will then focus on a selective network for deeper conversations that could lead to possible engagement.

**Strategic partnerships:** The Insight Centre has established partnerships with companies such as Fujitsu, Novartis, United Technologies and Huawei. This expands to a partnership with other CoEs, where the Insight Centre participates in multi-industry consortia (such as the Smart Cities, ENABLE, and Spoke). The Insight Centre is working with industry networks and centres in Manufacturing, Agriculture and Financial services to combine expertise into attractive packages for potential industry collaborators.

All this form the basis for appealing and attracting talents to the Insight Centre. Table 9 contains a summary of the Business Development practices of the Insight Centre.

### 5.2. Collaboration

Since its inception, the Insight Centre has delivered numerous industry projects in collaboration with companies of all sizes from global multi-national companies to local small and medium enterprises (SMEs). Such collaborations have built capacity in both the Insight Centre as a research entity and industry; enabled new products and services to be developed; supported job creation and retention and stimulated international and domestic investment.

**Research Priorities:** The Insight Centre has identified and stated its priority research areas and their applications domains that are being focused on. In this regard, the Executive Committee and Senior Management team regularly hold consultative meetings with staff and external stakeholders to re-assess, redefine and refine the centre’s priorities.

**Collaborative network:** The Insight Centre has established a substantial industry network, working directly with over 85 companies in company-funded collaborative research projects. Indirectly, it engages with partners in hundreds of European Union projects, and educational, industry and public forums. The Insight Centre has developed solutions for challenges across a broad spectrum of industries, including Healthcare and Bioinformatics, Smart Cities, Telecommunications and Networks, Financial services, Marketing and Retail, News and Media, Services and Tourism, e-Government, Agriculture, Manufacturing, Transportation and Semi-autonomous vehicles, Environment, and many more. Collaboration in the Insight Centre can be described under two headings:

**Cross-discipline collaboration:** Within each university, the Insight Centre has led important new collaborations with faculties and disciplines beyond data science, including Life sciences, Engineering, Computer science, and many more. Collaborations have further reinforced this at centre level (i.e. with other research centres in Ireland) and within the scope of EU and other funded projects.

The Insight Centre collaborates and engages with other stakeholders internally and externally, among researchers and other domains, local and international. In particular, the Insight Centre arranges cross-discipline collaboration to leverage skill sets. An example is the collaboration arrangement with NUI Galway’s Engineering Department on the *Waternomics project*.
Collaboration is a part of the Insight Centre’s strategy for existence. Industry collaboration demands a massive effort and experience over the years. The advice is that the more a research centre gets involved in the domain activities, the more it is recognised and the more trust the industry people have in it and want to do business with it. The Insight Centre has received the benefits of that assertion, particularly since 2016, as more people are coming to do business in Galway. In other words, industry collaboration is bringing increasing cash revenues to the centre.

**Industrial Master Classes:** The Insight Centre offers a Masterclass programme that has taken cutting-edge data science research and resulted directly to industry partners. Masterclasses are short, focused presentations of between 30 and 40 minutes offered by Insight’s leading researchers and scientists. These can be given as a bundle (with one, two or three presentations bundled together making up a 2-hour session), or as single presentations. The Masterclasses can form part of a company event such as an away day or can be an in-house activity like a breakfast briefing, brown bag lunch, technical afternoon session, or whatever suits a company. Masterclasses are part of Insight’s company outreach activities, and there is no fee or expense policy for this. To date, Masterclasses have educated on the order of 500 personnel in over 40 companies about the potential of Data Analytics to benefit their industry.

### 5.3. Research Support Services

Research support services are key to the success of research activities, and Insight provides a series of support services financed by an appropriate budget.

**Proposal Support:** Grant Development Managers at the Insight Centre sites provide support at all stages of the project lifecycle from proposal submission, negotiation, implementation and completion.

**Project management:** A nominated research project manager owns each project and works closely with the Principle Investigator and the industry partner to ensure that the project is effectively delivered. All projects have allocated resources, clear objectives, an agreed approach, as well as the defined timelines.

### 5.4. Technical Infrastructure

**Technical infrastructure:** The Insight Centre has excellent infrastructure and support for input services to facilitate the delivery of world-class research and professional industry collaborations. The various sites of the Insight Centre have their requisite technical infrastructure, commercial-quality offices and laboratory facilities, and ample meeting spaces and conference rooms. Researchers have easy access to any equipment they require in a collegiate and supportive environment.

Further information on this case study reveals that, like any other research centre, the Insight Centre for Data Analytics has an on-going development of its research infrastructure. You cannot attain the very highest level of such developmental needs, and all centres are trying to improve in that sense. Regarding the infrastructure, experimentation and the network of partners, there is more information to be added to the above. For example, to meet the needs of Hadoop, the Insight Centre Management had to outsource the need to acquire the right capability. Sometimes, this could mean purchasing a cloud facility through Amazon; and this situation presents some challenges.

In general, regarding the development of capabilities – people, process and infrastructure, availability of funds is the limiting factor. The Insight Centre gets its major funding from SFI for infrastructure and most of the time; additional money comes in small projects over a short period. This arrangement limits the capability to develop infrastructure. On the other hand, SFI is not interested in investing in short-term infrastructure that may become obsolete within a short period of about three years. The organisation prefers to
invest in long-lasting bigger infrastructure as an alternative. Understandably, it is very difficult to build a stable infrastructure that works forever, particularly in IT and Data Analytics domains. The future is doubtful as to which direction the trend of infrastructural development might go.

**Internal Data Centre:** Insight has some internal data centres at each of the host Universities. Currently, the DC resources are not centrally coordinated beyond the sectorial coordination of education by the HEANET.

**Cloud Services:** Insight leverages cloud-based services on an as-needed basis for specific projects.

**Research management information systems:** (Figure 9) The Insight Centre project management tools include

- **Research Management:** JIRA is the repository used for all documentation associated with research deliverables. Each research unit in the Insight Centre reports on this platform. Where plans are deviated from, or in the event of issues being raised on the JIRA system, the Research Project Manager, Research Group Leader, and Site Director (supported, as necessary, by the EC and the Operations teams) are responsible for working with the Research Project Manager to get the research back on track.

- **Software Development:** Gitlab and Bitbucket systems are used for managing codes.

- **Project Management:** Slack and Google’s G-Suite are project communication tools used in tracking issues. For progress management, the Insight Centre utilises additional toolsets, such as JIRA, and Basecamp.

- **Impact Assessment:** Insight has a specific information system to track the impacts of their research activity covering scientific, economic and societal impacts. This system mirrors the requirements of the SFI census concerning publications tracking. It is beneficial in providing progress reports, individual public profiles, and publication data related to journals, conferences, presentations, and workshops.

**5.5. Experimentation / Demonstration Platforms**

Insight has some platforms for experimentation and demonstration sites. Involvement in European projects has been a key driver of these platforms. Example platforms include:

- **FIESTA-IoT:** The EU FIESTA-IoT (Federated Interoperable Semantic IoT Testbeds and Applications) project provides tools, techniques, processes and means for testbed agnostic access to experimental IoT datasets and data-streams, and addresses semantic interoperability issues with hardware, data, model, query, reasoning, service/application and applicative domain levels.

- **Waternomics:** WATERNOMICS is an EU-funded research project, led by Insight NUI Galway, involving nine partners. The objective of the project is to improve management and user-awareness of water consumption and is demonstrated in high-impact pilot sites in Ireland including Engineering Building, NUIG (Galway) having a significant number of sensors and actuators.

- **OpenIoT:** The FP7-287305 OpenIoT project (co-funded by the European Commission) is a
joint effort of prominent open source contributors towards enabling a new range of large-scale IoT based applications. Other than providing an open-source IoT platform enabling the semantic interoperability of IoT services, it also includes a middleware framework and manages cloud environments for IoT applications as well as offers utility-based (i.e. pay-as-you-go) IoT services. The experiments have been conducted related to Phenonet, Urban Crowdsensing, and Smart Campus Application for the Proof-of-Concept based on the OpenIoT platform.

5.6. IP and Data Protection

The Insight Centre has implemented a series of processes and procedures that mandate the comprehensive recording and documentation of research plans, results achieved, data created, data distribution, IP creation and management, Non-Disclosure Agreements (NDAs), IP assignment agreements, publications protocols, invention disclosure protocols, and other aspects of good research governance.

Intellectual Property and Data Protection Committee: The Insight Centre Intellectual Property (IP) and Data Protection (DP) Committee oversees the development, implementation and update of policies and procedures relating to IP and DP, including Responsible Research and Innovation (RRI). The IP and DP Coordinator work with the Site Directors and Site Managers to implement and ensure compliance with these policies and procedures including IP creation and management, Non-Disclosure Agreements (NDAs), IP assignment agreements, publications protocols, invention and disclosure protocols.

Data Collection Guidelines: Each of the divisions of the Insight Centre follows the data collection guidelines, as outlined in its parent university while dealing with personal data. The Insight Centre NUI Galway operates under a Research Ethics Committee that safeguards the health, welfare and rights of human participants and researchers in research studies.

Defining Data Policy: The Insight Centre has led the Magna Carta for Data initiatives at a European level, establishing a set of common values for data ownership, rights and usage; exploring the balance between the rights of the individual and the potential societal benefit of data-enabled governance and public services. This initiative received extensive attention nationally and at European Parliament and European Commission levels. This development is an important input into the on-going evolution of data-related regulations. The Insight Centre adopts the Data Protection by-Design and by Default principles recommendation of the General Data Protection and Regulation (GDPR) through the development of a set of data privacy management practices that operationalise the enforcement of data protection procedures. To strengthen the implementation of data protection regulations, the role of IP and Data Protection Manager has been created which will have responsibility for ensuring, in conjunction with the relevant Universities Technology Transfer Offices, that the Science Foundation Ireland “Guidelines for Access to Intellectual Property”, and IP aspects of the Inter-Institutional Agreement (IIA) are implemented across the Centre. The various co-led universities maintain their respective codes of conduct for managing personal data protection.

Supporting National Data Policy: The Insight Centre’s capabilities for data collection, analytics and interpretation have been deployed to support the delivery of national policymaking. Key industry collaboration agenda utilised the Insight Centre’s capabilities to develop an optimised model for the allocation of healthcare resources, to reducing hospital wait times to meet the desired targets.

5.7. Education and Public Engagement (EPE)

Education and Public Engagement (EPE) is a term that brings together some diverse dissemination activities with which the Centre informs the public about the science and technology developments in the centre. The aim is to enable the public to appreciate science and technology and the Insight
Centre has a dedicated EPE team that is centrally coordinated with EPE experts at each site. A dedicated team for researchers and engagement managers to run multiple activities and projects targeted at different age groups within the public. The list of activities includes, but is not limited to, hackathons and coding clubs, competitions and safety talks. Education and Public Engagement activities (EPE) communicate the value and excitement of science, and science, technology, engineering and mathematics careers, to the general public, students of all ages (particularly female students) and remote and disadvantaged communities with reduced access to technology.

EPE is delivered as a whole-centre component of Insight – while there are local EPE resources at each site, they work in an integrated manner. Academic staff is a critical component of EPE because they deliver many of the events, write many of the media materials and provide the Data Analytics knowledge at the core of most EPE outputs. EPE activities, including those involving academics and more junior researchers, are delivered by and for the Insight Centre.

The first point is that there are three underlying principles in EPE at Insight: (1) Create, (2) Include and (3) Question. The second point is the overall policy of SFI (Insight’s main funder) which is not to only make Ireland’s populace scientifically aware but also to engage members of the populace in scientific and technological outcomes including knowledge, products and services. The EPE programme is very important because science and technology outcomes should reach all sectors of society, from young to older adults. The goal is to have a smart economy by 2020, where all people are expected to be part of it (and not isolated from it). The aim is to enable everyone to contribute to science and technology as producers and users. This new EPE principle requires researchers to embed EPE into all aspects of research. EPE should not be looked upon as additional work but considered as part of the fabrics of what constitutes a research centre. In other words, staff, students and researchers in a research centre will now be more involved in EPE programmes going forward.

EPE has many facets, including:

- School engagement talks to a lay audience or a professional audience.
- Influencing and changing government policy.
- Demonstrating research outcomes within the Insight Centre or at public engagement events, such as science festivals.

### 5.7.1 Approaches to Education and Public Engagement

The core principles of the Insight EPE approach are create, include and question.

1. **The Create approach:** This is to empower people, particularly young people, to create models, activities and processes based on the research outcomes of the Insight Centre and in general science. The coding programmes is a very creative learning process for young people organised by the Insight Centre. By this programme, the Insight Centre has made a fundamental change in Irish research and science programmes by influencing government policy to introduce the computer science subject into the school curriculum. Furthermore, the new directive from the funding agencies demands that everybody in the Insight Centre should be engaged in EPE in one way or another to give research projects some EPE support.

There are now about 15 important metrics for measuring EPE activities to be adopted by the Insight Centre under the new EPE directive from SFI. Over time, all SFI funded researchers and staff should be involved in EPE. Before this, the EPE activities for researchers were primarily focused on:

Participation in public Science, Technology, Engineering and Mathematics STEM festivals, coding sessions in schools, and app development workshops for second-level college workshops at the Insight Centre.
Speaking in Thesis-in-3 (Threesis) competitions.
Supporting digital makers, groups, and school career talks.
Input into Apps4Gaps (national app making competition).
Open Data hackathons, organising/mentoring female empowerment STEM seminar.
Social Inclusion programmes.

Although these activities have been largely successful and have earned Insight a national reputation status for its outreach programmes, the centre is further committed to expanding EPE programmes through embedment in all research projects using a wide range of options, including communications training, dialogue with policymakers, stakeholder capacity building, development of demonstrations for schools and the general public, and having researchers maintain online profiles.

From 2017, the new directive also mandates measurement of EPE performances using selected Key Performance Indicators (KPIs) metrics, that is, each researcher or staff of the Insight Centre must be involved in at least four of them per annum, and that the Centre must record a 25% personnel involvement by 2019. The 15 metrics for measuring EPE activities are enumerated below:

1. Contributions to online communications
2. Development of online resources
3. Communications/Engagement training
4. Collateral for a lay audience
5. Development of school interactions
6. Teaching materials/methods
7. Festivals/events in institutions
8. EPE activities with museums, galleries or public access venues
9. Citizens’ science experiments or research
10. Contribution to broadcast or media productions
11. STEM EPE activities
12. Dialogue with policymakers
13. Public education
14. Public consultation
15. Stakeholder capacity building

2. The Include approach: This approach states that all sectors of the society will be part of the EPE target audience. The Insight Centre has to engage with all sectors of the economy, including areas such as social deprivation, inner-city, geographically isolated schools in the island, different ethnic groups and age groups, professional bodies, business people, and students. This is highly inclusive particularly because the programme is targeting areas where support is needed, e.g., schools outside the technology corridors, away from main cities such as Galway City, into communities that would not ordinarily have the opportunity to engage with science and technology.

To reach remote locations, the Insight Centre uses a strategy that simplifies scientific and technological concepts to an understandable, useful and applicable level in the context of the target audience. For instance, when working with a small village community in a rural area, members of the Insight Centre may look at relevant themes such as the local heritage data. A project, such as data collection and analysis can be designed to use the data to develop an online archive of the community history made up of photographs, films, and podcasts. Furthermore, all children are now allowed to learn how to code and so in a small school of about one or two teachers, who probably do not know how to code, the Insight Centre introduces the mentoring programme as an indoor activity. This is expected to become a part of the fabric of teaching in that community. This approach involves teaching the teachers through the centres but also involves work in the classrooms to show
the teachers how the activities are done. This is a part of the primary requisite to train the trainers, who are working in government education centres. Besides working through educational centres, the Insight Centre also works directly in schools. As part of these engagements, the Insight Centre’s EPE programme demonstrates to people how science and technology are changing and the importance of taking ownership of the change and becoming active participants in new or emerging technologies.

Outreach activities affect the operation of the Insight Centre in many ways. Firstly, the activities help to develop science-oriented future researchers of the Insight Centre and of course other centres. In other words, the activities are geared towards up-skilling of people for research works in the future. Secondly, the outreach target audience is taxpayers whose money is used to finance the activities of the Insight Centre. For transparency, the Insight Centre is required to show taxpayers the value for their tax money. Thirdly, with the way science and technology are developing, there will be opportunities for decentralisation. For instance, working from home will demand improved means and a sense of connectivity. Also, other science research domains at the Insight Centre such as Web Analytics, etc., whether applicable in Agriculture or Fishery; they are parts of the research efforts beneficial to the society.

3. The Question approach: This dwells on the understanding that everything done in science should not be taken for granted as beneficial. In other words, every outcome of scientific investigations should not be assumed to benefit society. The fact that scientific results will be beneficial is far from reality; particularly in the 20th and 21st centuries – the era of the modernised industrial revolution, high-level technology and science have been used to destroy the world in so many ways. For instance, human societies are contributing to climate change through the burning of fossil fuels at a huge rate. Scientific research has led to the development of weaponry (e.g. nuclear weapons) that can destroy the planet. For too long, technology has been used to destroy people and the world. Therefore, people should not take it for granted that everything from science and technology development is good and would necessarily benefit humanity. The Internet, for example, is a great development for humanity; however, it has also brought cyberbullying and loss of privacy. People should not ignore the big issues associated with science; instead should question the importance, benefits and issues of science, and also question how to improve on the outcome of positive scientific research.

The approaches to EPE are interrelated. The first two approaches ‘create’ and ‘include’ can be regarded as external activities. The last one, which is ‘question’, is internal since it focuses on ways to connect the scientific community with the positive needs of the society. The ‘question’ approach also involves external activities such as bringing awareness about unintended scientific outcomes not only to researchers but also to consumers alike. For example, the Insight Centre provides lectures to people on how to avoid and how to report cyber-bullying problems – an important aspect of the science outreach responsibility.

Another example is the agitation over the development of Artificial Intelligence (AI). Robots are great tools to support human work, yet people complain about robots taking their jobs or their means of income and positions in their societies. This is true because science is disempowering people in this context. In this regard, it is the responsibility of an outreach programme to educate people on the fact that where jobs are lost to robotics, other types of jobs are created for humans. Consequently, people have to be educated on the need to up-skill their capabilities to meet the requirements of new jobs.

The important issues being tackled by the ‘questioning’ outreach strategy is how to overcome the negative results of science and technology research. While efforts are geared towards educating the user community, policymakers are inclusive. EPE is not only about talking to the
grass-roots individuals, but also the government and policymakers as an important part of society. As an example of policy change, the coding programme mentioned earlier was initially done by volunteers from the Insight Centre and other organisations involved in mentoring in the classroom and through the after-school volunteer CoderDojo clubs. Currently, a policy change had been achieved in support of computer subjects in schools.

Concerning the key practices of outreach, the Insight Centre’s programmes cover areas including i) School visits, ii) Involvements in Science fairs (e.g. Science Week), and iii) Presentation skill activities, e.g. Thesis-in-three, career talks, and so on.

In summary, the outreach is brought in one way or another through career talks, science festivals, and community groups of older adults, asylum seekers, school visits, policymakers and business groups, as well as the national museum outreach. In the EPE approaches, it is assumed no one is an island under EPE programme; hence the Insight Centre collaborates and partners with schools and volunteers in the corporate sector to achieve the desired goals. Table 9 includes a summary of the outreach practices obtained from the Insight Centre case study.

### 5.8. Policy Outreach

**Influence National Policy:** The Insight Centre influences policymaking, e.g. through data collection, analytics and interpretation capabilities deployed to support optimisation of the allocation of healthcare resources in Ireland’s hospital collaboration programme. It has also influenced government policy to introduce the computer science subject into the school curriculum through the Insight Centre’s creative learning which brought coding programmes to young students in secondary schools. Insight is also responsible for influencing the national and European policy in the areas of Digital Economy, Industry 4.0 and the Data Economy.

**Research Integrity in Ireland (RII):** RII is implemented as a package that includes multiactor and public engagement in research and innovation. It enables easier access to scientific results, the consideration of gender balance and research and innovation ethics regarding content and process and in formal and informal science education. The Insight “brand” is respected and promoted in this way; not only does this communicate the unity of the centre, but it also makes resources and presentation materials more easily reusable. The Insight Centre’s policy activities to date have primarily focused on data ethics. In this regard, the Insight Centre is actively contributing to policy efforts for data protection.

As a matter of policy, the Irish Universities Association (IUA) developed the National Policy Statement on Ensuring Research Integrity in Ireland. There are four statements of commitment to research integrity in the policy body which include the following and their brief explanations that are reproduced, with further readings provided by the National Forum on Research Integrity in Ireland:

- **Commitment 1: Standards** – Is a commitment to ensure the highest standards of integrity in all aspects of research, founded on basic principles of good research practice to be observed by all researchers and research organisations in the country.

- **Commitment 2: Education** – This is about the fact that education and promotion of good research practices are the foundations of research integrity. Ireland is committed to maintaining a national research environment that is founded upon a culture of integrity, embracing an internationally recognised good

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practice and a positive, proactive approach to promoting research integrity. It supports the development of researchers through education and promotion of good research practices.

- **Commitment 3: Collaboration for continuous improvement** – Is a commitment to work together to reinforce and safeguard the integrity of the Irish research system and to review progress regularly.

- **Commitment 4: Action to address misconduct** – The fourth commitment is to employ transparent, fair and effective processes to deal with allegations of research misconduct when they arise.

Using the language of the IUA “Research Integrity relates to the performance of research to the highest standards of professionalism and rigour, and the accuracy and integrity of the research record in publications and elsewhere. It is essential that the Irish research system as a whole protects its reputation for the quality and integrity of its research activity and outputs, so that our international partners and we may rely on those outputs to promote economic and social development and growth”.

### 5.9 Technology and Knowledge Transfer

**Technology transfer:** The Insight Centre has spun out eight high-potential SMEs and issued 54 licenses of its intellectual property. It has also worked with a large number of innovative SMEs, with special arrangements and facilities to lower barriers to collaboration.

### 5.10 Performance and Impact Assessment

The Insight Centre has KPIs and measures its performances bi-annually, annually and every two years, according to SFI recommendations in terms of stated strategic areas using the KPIs. A set of strong KPIs has been imposed by the centre’s financial sponsor (SFI). The Insight Centre’s KPIs, which have been operationalised, cover a lot of the impact areas, such as economic, commercialisation, and academic.

#### Table 1: Summary of capabilities of the Insight Centre

<table>
<thead>
<tr>
<th>Practice</th>
<th>Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated Business Development role at each site with a centralised role for coordination</td>
<td>BD</td>
</tr>
<tr>
<td>Strategic Partnership Manager role was created for which one officer was recruited for the entire Insight Centre (working for all four sites).</td>
<td>BD</td>
</tr>
<tr>
<td>Commercialisation and licensing aspects are done by the Technology Transfer Office (TTO).</td>
<td>BD</td>
</tr>
<tr>
<td>To establish research collaboration, the Insight Centre engages industry stakeholders and researchers working with agencies, e.g. IDA, IE seeking interested partners on projects</td>
<td>BD</td>
</tr>
<tr>
<td>Works with national investment agencies to support the attraction of investments to Ireland. (i.e. IDA)</td>
<td>BD</td>
</tr>
<tr>
<td>Organises industrial days to showcase research and innovation outputs in the centre. (i.e. Smart Enterprise)</td>
<td>BD</td>
</tr>
<tr>
<td>BD function gathers industrial feedback from companies as input for research direction.</td>
<td>BD</td>
</tr>
</tbody>
</table>

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Acts as an intermediary between academics and companies, while providing a consistent interface for the Centre to a company | BD

Developed a staged business development process | BD

The Insight Centre employs a business development capability to engage industry proactively | BD

It provides support to principal investigators to pursue research goals (national and international) | BD

Supports scientific invention and the applied research and innovation actions as an outlet to support the transfer of research outputs to industry | BD

The Strategic Projects Manager is a key position to ensure the success of ambitious and complex programs; the role is:
- to initiate and develop engagements with key MNCs and SMEs, centring on agreed common focus areas,
- to identify and finalise with the Industry Partners some goals in connection with focus areas, e.g. recruitment and development of Human Capital, Connected Health, and Discovery Economy.
- SPM engagement process reflects a multi-year-collaborative research partnership to deliver projects through SFI and EU funding programme.

Cross-discipline collaboration to leverage several skillsets and resources beyond Data Science into Life sciences, Engineering and Computing. Collaboration with other research centres in Ireland and the EU | Collaboration

Industrial collaboration for network and, e.g. with over 85 companies and others on EU projects covering many areas, e.g. Manufacturing, Agriculture, Financial Services, and Smart Cities. | Collaboration

strategic partnership | Collaboration

Masterclasses to industrial partners from leading scientists in the centre | Collaboration

Examples of collaboration benefits include:
- **Waternomics** – a smart city initiative created by Insight and Engineering Department of NUI Galway
- Collaboration capability is leveraged in strategy implementation for success
- Collaboration capability helps in attracting industry partners for cash revenues

The Insight Centre has an on-going development of research infrastructures to ensure infrastructure and services, facilitating the delivery of world-class research and professional industry collaborations (including Testbeds, and Living labs) | Tech. Infra.

It has developed experimentation test labs and living labs including smart building and partnership with cities | Tech. Infra.

Research management support systems include source control, business process, issues trending, helpdesk, project management, Jira (repository) and Google suites (project communication), Impact? Other supports? | Tech. Infra.

Internal data centres at each of the host Universities without central coordination. | Tech. Infra.

Cloud Services: Insight leverages cloud-based services on an as-needed basis for specific projects. | Tech. Infra.

Insight has a dedicated EPE team that is centrally coordinated with EPE experts at each site | EPE

Researchers collaborate with an EPE expert to bring the EPE programme to target different age groups in public outreach. | EPE

The three principles of EPE approach: Create, Include and Question | EPE
- Create – is an approach to get people involved in scientific activities.
- Include – make all sectors of the economy, community and the society the target for EPE activities.
- Question – teaches the idea that science and technology research should be evaluated to understand whether outcomes are beneficial to humanity or not.

| EPE performances to be measured using KPI starting from 2019, each researcher or staff of the Insight Centre must be involved in at least four of the KPIs per annum, and each of them must record a 25% personnel involvement by 2019. | EPE |
| Part of the aims of the funding organisation (SFI) is to make Ireland | EPE |
| • A scientifically aware society, and | |
| • engage with scientific outcomes | |
| All staff of the Insight Centre has to play roles in the EPE programmes | |
| EPE activity must be embedded in all aspects of research. | EPE |
| IP and DP Policies are overseen by coordinators working with the Site Managers and Site Directors for each of the divisions of the Insight Centre. | IP and DP |
| RII is implemented as a package that includes multi-actors and public engagement, enabling easier access to scientific results, the consideration of gender and ethics in innovation concerning content and process, and formal and informal science education. | IP and DP |
| The Host Universities’ policies support research Integrity | IP and DP |
| IUA produced the National Policy Statement of Commitments on Ensuring Research Integrity in Ireland. These commitments include: | IP and DP |
| • Standards | |
| • Education | |
| • Collaboration for continuous improvement | |
| • Action to address misconduct | |
| The Insight Centre adopts the Data Protection by-Design and by Default principles recommendation of the General Data Protection and Regulation (GDPR) | IP and DP |
| • Through the development of a set of data privacy management practices that operationalise the enforcement of data protection procedures. | |
| • A Data Protection Manager role help strengthen the implementation of data protection policies | |
| • The various co-led universities maintain their respective codes of conduct for managing personal data protection | |
| • Through the leadership of Magna Carta for Data initiative at a European level. | |
| The Insight Centre influences policymaking, e.g. through data collection, analytics and interpretation capabilities deployed to support optimisation of the allocation of healthcare resources | Policy outreach |
| The Insight Centre influenced policy change for secondary school subjects; e.g. the Coding programme led to the introduction of computing subject in secondary schools | Policy outreach |
| Insight has influenced research and innovation policy at both national and European levels, including Digital Economy, Digitisation of Industry (Industry 4.0), and the Data Economy. | Policy outreach |
6 Impact Elements
The Insight Centre measures its impact, according to SFI’s eight pillars, to “demonstrable contribution that excellent research makes to society and the economy”. These pillars are divided across the three broad categories in BDVCoE model as follows (Figure 10).

As environmental factors influence the operations of the Insight Centre, the Centre generates outputs that also influence activities in the environment. For instance, the Insight Centre’s data collection, analytics and interpretation capabilities have been deployed to support the optimisation of the allocation of healthcare resources.

Similarly, information gathered from the outreach activities states that the Insight Centre’s secondary school coding programme, an initiative under the Education and Public Engagement (EPE) mandate, has been so successful. As a result, a computing subject has been introduced into secondary schools in Ireland. These examples demonstrate a feedback loop that exists between the environment and the Insight Centre to maintain sustainability in some way in that, students are now systematically guided to develop an interest in science subjects and mathematics which will later provide intake for the Centre.

### 6.1. Economic Impact

**Pillar 1 - Economic and Commercial Impact:** The Insight Centre’s economic and commercial impact has been substantial. The Insight Centre has helped 127 companies to develop new products, services and capabilities through collaborations, knowledge transfer and supply of excellent graduates. While the Insight Centre cannot take credit for the presence or scale of its industrial partners, its collaboration has delivered value and helped them make positive decisions about investment, expansion and remaining in Ireland. Other indicators of Insight’s economic impact are:

- Over €15m value of industry investment projected (cash plus in-kind by contract value).
- Eight companies spun out from Insight.
- Insight has licensed its technologies on 54 occasions.

**Pillar 7 - Impact on Professional Services:** The aggregation, interpretation and management of data are central to many professional services. The Insight Centre’s work on data ethics makes an important contribution to the guidelines and recommendations governing such data, as well as

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**Figure 4: SFI Impact Framework** (Source: www.sfi.ie/funding/award-management/research-impact/)
to the training and capabilities of professional services practitioners. This is evidenced by four important projects with a global insurance company and a great deal of interest from other insurance companies, in related research areas, and strong prospects of new products and services, and better customer relationships.

Pillar 8 - Impact on Human Capacity: As a major research centre, the Insight Centre has delivered a substantial impact on human capacity. The centre brings together the leading data scientists from across Ireland, in a single coordinated entity. This facilitates interaction and collaboration and enables industry collaborations and other outputs that an archipelago of separate sites could not. Summary of relevant metrics is as follows:

- Over 400 researchers in a single Centre,
- Over 250 planned PhD/MSc students in the centre,
- Over 101 internships and placements,
- 27% of graduates who have progressed to industry,
- 40 Masterclasses, reaching over 500 industry employees, and
- 28,311 students reached by Education and Public Engagement.

Collaboration with industry and other categories of partners provide economic benefits. Collaboration with industry partners has also provided job opportunities for over 500 personnel and businesses for companies. Similarly, Technology Transfer and Business Development are processes or activities that have produced spinouts into SMEs, IP licences.

6.2. Scientific Impact

The scientific impact of the Insight Centre is measured in terms of peer-reviewed journal and conference papers. Following metrics provide evidence of the Insight Centre’s scientific impact.

- 400 peer-reviewed journal papers
- 1,000+ peer-reviewed conference papers
- 182 conference papers with co-authors from the industry partner base
- Hosted and contributed to the running of more than 200 conferences

6.3. Societal Impact

Pillar 2 - Societal Impact: The Insight Centre’s societal impact is primarily in the appreciation of science by society as a whole and by specific target audiences. Demonstrating the value of science, the scientific method and respect for rigorous data and evidence-based decision-making is a key objective of the Insight Centre. A more scientifically literate and better-informed society is empowered to make better decisions at all levels, from the individual to government. A second key objective is to communicate to society how important and attractive science is, and how it underpins modern standards of living, products and services. The following metrics demonstrate a societal impact:

- 1137 school visits, reaching approximately 28,311 students, of whom 50% are disadvantaged groups. 550 lectures, workshops, and demonstrations to public groups were given, of whom 25% are female-centric.

Pillar 3 - International Engagement Impact: As a leading data science research centre, international engagement has been (and remains) central to the Insight Centre’s mission and activities. In research, the Insight Centre has established or been asked to join, numerous international consortia, to pursue specific research challenges and opportunities. These include international research projects funded by the EU, as well as policy and standards bodies such as the Big Data Value Association. In the industrial sector, we have excellent collaborations in place with a wide range of multi-national companies. At the policy level, the Insight Centre has made
important contributions to the European policy and guidelines on data ethics, via the Magna Carta for Data initiative. Another important form of international engagement is the Insight Centre’s leadership and participation in international research projects, as demonstrated by the following achievements:

- 44 EU projects, 14 EU as coordinator, with a value of €21.5m and a total value of €200m,
- Four Memoranda of Understanding (MoU) with global data science leaders,
- 40% of researchers recruited from overseas, and
- 67 researchers from the Insight Centre who have been recruited by overseas research groups.

Pillar 4 - Impact on Public Policy, Services and Regulation: The Insight Centre has made important contributions to policy and standards, particularly in data ethics. The Insight Centre also actively participates in the Open Data Initiative, in eHealth Ireland, and helps to shape public, national and international policy.

Pillar 5 - Health and Well-being Impact: The Insight Centre has an entire research domain (‘connected health’) dedicated to the confluence of health, technology and data. The centre has developed new technologies for health-related monitoring, behavioural change, self-management and for improving patient quality of life. The Insight Centre’s health-related research is an excellent sectoral fit concerning Irish industry, given Ireland’s substantial clusters of medical devices and Healthcare ICT companies. The Insight Centre has worked with over 20 companies within the Healthcare sector and is involved in four EU projects in Healthcare.

Pillar 6 - Environmental Impact: The Insight Centre’s work in the environment has focused on sensor development, resource optimisation (energy, water) and smart environments. This has underpinned projects with industrial partners, with new products and services. It has also contributed to the €12m value ENABLE Spoke, which focuses on Smart Cities, in which the Insight Centre plays a leading role. The centre has also worked with over ten companies in the Environmental sector, and five EU projects in Environmental Management.
About
7.1. About BDVe

The goal of BDVe project is to support the Big Data Value Public-Private Partnership (BDV PPP) in realising a vibrant data-driven EU economy by effectively combining in a consortium Large Enterprises, SMEs and Academia.

7.2. Big Data and AI Centres of Excellence

The BDV PPP is furthering the development of the European data ecosystems as a data-driven economy. One key action is the work to support a network of BDAICoE to foster collaboration, share best practices and know-how among centres, facilitate meetings of the network participants and provide expert guidance and support for the establishment of new CoEs in Europe.

7.3. Big Data and AI CoE Best Practice Framework

A best practice framework for BDAICoEs has been developed through an extensive survey of existing CoEs in Europe, identification of their challenges and opportunities, as well as their best practices and guidelines. The framework has been enhanced by feedback from experts within CoEs.

7.4. Persons of Excellence

We conducted interviews with a wide range of experts within the CoEs, from the top executives and academic leadership involved in daily operations, management decisions and strategic decision-making processes to specialists in areas such as academic-industry collaborations.

7.5. Call to Action

- Are you a Big Data and Artificial Intelligence Centre of Excellence and want to share your best practices?
- Are you a senior manager or director of a Big Data and Artificial Intelligence Centre of Excellence and want to be interviewed?
- Are you a new Big Data and Artificial Intelligence Centre of Excellence or you know of any that seeks support?

Please do not hesitate to contact us at: edward.curry@insight-centre.org

7.6. BDAICoE Framework Team

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- Edo Osagie
- Niki Pavlopoulou
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7.7. About Insight

The Insight Centre for Data Analytics is a joint initiative between researchers at Dublin City University, National University of Ireland Galway, University College Cork, University College Dublin and other partner institutions. Insight brings together more than 400+ researchers from these institutions, 100m+ funding, and with over 80+ industry partners, to position Ireland at the heart of global data analytics research.