

Strategic Plan 2017 - 2025



1	Introduction	1
1.1	Forward	1
	Oliver Daniels, CEO	1
1.2	Background and Context.....	2
1.3	Insight in the Irish research landscape	3
2	Executive Summary	5
3	Insight Mission & Vision	7
4	Insight Strategic Goals.....	7
5	Excellent Research.....	8
5.1	Introduction.....	8
5.2	Strategic actions for research	9
5.3	Strategy Overview.....	11
6	Economic and Commercial Impact.....	18
6.1	Introduction.....	18
6.2	Strategic actions to drive Industry Benefit	18
7	Building Capacity	19
7.1	Introduction.....	20
7.2	Strategic actions to build capacity.....	20
8	Multiple sites – one Centre.....	22
8.1	Introduction.....	22
8.2	Strategic actions for Integration and cross-site collaboration.....	22
9	A Positive Environment.....	23
9.1	Introduction.....	23
9.2	Strategic actions for attracting and retaining talent.....	23
9.3	Strategic actions for career development.....	24
10	Communications	25
10.1	Introduction.....	25
10.2	Strategic actions for Communications	25
11	Education and Public Engagement (EPE).....	26
11.1	Introduction.....	26
11.2	Strategic actions for EPE	27
12	Data Analytics Leadership	28
12.1	Introduction.....	28
12.2	Strategic Actions for Data Analytics Leadership.....	28
13	Appendix 1: External and background material	30
13.1	Irish Government Strategy for R&D, Science and Technology - Innovation 2020 ..	30

13.2	Irish Government National Skills Strategy 2025	30
13.3	Irish Government National Enterprise Strategy - Enterprise 2025	30
13.4	SFI strategic plan - Agenda 2020.....	30
13.5	Insight Review 2015.....	31
13.6	HEI strategies [DCU, NUI Galway, UCC, UCD].....	31
13.7	Research Prioritisation report.....	31
13.8	EU Publications	31
13.9	Hauser Catapult report.....	32
13.10	Turing Institute documents	32
13.11	Fraunhofer presentations	32
14	Appendix 2: Stakeholder Inputs	33

1 Introduction

1.1 Forward

Oliver Daniels, CEO

The explosive increase in data is a defining feature of the 21st century. There is hardly a scientific discipline, an industry sector, or a leisure activity that does not generate data in ever-increasing amounts, from genomic databases to retail profiles, activity trackers to online video games. Navigating and sifting this immense



ocean of information - *data analytics* - is a scientific discipline that offers unprecedented benefits – scientific breakthroughs, smarter cities, more efficient manufacturing and more effective marketing, and a wide spectrum of new products and services.

Insight is Ireland's national research Centre for data analytics, and the largest of all SFI Research Centres. Our research explores fundamental topics in the core of the discipline, such as statistical models and constraint programming, as well as applications and commercial projects with our 80+ industrial partners. Collaborations with other Research Centres and with European consortia enable us to apply our skills to challenges in a range of scientific disciplines, from smart cities to financial sentiment, semantics to energy efficiency.

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. The effectiveness of the Centre in achieving this is reflected by the companies and international research centres that collaborate with us, by the licenses and spin-out companies that we generate, and by the publications and other scientific indicators that we have achieved.

Insight builds on many years of established leadership in data sciences, combining the skills and experience of world-leading research centres 4C, TRIL, CLARITY, CLIQUE and DERI. This unique mix of capabilities positions Insight to address key challenges in data analytics and to confirm its position as a global leader.

Insight is committed to further multi-disciplinary research, leveraging the broad spectrum of competencies available to us. We will continue to build new industrial relationships, and contribute to the economic growth of Ireland. As a major research centre, we will inspire, attract, retain, and train new generations of scientists, for academia and for industry.

This document presents the strategic plan for the Insight Centre for Data Analytics ('Insight'), for the period 2016-2025. It outlines the long-term strategic aims for Insight, across excellent research, industry benefit, capacity building, outreach and delivering an excellent research environment. Herein, we state our key objectives and priorities, and the strategic actions which we will carry out to achieve them. We outline how we will further refine and improve all our activities, from core research to industrial collaboration, from public engagement to communication, from securing funding to providing an excellent environment in which to do research.

The document represents the distillation of inputs from a broad range of Insight stakeholders, from government, industry, our member universities, and the Insight community, as well as analysis in the light of other strategic documentation from SFI, from the Universities, from Government, and from peer organisations abroad, such as the Alan Turing Institute and the Fraunhofer Organisation. It demonstrates a shared ambition for Insight to remain a world-leading research centre. I would like to thank all those who gave of their time to assist in this process, and look forward to working with you in delivering our shared vision.

1.2 Background and Context

Insight is a **research centre**, focused on the domain of data analytics. Its research community strives to use excellent science to create new knowledge in data analytics and its applications, while also delivering industry impact and economic benefit.

Insight is a joint initiative between four Irish universities (DCU, NUI Galway, UCC and UCD) as *co-lead sites* and four *associated sites* (MU, RIA TCD, and Tyndall) in a single national organisation, comprising over 400 researchers. Research groups and subject matter expertise are distributed between and across sites, reflecting the competencies of the individuals at each site; research activities are led by a group of over 50 Principal Investigators and Funded Investigators. The Centre has over 80 industrial partners, who work with the academic researchers on projects ranging from blue-skies and abstract mathematical research to specific applications of data analytics to answer a commercial question.

Insight also enjoys collaborations with prominent research groups across Europe, by leading and participating in a portfolio of EU-funded research projects. The Centre continuously pursues new opportunities for collaborative projects, both in Ireland and overseas. Insight is also mandated to promote science as a career, and to improve public appreciation of science, through its Education and Public Engagement activities. The Insight Communications team manages the Centre website, maintains media profile, and manages public relations.

Insight's core funding is provided by Science Foundation Ireland (SFI) under its '*Research Centres*' programme, for the period 2013-2019. It subsumes, and replaces, five earlier national research programmes (CLARITY, DERI, 4C, CLIQUE and TRIL), bringing together a uniquely multi-disciplinary and experienced team. In addition, as part of the SFI Centres Programme, Insight has submitted a proposal for the funding period from 2019 to 2025.

1.3 Insight in the Irish research landscape



Insight is the largest of the SFI Research Centres, and the only one dedicated to data analytics. It has common research interests with several other Centres, including CONNECT (primarily a networks research Centre, but involved in transmitting and managing substantial quantities of data), Lero (focused on software engineering, but addressing big-data challenges that intersect with Insight) and ADAPT (focused on digital content, which itself represents very large bodies of data, with data-analytics challenges in management, retrieval, etc.), and in addition has carried out work with other SFI Research Centre including AMBER and INFANT. Insight is committed to working with other research institutions on shared research opportunities. Data analytics offers significant value and opportunity across a very wide spectrum of application domains; Insight will contribute and collaborate wherever this helps us to meet our strategic goals.

Insight and its peers operate in a dynamic and rapidly-evolving business and technology landscape, where sources, varieties and volume of data are increasing rapidly, and where scientific and commercial appreciation of the potential value to be derived from this data is widespread. Leading global IT companies have made large investments in big data and data analytics capabilities as part of their core products and services; major actors in other sectors (healthcare, financial services, security, media, retail, manufacturing, transport, etc.) are also beginning to better understand the value of their own data, and establishing R&D teams to exploit it. Establishing a research leadership position and remaining 'ahead of the curve' is a key priority for Insight. Simply '*being in data analytics*' is no longer sufficient - Insight must identify and build leadership in specific niche topics, both within data science

itself (e.g. in statistics, decision support or machine learning) and in its applications (e.g. personal analytics, healthcare, environmental monitoring, etc.).



2 Executive Summary

Insight is the national research centre for data analytics. The largest SFI Research Centre, it brings together leading research teams from four lead universities (DCU, NUI Galway, UCC and UCD) and four associate sites (MU, RIA, TCD and Tyndall), to deliver a world-class research programme, significant industrial and economic benefit and compelling outreach and education. Insight has over 400 researchers, over 80 industrial partners and a committed budget of over 80 million euro.

This strategy document outlines Insight's ambitions for the period to 2025, and the strategic actions foreseen to achieve these ambitions. The strategy was developed following a comprehensive consultative process, and provides a reference point for the ongoing and future management and delivery of the Centre.

The following is a brief summary of each major part of the document:

The document opens with a short **introduction** and **foreword**. These are followed by an overview of the nature of Insight, and how it is located in the broader Irish research landscape.

The **core** of the document is comprised of a series of sections, each dedicated to one of the strategic goals listed below.

1. The **research programme** presents Insight's current research activities, and presents a list of research and research management actions which will further improve the high-quality research being carried out. Scientific excellence, industry relevance, alignment with national priorities, commitment to 'open science' and the pursuit of non-exchequer research funding are highlights. The **research agenda** then presents the four major application domain themes that Insight will continue to pursue – (i) Health and Human Performance; (ii) Smart Communities and Internet of Things; (iii) Smart Enterprises and Services; and (iv) Sustainability and Operations. The manner in which the themes are interrelated, and how they are supported by the overall research agenda, is presented, as are the major research priorities supporting the themes.
2. **Economic and commercial impact** outlines our approach to working with industry and the value proposition that Insight represents. Strategic actions include (i) exploring the long-term aims of our partners, and how we can help them to achieve these aims; (ii) contributing 'core' research into multi-disciplinary projects, to generate more "applied research" opportunities; (iii) extensive collaboration with IDA Ireland and Enterprise Ireland; and (iv) working with our member universities to simplify the intellectual property model for multi-university projects.
3. **Building Capacity** looks at our approach to attracting and retaining talent, and training future generations of data scientists. Facilitating the recruitment of graduates into industry (both our industrial partners and other companies) is highlighted, as are

the career development of new research leaders, and the provision of Continuing Professional Development (CPD) opportunities to industry.

4. Combining teams effectively across **Multiple Sites into One Centre** is a key aim of Insight, so that the Centre delivers more than the sum of its parts. Awareness of one another's skills and track record, regular contact at meetings, symposia and other events, and collaboration on shared projects are all important enablers for effective integration. Strategic actions include encouraging and facilitating communication and interaction, incentivising cross-site grants and publications, and sharing best practice.
5. The provision of a **Positive Environment** for our researchers is essential, if they are to do their best work, and if Insight is to attract and retain the brightest talent. Personal and career development, skills building, opportunities for responsibility and a collegiate, inclusive atmosphere are essential. Strategic actions include active recruitment strategies, encouraging young researchers to publish, to seek grants, and to network across the Centre, as well as offering industry placements and opportunities to work with diverse research groups at other sites.
6. **Communications** are essential for the Centre to maintain its international profile, as well as maintaining public and industrial awareness in Ireland. International profile encourages inclusion in research consortia, as well as invitations to speak, opportunities for joint publications, etc. National profile demonstrates the economic and societal dividends paid by taxpayer support, makes industry aware of the benefits of working with Insight, and helps to encourage students considering STEM careers. Strategic actions include communications activities aimed at (i) the international scientific community; (ii) industry; (iii) media and general public; and (iv) stakeholders such as SFI, IDA, EI and the universities.
7. The twin aims of Insight's **Education and Public Engagement** activities are encouraging students to consider careers in STEM, and improving the public perception of the broad benefits of science. These remain an important focus going forward. Strategic actions include (i) expanding existing activities (demonstrators, school visits, internships, etc.); and (ii) targeting third-level under-graduates.
8. Finally, Insight is committed to **Data Analytics Leadership**, acting as a national source of expertise in data analytics, its capabilities and limitations, opportunities and dangers. There are extensive opportunities to add value to evidence-based policy making at national and international levels, including to public and government conversations about big data, privacy, security, open science, healthcare and other domains of application. Strategic actions are focused on these opportunities – to engage in policy and best practice, to provide expertise to government, healthcare and other agencies, and to contribute to international initiatives on big data.

Short **appendices** list key bibliography sources, and thank the (listed) individuals who contributed to the strategic planning process.

3 Insight Mission & Vision

Our 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.

Our Vision: Empowering Citizens. Smarter Societies.



4 Insight Strategic Goals

- To pursue **scientific excellence** in data analytics and its applications
- To deliver beneficial impact to our **industrial partners** and to the Irish economy and society
- To foster a **new generation** of data scientists in Ireland, equipped to pursue the opportunities of data analytics in science, industry and beyond
- To grow our profile as a **world-renowned** centre in data analytics and its applications
- To create and grow strategic **partnerships** with other research institutions, in Ireland and overseas.
- 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 pursue excellent research and innovation as a **single integrated national Centre** with critical mass and scale
- To **facilitate discussion and understanding** of data analytics, its applications and limitations, its ethical aspects and societal value, in the public arena.
- To **grow and diversify funding** to sustain the long-term development of the Centre

5 Excellent Research

“To pursue scientific excellence in data analytics and its applications”



5.1 Introduction

A key objective of Science Foundation Ireland’s Agenda 2020 is

“...to develop a set of world-leading, large-scale research centres that will provide major economic impact for Ireland. SFI Research Centres link scientists and engineers in partnerships across academia and industry to address crucial research questions; foster the develop of new and existing Irish-based technology companies; attract industry that could make an important contribution to Ireland and its economy; and expand educational and career opportunities in Ireland in science and engineering.”

When Insight was established, it described its research competences in terms of fundamental science (machine learning, optimisation & decision-making, sensing, and semantic web), enabling technology (recommender systems, linked data, and media analytics), and application domains (“connected health” and “discovery economy”).

To date Insight has had much success in these areas and has developed a variety of additional application domains both with Industry and in H2020. Equally, core competencies have been added through organic development and by partnering with ICT and application domain centres and groups nationally and in Europe.

As we move to the next phase, it is crucial for the Centre to develop and evolve the core technology and expertise in data science in line with global research and industrial state-of-the-art (and beyond) trends. This is required not only to meet the SFI's requirement to benchmark against excellent science, but also as a means to further extend into several other ambitious application domains of high economic and societal impact over the next 10 plus years.

This is precisely what the Insight Scientific Advisory Board suggested in their recent report:

“One potential approach discussed by the committee, in developing a unified vision for Insight, would be to have a cross-cutting “core data analytics” component for Insight consisting of broadly applicable methodologies for working with complex data, including statistical analysis methods, machine learning, semantic modelling, optimization, databases, and so on). This “core component” would exist in addition to domain-specific themes”.

The national expectation and ambition for Insight is high. The Centre is expected to make significant scientific advances in core data science and analytics and related fields, in addition to collaborating closely with industry and government agencies to support the development of Ireland's capability in areas impacted by data science, artificial intelligence, and related areas. This must all be achieved in the context of Insight becoming a world-leading research centre known for its work in several strategic programmes.

In achieving these goals, to support 'full stack' multi-disciplinary impact, and in line with SFI policy, Insight will increasingly foster deeper strategic relationships with platform ICT and domain-specific SFI Research Centres, participate, contribute to, and leverage national research infrastructure services and pilots, and generally develop deeper international alliances in data science (in addition to H2020, related and future programmes).

5.2 Strategic actions for research

1. Continue to pursue challenge-based **multi-disciplinary** research, by taking advantage of skill-sets across the Centre, to build **optimum teams** for each challenge.
2. Work together with **researchers from all scientific domains**, in particular natural sciences and economics, to embed core data analytics research into multi-disciplinary projects.
3. Maintain scientific excellence by **selecting** and defining research projects that go beyond the state of the art; are **scientifically exciting**, and stimulate and develop the Insight research community.
4. Maintain our **industry relevance** by working with industrial partners to inform our research agenda, to define projects, to deliver outputs and to translate these research outputs into innovation.

5. Ensure alignment with **national research priorities**, by combining Insight capability with the skillsets of other SFI Research Centres, to address challenges across nationally prioritised research topics.
6. Partner with the best of **international peers** on a formalised basis, opening up opportunities for student and researcher exchange and collaborative projects.
7. Continue to **pursue non-exchequer funding** and develop our international research activities, building Insight's profile in Europe and beyond, while enhancing our own capabilities.
8. In the spirit of '**open science**', publish our data, analysis results, techniques, papers and software for re-use by the broader research community, whenever contractual agreements allow.
9. Establish and maintain a rigorous technology and market **horizon-scanning** process, to identify new challenges and opportunities in a timely manner.
10. Establish a substantial **discretionary research fund** to proactively pursue new opportunities in core and/or targeted research or expand particularly successful initiatives.
11. Deliver on our commitment to research integrity and **ethics** in research, by training all researchers in these important areas.



5.3 Strategy Overview

Data is provided from data sources and data repositories that are massive in scale, multi-modal in nature, temporal and real-time sensitive, and spatially distributed (e.g., social networks, satellite data, etc.). Furthermore, the heterogeneous data sources are highly distributed urging requirements for data integration, linking and semantic normalization in preparatory phases.

Data science is a multi-disciplinary research domain that requires scientific expertise in 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, different kinds of optimisation solutions, high performance computing, amongst others.

Data analytics requires the same range of expertise, and applies it to decision support, knowledge discovery and the development of new technologies in a range of scientific and technological application domain themes, including Health & Human Performance, Smart Communities & Internet of Things, Enterprises & Services, and Sustainability & Operations. The Insight Centre for Data Analytics brings together researchers from all the above domains, benefits from core science research and leadership, embeds advanced research into transferrable technologies and affirms its leadership by delivering demonstrator platforms and advanced, industry-driven collaborative research projects.

Insight's strategic vision is enabled by its core and evolving scientific competencies with a strong emphasis on multi-disciplinary excellence, innovation, and impact. The vision is underpinned by world-class, diverse, complementary and well-aligned, constituent research groups and is executed in collaboration with its national and international academic, public research and industrial partnerships

Insight's strategic research priorities are informed by the following principles:

1. Research is centered on scientific challenges that require core research, where the acquired scientific solutions feed into enabling technologies and targeted projects as well as contributing to other scientific challenges within Insight.
2. The ongoing pursuit of world class research within Insight's core data analytics disciplines: Machine Learning & Statistics, Constraint Programming and Optimization, Sensing and Personal Analytics, Recommender Systems, Linked Data Semantics, Natural Language Processing (NLP), and Media Analytics, which feeds into an integration and demonstration research programme which showcases demonstrators in the Augmented Human, Smart Enterprises and Sustainable Societies
3. Ensuring that priority is given to important and cross-cutting research in data analytics domains, such as security and privacy, human data interaction (HDI) while embracing new computing and novel architectures for high performance computation and data management by design.
4. Recognition of the societal and commercial relevance of the application themes supported, in terms of economic and human capital impact, nationally and on a world stage.
5. The focus on challenges and multi-disciplinary integration platforms that combine the core competencies into transferrable technologies to serve these application themes and sectors.

Figure 1 below provides an overview of the research program structure, bringing together many research capabilities and teams, operating with many different types of data sources and structures, and addressing a broad set of application domains and ultimately commercial sectors

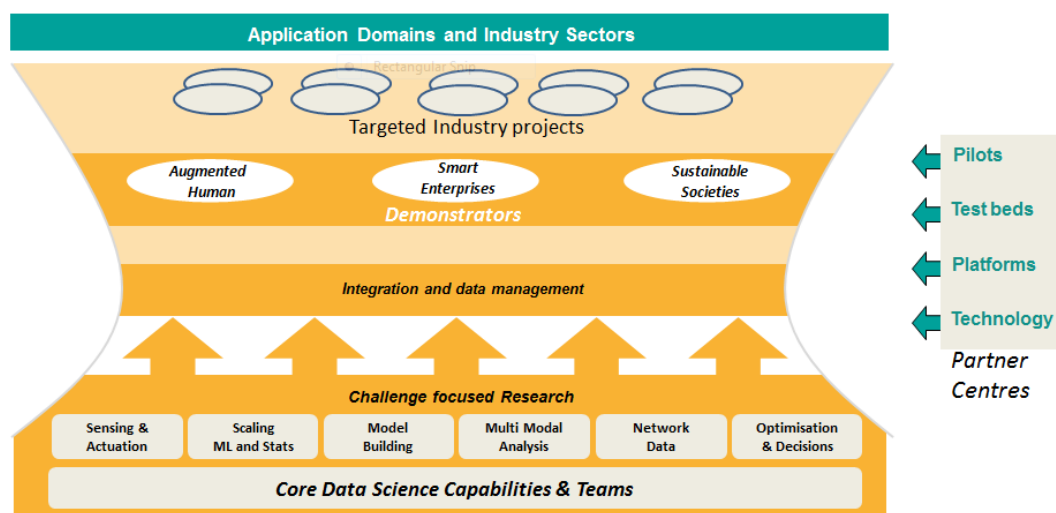


Figure 1: Overview of Research Programme Structure

Enabling technologies are delivered by combining the core research areas, the technology transfer areas and the most appropriate competencies across Insight to address domain specific application areas.

Increasingly this is accomplished via Insight-wide **integration platforms** or **demonstrator platform** projects focused on application domains and supported in many cases by partnering with other research performing entities to address application challenges and opportunities.

The **application domain themes** shown are informed by Insight's current research competencies, TRL focus, long term trends in data science, national or H2020 industry needs and Ireland's economic enterprise priorities in general.

Research challenges have been aligned with multiple real-world applications; and specific challenges, enabling technologies, and application areas are mapped to one or more application domains to develop cross-cutting challenge based research (see below).

Application Domain Thematic Areas

Insight's four major application domain **thematic areas** are as follows:

- 1) **Health & 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.
- 4) **Sustainability and Operations**, including smart manufacturing 4.0/logistics, agriculture/food analytics, marine analytics and the environment.

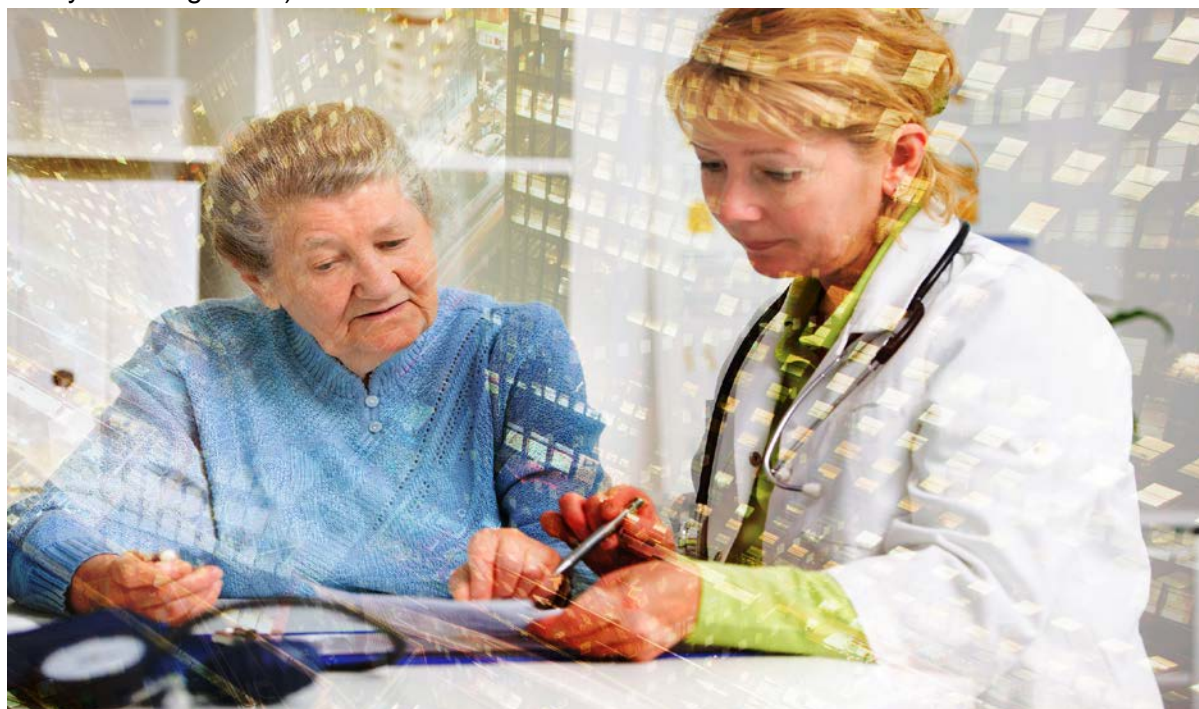
Health & Human Performance	Smart Communities & Internet of Things	Enterprises & Services	Sustainability & Operations
Connected Health	Smart Cities	Cognitive Enterprises & Learning	Smart Manufacturing
Sports Science	Transportation & Connected Mobility	Financial Services Banking & Insurance	Agriculture & Food
Bioinformatics & Pharmaceuticals	Smart Networks	Retail/Marketing Customer Engagement	Marine
Healthcare Systems	Public Services	News & Media Public/Social	Environment

1. Health and Human Performance

Humans' biomedical needs (e.g., data on nutrition), human performance and health form a domain where sensing data, social media data, scientific information, and other types of data are used in a wide range of scenarios. This domain is addressed by Insight's research expertise from different angles including recommender solutions, personal sensing, biomedical data analytics, machine learning and artificial intelligence. The research work spans from core science in biomedical data analytics to demonstrator platforms for human performance.

Biomedical data analytics is a multi-disciplinary research domain that provides answers for complex questions and complex types of data. In the life science domain such questions reach from core genomics research (e.g. which cell type changes in immunological cells best fight off cancer), into the drug discovery domain (e.g. which alternative use of a drug can be exploited), and into the clinical domain (e.g. which treatment of a patient gives the best survival rate). For example, a data scientist in the biomedical domain uses heterogeneous scientific expertise to assess and exploit available data to answer a research question within the scope of the experimental approach and the anticipated hypothesis. Current applications of data analytics in the life sciences may exploit imaging data, unstructured data from the literature, content from scientific databases, public experimental and numerical data, and semantic resources for better interpretation. This may enable the validation of new experimental data against existing resources and the development of large-scale and advanced analytical methods, but may also support the interpretation of the resulting data against validated data resources. Key challenges lie in building large-scale probabilistic models for experimental data exposing complex scenarios in life sciences (e.g., cell state regulations) but also in the exploitation of semantic theories to achieve interpretations of data sources according to human standards.

Further Insight research focuses on the integration of the human (through his personal data) into an infrastructure that offers an opportunity of performance enhancements the “**augmented human**”. This research builds on data capture, data engineering and human data interaction (HDI), leading into recommendation solutions (e.g., for performance improvements), real-time data analytics and ultimately into a demonstrator infrastructure of core Insight expertise, e.g. in personal sensing, connected health, data analytics for health, media analytics, optimization solutions, recommender systems, semantic theories and others. The “augmented human” domain covers four dimensions: Augmented Intelligence, Augmented Decision Making, Augmented Performance, and Augmented Privacy. Specific input for Insight research in this area will derive from: industry-driven solutions with direct impact on customers’ needs; sensor driven closed loop robotic systems to augment human performance; and modelling and recommendation solutions for behavioural change (incl. lifestyle management).



Insight’s work in the area of **data analytics for health** will focus on topics such as:

- **Drug discovery** by exploring heterogeneous sets of data to expose the effectiveness of known drugs or the involvement of early stage drugs into biological processes;
- **Assessment of cellular, tissue and organ states** through their genomics and expression profile, to determine their differentiation towards cancerous or anti-cancerous specialisation.
- **Evaluation of treatments in the clinical domain:** building statistical, probabilistic and semantic models for the evaluation of genomic profiles of selected patients against predicted outcomes in treatments or survival rates of the disease candidates.

The **underlying core research challenges** that need to be addressed in this context include:

- **Semantic theories:** Use of validated and semantic sources for data interpretation according to human standards, analysis for human needs and interpretation;
- **Probabilistic and dynamic modelling:** large-scale data analysis and training of supervised/unsupervised models for complex data analytics, knowledge extraction

and representation: transformation and alignment of unstructured data with fact repositories, interpretation of data against semantic sources;

- **Semantically linked data and open knowledge graphs:** Graph based data analytics for inferences of explicit knowledge from existing reference data sources.
- **Image analysis and Multimodal data analysis:** use of multi-modal data for complex data analytics across data sources ,and interpretation of complex data types

2. Smart Communities and Internet of Things (IoT)

IoT brings together streaming data at scale in diverse forms and formats which, when fused with other data sources, drives automated or augmented decision making in a deeply contextual way. The IoT vision of a massively connected world with pervasive availability of data presents many opportunities to exploit Insight's breadth of research capabilities, enabling technologies and application domain expertise to drive multi-disciplinary core science, innovation and economic impact. Insight has the diversity in its key underpinning data analytics disciplines of sensing, semantics and linked data, computer vision/learning, machine learning/statistics, optimisation and recommender systems, to exploit the dramatically expanded data scale and open innovation challenges of this hyper-connected IoT world.

In this theme, Insight research will explore the following areas

- **Advanced Reasoning**, including (i) techniques for complex reasoning over background knowledge and streaming data; ii) knowledge-driven and probabilistic hybrid mechanisms for reasoning over uncertain, incomplete and noisy data and use of such data for knowledge learning and knowledge evolution in adaptive systems, and iii) incremental and streaming algorithms for automated deduction and complex event detection.
- **Data fusion** over multiple modalities, to optimise and transform raw data into actionable knowledge, resulting in the availability of secure, privacy-aware and quality-aware adaptive analytical solutions.
- Large scale **computer vision analytics**, at device, edge and cloud level, with semi-automatic annotation of large volumes of data, object detection/recognition and scene understanding based on deep learning and semantic search with ontologies.
- Managing increasing volumes of data and incrementally incorporating new data into the decision making process, exploiting virtualized and reconfigurable networks, and **scaling the decision support** to the most appropriate selection of data.
- **Scenario-based design** and tools for accessible open data platforms, models and methods for open data-driven public service and value engineering of open data products and service.
- **Making decisions at scale** based on the extracted information, and enabling interactive approaches to tune decision processes according to predefined requirements.
- **Autonomous learning** to handle a dynamic urban environment, where agents may have heterogeneous, conflicting objectives, while still allowing for distributed, cross-domain reasoning.

To integrate these areas into platform capabilities, demonstrator initiatives will be progressed across teams and with other Centres to attract new industrial partnerships around long term

challenges, supported by national testbeds and pilots. Internationally, Insight has extensive leadership today within the IoT Forum, IOT Consortium, W3C, the European Platform Initiative, and within H2020 consortia such as OPEN-IoT, VITAL, FIESTA, Cloud-LSVA, VI-DAS, CityPulse, Cloud LSVA, VI-DAS etc. Ambitious plans will be pursued to expand on these activities in the next stage of H2020 and FP9 Future and Enabling Technologies (FET).

Target **application areas** for this theme include **smart urban applications** (building on the ENABLE cross-Centre (2017-2020) spoke project), in autonomous and connected mobility, in Smart networks and in government and public services. The growing use of advanced computer vision AI, deep learning and optimisation techniques in connected mobility is of particular relevance, given the increased focus on trustable pervasive analytics, guidance and optimisation of autonomous entities.

Autonomy and pervasiveness in this context requires computation and analytics optimisation at the edge whilst trust requires that the context and consequences of all decisions are fully explored. Strong Insight competency in telecom and network analytics is being applied to IoT network design and value creation, with a focus on adaptive heterogeneous networks which respond to observed traffic and internal network state to reconfigure network topology, medium access, and routing and admission control.

3. Enterprises and Services

This theme covers applications of data analytics that enable the enterprise or other complex organisation to have a deeper, more detailed and more dynamic understanding of itself, its offerings and its customers by mining, interpreting and integrating enterprise data repositories and streams, customer data sources and relevant and contextual open (publicly available) data, in order to make better augmented decisions or recommendations.

The research theme will integrate and apply methods for the dynamic generation and maintenance of **enterprise knowledge graphs** that capture, represent and interrelate all relevant knowledge items across and beyond the enterprise to:

- capture heterogeneous data, across modalities, domains, and languages
- extract, represent and integrate information on a semantic level
- interrelate derived knowledge in probabilistic and symbolic ways
- enable and augment informed, semantic level recommendation and decision support

Enterprise knowledge graphs will build on the integration, extraction, derivation and generation of a variety of knowledge sources, including:

- Similarity Indices over documents and document segments, ranging from words, images, video, A/V and tables to sentences, paragraphs and sections as well as entities, facts and events
- Thesauri of enterprise specific categories, terminology and taxonomies, including multimodal and multilingual equivalents and translations

- Semantic Networks representing semantic and ontological relations including subsumption, part-of, causality, etc. as well as domain-specific relations, properties and attributes
- Social Networks of actors within and beyond the enterprise, including e.g. employees, customers, external contacts, departments, entities of interest across society, etc.



Data analytics within and across the enterprise will enable **innovative applications** that include the development of new services and products, optimization of business processes, more efficient staff allocation and career development, improved customer satisfaction, etc. The following examples from across different industries and application areas may be considered:

- The retail and marketing industries have access to legacy, as well as real-time, geotagged and personalized customer records which can be combined with publicly available data such as reviews, blogs and vlogs that can be mined for sentiment, customer suggestions and emotional stance, leading to increased customer understanding, improved products or services, and contextualized, automated interaction with the individual customer through different channels (voice, text, video).

- The financial services industry experiences increasing regulation,

requiring automatic methods for keeping up with changing legislation as well as monitoring of

staff and customers in relation to proper procedures, due diligence, fraud detection and risk assessment. This requires data analytics over large collections of legal text, company internal correspondence and social media activity.

- News and media companies have large archives of textual and A/V content that can be analysed, made searchable and enhanced with external data for repurposing. Similarly, other cultural institutes preserve large archives of significant cultural value that can be analysed and enriched for repurposing in creative industries and tourism.
- Large enterprises, across industry and non-commercial sectors, experience particular challenges when merging or re-structuring, due to dispersed workforces, different organizational cultures and non-aligned business processes, such re-structuring may require enterprise-wide data analysis, alignment and integration for improvement of business processes, customer sentiment mining and engagement, resource allocation, etc.

Smart Enterprise research **demonstrators** will build on, integrate and significantly extend research from across **different disciplines**, including: natural language processing, image processing, A/V analysis, Linked Data and Semantic Web, Social Network and graph analysis, machine learning, recommender systems, decision support and optimisation. Demonstrators will include advances in dynamic customer profiling in marketing analysis, virtual team integration across enterprises, risk management systems in financial environments and novel methods to access multi-media archives.

4. Sustainability and Operations

This theme focuses on the development of computational methods for balancing environmental, economic, and societal needs for a sustainable future. It can be regarded as the development of data analytics techniques to help deliver on the sustainability challenges defined through the UN Sustainable Development Goals. These Goals are global challenges, each with specific targets to be achieved by 2030.

This theme addresses a variety of analytics challenges related to (a) integrating sensing technologies, with (b) the modelling and prediction of complex spatiotemporal phenomena and dynamical systems, through to (c) recommendation and policy design, (d) optimization, and (e) control.

Insight has been a leading contributor to this field for over a decade. For example, it has chaired international conferences, has run masterclasses in collaboration with industry, edited books and journal special issues, and delivered addresses on the topic at forums such as the United Nations as well as at international conferences. Significant international networks have been developed, such as Insight's membership in the US National Science Foundation-funded Computational Sustainability Network. Insight has worked closely with a variety of industry partners with specific strategic interests in the area of sustainable society.

Insight core underpinning research ambition is focused on the following topics:

- **Data engineering and management.** Data engineering has become a part of any solution that makes use of data for decision support. Increasingly, such data has to be managed from heterogeneous infrastructures
- **Environmental monitoring and understanding.** Data collection at scale across heterogeneous data sources is a key enabler for deriving new environmental insights.
- **Machine learning at scale.** Modeling the interactions of agents with different and often conflicting interests: multi-agent systems, multi-agent equilibrium models, game theory, and design of effective mechanisms and policies for the exchange of goods. Sparse-labeled data. Life-long learning.
- **Complex high-dimensional systems.** Understanding, modelling, predicting, and reasoning about complex dynamic and spatiotemporal phenomena and systems. Modeling, understanding, reasoning, and control of complex high-dimensional systems by combining physics-based models, model-based reasoning, optimization and control methods, and machine learning models built from sensor data.
- **Modelling and reasoning under uncertainty.** Reasoning under complex uncertainty in the contexts of large data-sets and big data.

- **Decision-making at scale.** Solving decision and optimisation problems involving in excess of 100 million variables represents a barrier to delivering global system solutions to sustainable society problems.
- **Explainable artificial intelligence.** Developing novel machine learning and symbolic approaches that ensure that AI-based systems can adequately justify and explain their rationale behind their decisions.
- **Human-data interaction.** Supporting human engagement and decision making; collecting, modeling, and presenting relevant information via usable interfaces.



Insight delivers impactful outcomes in domains such as personal health and well-being; environment (water quality, marine, and agriculture); energy; smart manufacturing; smart cities and communities; and government and public policy-making. From a methodology point of view, Insight's approach to addressing challenges in sustainable society will involve: **heterogeneous data fusion** (sensing, linked data, semantic web, etc.); **model building** (statistics, learning, data mining, mathematical programming, etc.); **decision-making** (optimisation, operations research, explanation, etc.); **policy** (mechanism design, incentive design, behaviour change, etc.); **actuation** (control, execution monitoring, explanation, etc.); and **feedback**.

6 Economic and Commercial Impact

“To deliver benefit to our industrial partners and to the Irish economy and society”

6.1 Introduction

A key mission for Insight is to use excellent science to **attract and retain industry investment** in Ireland, by collaborating with industry partners on R&D that leads to competitive advantage, innovative products and improved services. There are excellent **commercial opportunities in data analytics**, in sectors such as healthcare, agriculture, manufacturing, smart cities and buildings, internet of things, and many more.

Insight supports a broad portfolio of industry partners, from global leaders to small SMEs, with whom we pursue research across the ‘core-to-applied’ spectrum. **Industry partners benefit** from access to leading researchers, opportunities to carry out R&D which is relevant to their commercial aims, and the potential to recruit graduates. **Insight research benefits** from access to real-world data, to novel research challenges, and to opportunities for high-impact results. The **Insight community benefits** from new skills, improved employability, exposure to the commercial environment, access to industrial research teams, entrepreneurial openings, and more.

Building industry relationships, understanding and analysing industry needs and priorities, and assembling teams and resources to tackle these priorities, are central to Insight’s business development. A **key asset** is the broad range of skills and experience available across the Centre, able to address a wide variety of data analytics opportunities.

6.2 Strategic actions to drive Industry Benefit

1. Continue to seek out opportunities for industry collaboration that **combine scientific excellence with commercial benefit**.
2. Engage deeply with industry partners, to understand their **long-term strategic aims** and explore how working with Insight can help to achieve these aims.
3. Develop **novel technologies** as part of innovative and collaborative ‘platform research’ projects for industrial and academic benefit alike.
4. Include **core research results** as key ingredients into multi-disciplinary research that spins off applied research for commercial impact.
5. Build **bespoke ‘packages’** of shared research and government support, in collaboration with IDA and Enterprise Ireland, to address strategic challenges for targeted partners; such packages may also involve other SFI Research Centres and institutions, both in Ireland and overseas.

6. Further develop collaborations with **IDA Ireland, Enterprise Ireland and other agencies** to attract, retain and grow investment in Ireland
7. Engage with SFI to enable Centres to build shared projects with **the public sector**, such as government departments, the HSE and the Revenue Commissioners.
8. Establish a **'membership' scheme**, to broaden access to Insight research, to act as an attractant for new targeted projects and spokes, and to stimulate an ecosystem of partner companies and research organisations
9. Maintain and enhance our **project selection** and management process, to optimise the selection, resourcing and delivery of industry collaborations.
10. Work with our hosting universities to establish a **seamless IP model**, to facilitate cross-site collaboration
11. Investigate the establishment of a **'services section'** to deliver professional-grade software development and project management in industry projects.



7 Building Capacity

"To foster a new generation of data scientists in Ireland, equipped to pursue the opportunities of data analytics in science, industry and beyond"



7.1 Introduction

Insight is a world-class centre of excellence in data analytics. An important part of our mission is to **attract the brightest** young talent and to train new cohorts of data scientists, who can apply their skills in industry and in academia. PhD and post-doctoral researchers at Insight gain experience in both academic and industrial contexts, as well as developing transferable skills such as teamwork, communication, and project management. Industrial placements give students the opportunity to experience the commercial environment, and to explore multi-disciplinary career options.

There is **great demand for data analytics skills**, as companies establish teams to drive commercial benefit from their data, and as scientists explore the insights which data-intensive research can yield. The availability of talented graduates, equipped with up-to-date skills and experience of data analytics research, is an important **attractant for Insight's industry partners** and helps to encourage investment in Ireland, as a location for data research.

7.2 Strategic actions to build capacity

1. **Recruit** students and graduate researchers to pursue careers in data analytics
2. Particularly encourage and facilitate the recruitment of **female researchers**

3. Contribute to **under-graduate and taught-graduate** level, with modules and course materials that introduce and develop data science skills.
4. **Retain and develop** talented individuals within Insight.
5. Ensure that Insight graduates have the **skills needed for a successful career**, whether in industry, academia or elsewhere.
6. Equip Insight graduates with the skills, attitudes and experience to make them the **employees of choice** for industry.
7. Facilitate the **recruitment of Insight graduates into Irish industry**, e.g. by Industrial Fellowship programmes.
8. Continue to support **post-doctoral researchers in developing their careers** as research leaders.
9. Offer **CPD opportunities for industry** partners, from one-day master-classes to industry MSc and PhD programmes.

8 Multiple sites – one Centre

“To pursue excellent research and innovation as a single integrated national Centre with critical mass and scale”



8.1 Introduction

Insight is geographically distributed across four lead sites and four additional partner sites, with seven major research groups (some of which span more than one site). Working as a single national centre is a pre-requisite for the Centre to benefit from its scale.

It is a strategic priority for Insight that **researchers** across the Centre collaborate equally effectively, regardless of their location. **Awareness** of the skills and experience of individuals and groups in all sites is a key enabler. Regular **contact** (meetings, symposia, and Centre communications) enables Insight to build distributed teams to address new challenges. **Working together** on shared projects, proposals and other activities helps to build the common appreciation and trust essential in a distributed organisation.

Insight represents an important opportunity to **learn from one another**. Over the last several years, specific sites have been especially successful in specific types of activity (e.g. grant applications, industry projects, internships, career development). By **sharing best practice** and training, all Insight sites can learn how to improve their own processes and resources, and to share in that success.

8.2 Strategic actions for Integration and cross-site collaboration

1. Explore opportunities to **optimise scientific coordination** across Insight's research teams.
2. Ensure that all researchers are **aware of the capabilities of their peers** in other sites, by facilitating visits, holding a Centre-wide annual conference, seminars, presentations, symposia, special-interest-groups and other activities.
3. Incentivise and facilitate **cross-site** projects, grant applications, publications, etc.
4. Explore what each site does best, and **share best practice**.

9 A Positive Environment

“To attract and retain the best researchers, by providing a supportive, collegiate and stimulating environment”

9.1 Introduction

Attracting and retaining the best Irish and international research talent is essential, if Insight is to meet its core objectives, to further develop its research themes, and to continue to offer innovative collaboration opportunities to industry. We must **identify, recruit and retain** young researchers who will enrich the Insight environment, build their own research teams, and themselves contribute to the nurturing and development of new generations of researchers.

Insight aims to provide a stimulating, supportive, and collegiate **environment** in which to carry out research. We **encourage our researchers to develop** as individuals, as scientific leaders and team players, to collaborate within and beyond Insight, and to make the maximum scientific and economic contribution possible.

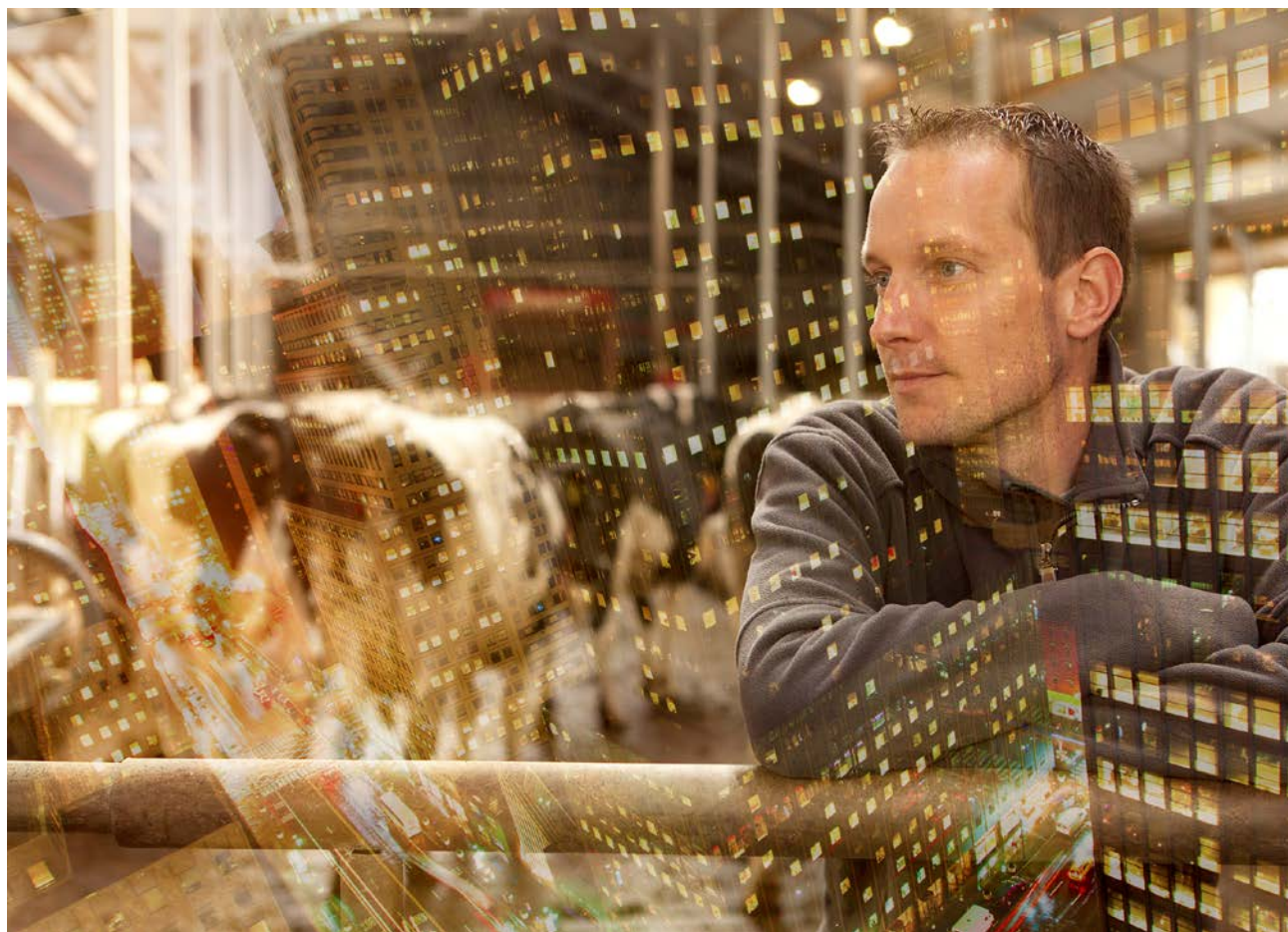
Insight seeks to **place a high proportion of its graduates in Irish-based industry**, thereby contributing to the national industrial R&D capacity. Insight's industry-relevant research builds graduates with the skills and knowledge that industry requires.

9.2 Strategic actions for attracting and retaining talent

1. Continue to **attract the most talented researchers** into Insight, from early PhDs to senior researchers, through active recruitment strategies, personal and professional networks, and building Centre profile.
2. Offer a **supportive environment** where we monitor and mentor younger researchers, to ensure that their work remains focused and they achieve their goals.
3. Support **scientific publications** and participation in conferences and workshops.
4. Stimulate **networking and collaboration** across the Centre community.
5. Offer **placements at industry** partners, to enable researchers to explore R&D beyond academia.
6. Offer a work environment that **respects best practice institutional gender and diversity policies**.
7. Bring **interdisciplinary scientists** to the data analytics research domain to transform core research (mathematics, computer science, other), into applied scientific outcomes.

9.3 Strategic actions for career development

1. Give **responsibility** to new research leaders, with the backup support of more senior team members.
2. Deliver **training** and offer opportunities to our researchers to gain **industry experience**, to pursue grant-aid, engage in EPE, set up and lead new research teams/groups, and build profile.
3. Support our researchers in preparing and delivering **grants** which enable career development for younger researchers
4. Facilitate **recruitment of graduates into industry**, in Ireland and overseas.



10 Communications

“To maintain an international reputation as a leading centre in data analytics and its applications”

10.1 Introduction

Communicating the excellence and impact of Insight and its activities is an important strategic goal for the Centre. A strong **international** reputation helps to attract the best new talent, to build networks of collaborators and partners for international research consortia, and to stimulate new contacts and collaborations with international industry. **Within Ireland**, effective communication ensures that existing and potential industry partners are up to date with our activities and aware of our broad range of skills and activities; it also informs key stakeholders such as SFI, IDA Ireland, DJEI and the host universities.

Robust **branding** and profile building for Insight as a Centre remains a priority. This is achieved by scientific activities (conferences, publications, etc.) as well as by media and social-media activity, event sponsorship/involvement and other marketing.

Public awareness of science, and of science’s contribution and benefit to society as a whole, underpins support for science and for public funding of research.

10.2 Strategic actions for Communications

1. Communicate Insight's **identity and value** to key target audiences, including the scientific community, industry, funding agencies, the general public, and the Insight community.
2. Maintain and cite the **Insight ‘brand’** wherever appropriate.
3. Continue to create, maintain and distribute **communications assets** that express the core scientific mission, and the industry value proposition, of the centre.
4. Enhance existing **website and social media** activities to communicate the size, quality and diversity of the centre and its activities
5. Address the scientific community by continuing to **publish** in high-profile venues.
6. **Reach out to industry** through events (workshops, briefings, master-classes, seminars), and assets (case studies, testimonials and demonstrators), showcasing Insight capabilities and their commercial applications
7. Maintain high profile in **mainstream media**.
8. Keep key **stakeholder organisations** (IDA Ireland, EI, SFI, universities) fully informed, to ensure that Insight plans and activities align with external contexts.

11 Education and Public Engagement (EPE)

“To inform and enthuse the general public and students in particular, about data science and its value to society.”



11.1 Introduction

Encouraging second-level students to **consider a career in science**, technology, engineering or mathematics (STEM) is a key challenge for Ireland. Skills shortages in these areas are already problematic; indicators of future trends suggest that these challenges will be exacerbated in the coming years. A particular issue is the relatively low interest in STEM shown by **female students**. Insight’s education and public engagement (EPE) activities address these challenges head-on, through a combination of schools outreach, hosting visits to Insight sites, involvement in STEM events (with several aimed specifically at female students), talks and workshops for parents, etc.

A related challenge is improving the **public perception of science**, and the value of investing in scientific research, as well as the related disciplines of technology, engineering and mathematics (STEM). The long-term and incremental nature of most scientific research means that particular effort is needed to justify investment, in the face of many urgent calls upon exchequer funding. The central role played by STEM in day-to-day life must be communicated and appreciated.

Insight’s Education and Public Engagement (EPE) programme addresses these challenges,

11.2 Strategic actions for EPE

1. Further develop our **existing excellent EPE activities** and facilities, and work with the Insight research community to expand critical areas such as demonstrators, internships, schools outreach and lab visits.
2. Develop and roll out a programme specifically aimed at **third-level undergraduate students**, to de-mystify research, demonstrate the wide range of career options for researchers, and encourage the choice of research as a career.
3. Achieve **greater synergies** from Business Development, Communications and EPE activities and resources.



12 Data Analytics Leadership

“To facilitate discussion and understanding of data analytics, its applications and limitations, its ethical aspects and societal value, in the public arena.”

12.1 Introduction

The benefits of data analytics are broad– domains such as healthcare, government, industry, and beyond benefit from the availability of unprecedented quantities of data and the evidence-based decision making this enables.

However, there are legitimate concerns about personal privacy and confidentiality, and about the ease of unintended re-use of digital information. As more and more aspects of modern life move online and into the cloud, the potential for abuse and cyber-crime increases. A strong regulatory framework, with recognised technical and operational standards, is essential if data analytics is not to become associated with intrusion, ‘big brother’, identity theft and infringement of privacy.

Insight is uniquely well-placed to provide informed, expert opinion on the technical aspects of data analytics, the potential and the constraints that apply to the field, and the impact of new developments. Insight can act as a trusted source of information, alerting government, public and industry to potential problems and abuses, as well as providing reassurance and an informed opinion in the face of poorly-informed alarm, and contributing to policy and guidelines.

Insight can help to set the international research agenda in data management, privacy and data ethics, where new policy is urgently needed. Scientifically-expert engagement with government, with the EU, with industry and with other stakeholders will enable Insight to play a leading role in this important domain.

12.2 Strategic Actions for Data Analytics Leadership

1. **Demonstrate research leadership** through platform research, standards development and solution provision to the research community.
2. **Lead EU discussions** and establish best practice on data privacy and stewardship (e.g. building on “Magna Carta for Data” initiative).
3. **Remain fully informed** on international developments, thinking, practices and legislation that apply to big data, how it can be collected and used, and how the privacy of the individual is preserved.
4. Contribute to media and **national policy** discussions on the collection, management and (re)-use of personal data for commercial, eGovernment and other purposes.

5. Continue to contribute to national and **international policy and guidelines**, and to drive the research agenda, in data management, privacy and ethics.
6. Provide data analytics **expertise in research policy** discussions, economic planning, sectoral development strategies and shaping Ireland and Europe's future scientific landscapes.
7. Enable data-driven science, healthcare, commercial and societal benefit by providing a **national source of expertise** in data analytics, its applications and its potential.



13 Appendix 1: External and background material

Very relevant to the strategic plan and the further development of Insight are the documentation published by the Irish government, by SFI, by the Universities, by the EU and by peer organisations overseas. The following were the most important external documents that fed into this process:

13.1 Irish Government Strategy for R&D, Science and Technology - Innovation 2020

The major national strategy document¹, published in 2015, places great emphasis on innovation - the creation of new knowledge through research, and its translation into wealth, jobs and commercial benefit. Having invested in research, this strategy shifts the emphasis to translation and innovation. Its key aims are scientific excellence, capacity building and economic/social impact - objectives that are very much mirrored in Insight's own strategic priorities.

13.2 Irish Government National Skills Strategy 2025

As part of the Action Plan for Jobs 2015, the Department of Education and Skills has developed a new National Skills Strategy 2025 - Ireland's Future². In the context of a third level sector which is under increased pressure to deliver more and better qualified graduates with reduced funding and other constraints, this strategy particularly targets learners at all levels, including PhDs, and sets out to provide all learners with the knowledge and skills they need to participate fully in society and the economy.

13.3 Irish Government National Enterprise Strategy - Enterprise 2025

This policy document³ on developing the commercial sector also focuses on the importance of industrial research and innovation (R&I) and the value to be derived from industry-academic partnerships. Attracting foreign direct investment (FDI) is a clear priority, and one to which high-quality research centres - and a well-educated workforce - make an important contribution, in concert with IDA Ireland

13.4 SFI strategic plan - Agenda 2020

SFI's strategic plan to 2020⁴ explores SFI's commitment to 'research with impact'. The commitment to economic benefit and translational research are clearly underlined. The role of Centres in attracting and retaining talent and investment is also central to the SFI vision.

¹ <https://www.djei.ie/en/Publications/Publication-files/Innovation-2020.pdf>

² https://www.education.ie/en/Publications/Policy-Reports/pub_national_skills_strategy_2025.pdf

³ <https://www.djei.ie/en/Publications/Enterprise-2025.html>

⁴ www.sfi.ie/assets/files/downloads/News%20and%20Events/AGENDA%202020.pdf

13.5 Insight Review 2015

Insight's first Centre review, in 2015, praised most aspects and activities of Insight. A number of recommendations were made, including the need to demonstrate value through integration and the importance of selectivity when establishing industry partnerships. Many of these recommendations are addressed in this strategic plan.

13.6 HEI strategies [DCU, NUI Galway, UCC, UCD]

Each of the hosting universities has its own University strategic plan⁵. While they vary in emphasis, they share a common message – a commitment to excellent education and student environment, high-quality research and innovation, and engagement with the community and with industry. The attention given to external philanthropic funding is notable.

13.7 Research Prioritisation report

The Irish government's Report of the Research Prioritisation Steering Group (2011)⁶ is now several years old, but retains a great deal of relevance for Insight, because of the emphasis that SFI places upon it, and its informing of the Centres programme. Priority Area B 'Data Analytics, Management, Security and Privacy' is central to Insight; areas A, C, and D are also very relevant (A: Future Networks and Communications; C: Digital Platforms, Content and Applications; D: Connected Health and Independent Living).

13.8 EU Publications

The EU's strategic publications are relevant due to their influence on national funding strategies, and on the context and drivers for Horizon 2020. The EU documents tend to shift the balance more towards scientific excellence, while maintaining a clear focus on innovation and economic impact; broader strategy initiatives (e.g. Europe 2020⁷) also address issues such as climate change, poverty and social inclusion. Of direct relevance to Insight is the EU's strategy and Communication for a data-driven economy (2014⁸), which underpins the recent 2017 Communication⁹ on 'Building a European Data Economy'; such clear commitment indicates that EU support for data analytics as a research field is unlikely to waver. The use of data analytics of course appears frequently in the current ICT Work Programme; data analytics also finds applications right across the Societal Challenges pillar. The Principles of Innovative Doctoral Training document is an important input to the Marie Curie programme, and to structured-PhD planning.

⁵ See the HEI websites for access to these documents

⁶ <https://www.djei.ie/en/Publications/Publication-files/Research-Prioritisation.pdf>

⁷ ec.europa.eu/europe2020/index_en.htm

⁸ <https://ec.europa.eu/digital-single-market/towards-thriving-data-driven-economy>

⁹ <https://ec.europa.eu/digital-single-market/en/news/communication-building-european-data-economy> and <https://ec.europa.eu/digital-single-market/en/building-european-data-economy>

13.9 Hauser Catapult report

The review¹⁰ of the UK's Catapult programme by Hermann Hauser in 2014 raises many issues familiar to Insight. While the emphasis is different (core or 'basic' research is not a central part of the Catapult remit, which is more translational in nature), the UK report looks at topics such as the relationships with SMEs and with Universities, and balancing industry engagement with staying ahead of the market.

13.10 Turing Institute documents

The more recently-formed Alan Turing Institute (ATI) is perhaps the UK's closest parallel with Insight, with a similar aim to combine core research with industrial impact and innovation, training and public engagement. The ATI is still getting off the ground, so that its main outputs describe the processes used to set it up and to define its research agenda.

13.11 Fraunhofer presentations

The Fraunhofer Institute is often put forward as a role model for translational research and industrial impact. However, as with the Catapults, the Fraunhofer has a clear focus on applied research, lacking Insight's commitment to more fundamental work. Several Fraunhofer presentations, documents and web resources were reviewed.

¹⁰ <https://www.gov.uk/government/.../bis-14-1085-review-of-the-catapult-network.pdf>

14 Appendix 2: Stakeholder Inputs

This document is informed by the direct inputs of Insight stakeholders. The author would like to thank the following for taking the time to meet, discuss Insight and provide feedback and commentary.

- SAC: Prof Ken Ford
- IAC: Margaret Burgraff
- Governance Committee: John Herlihy

- Inter-institution committee: Richard Stokes, DCU
- Inter-institution committee: Prof. Orla Feely, UCD
- Inter-institution committee: Prof. Lokesh Joshi, NUI Galway
- Inter-institution committee: Prof. Anita Maguire, UCC

- SFI: Dr Darrin Morrissey, Prof. Mark Ferguson
- IDA: Leo Clancy, Dr Chantelle Kiernan, Keith Fingleton, David Brody
- DJEI: Marcus Breathnach

- The CEO (Oliver Daniels) and COO (Mike Turley)
- SLG members (including directors) at UCC, DCU, NUI Galway and UCD
 - o UCC: Prof. Barry O'Sullivan, Dr Derek Bridge, Prof. Ken Brown, Prof. Eugene Freuder, Helmut Simonis, Prof. Greg Provan, Dr. Steven Prestwich.
 - o DCU: Prof. Alan Smeaton, Dr. Mark Roantree, Dr Breda Kiernan, Dr Suzanne Little, Ray Walsh, Dr Andrew McCarren, Prof. Noel O'Connor
 - o NUI Galway: Prof. Dietrich Rebolz Schuhmann, Dr Paul Buitelaar, Dr Brian Wall, Dr Muhammad Intizar Ali, Dr Adegboyega Ojo, Mark Mellotte, Dr Conor Hayes
 - o UCD (two meetings): Prof. Brian Caulfield, Prof. Barry Smyth, Dr Aonghus Lawlor, Dr Michael O'Mahony, Prof Nial Friel, Prof. Andrew Parnell, Prof. Neil Hurley, Prof Derek Greene, Prof Georgiana Ifrim, Prof. Madeleine Lowery, Prof. Brendan Murphy
- The Business Development team (Eamon O'Doherty, Mike Conroy, Peter Fitzpatrick, Hugh O'Neill; Marc Mellotte, Dr Chrys Ngwa)
- Site Managers at UCC, DCU, NUI Galway and UCD (Linda O'Sullivan, Dr Breda Kiernan, Dr Brian Wall, Dr Donnacha O'Driscoll)
- The communications team (Louise Holden & Grainne Faller)
- The EPE team (Dr Aoibheann Bird, Brendan Smith, Dr Chrys Ngwa)