Big Data and Artificial Intelligence Centres of Excellence Framework

CORE MODEL PRACTICES

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THE BIG DATA AND ARTIFICAL INTELLIGENCE CENTRE OF EXCELLENCE SERIES

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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 in this report a more detailed elaboration of the best practices within the BDAICoE model. This involved identifying specific practices for the capabilities part of our framework. This was achieved by performing a detailed analysis of the case studies and interviews with subject experts. The model has been extended with key practices for the core model capabilities (Strategy, Governance, Structure, Funding, People and Culture).

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 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

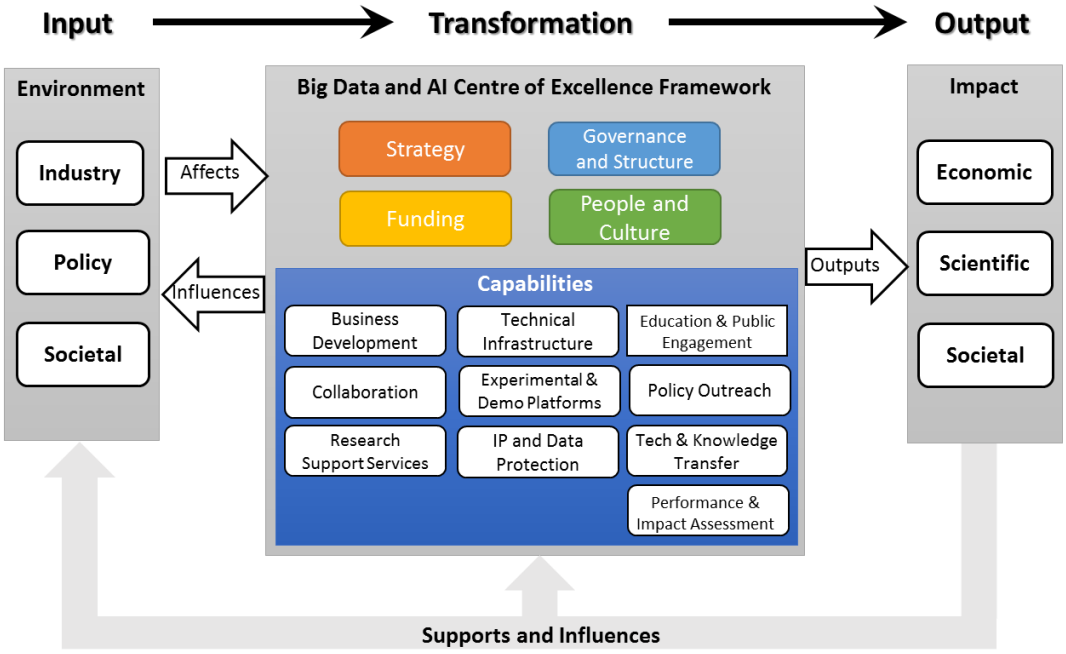

Figure 1: BDAICoE Framework

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 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.

Table 1: Core operational capabilities of the BDAICoE framework

Operational Capability	Definition
Business Development	How the centre develops new business opportunities and manages its partnerships
Collaboration	How the centre enhances Academic to Academic and Academic to Industrial Interactions
Research Support Services	The local research support services implemented by the centre
Technical Infrastructure	Computing resources used to support the research and innovation activities of the centre
Experimentation/Demonstration Platforms	The platforms that support the scientific and innovation activities of the centre
Intellectual Property (IP) and Data Protection (DP)	How the centre approaches IP management and DP
Education and Public Engagement (EPE)	How the centre's dissemination activities inform the public of the science and technology developments
Policy Outreach	How the centre tried to Influence future policy
Technology and Knowledge Transfer	How the centre drives the transfer of know-how and adoption of its technology
Performance and Impact Assessment	How the centre identifies and tracks its performance and impact

2 Core Model Practices

2.1. Strategy

The definition of strategy in the context of BDAICoE framework is:

"The strategy represents the means by which a centre of excellence intends to achieve its overall mission and goals."

Within the case study centres, we examined 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 broad 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 wider data ecosystem, for strategic issues is also an essential part of the strategy formulation process.

In terms of the importance or priority of the strategies they 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 relevant 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. To prioritise, the Executive Committee and Senior Management team can hold consultative meetings with staff and external stakeholders to re-assess, redefine and refine the centre's priorities to meet changing circumstances.

Within the studies, examples of good practice are captured in Table 2.

Table 2: Summary of Strategy Practices

Practice	Keywords
Clearly stated research strategy with goals, objectives, and research areas.	Strategy and objective
Centre aligned with National and European research and innovation priorities.	Aligned with national and European priorities
Seeks to influence national and European research and innovation priorities.	Influence national and European priorities
The Senior Management formulates strategy and objectives.	Strategy/objectives formulation
Widespread consultation for the formulation of strategies including research topics dialogue with stakeholders in the research ecosystem, including industry and funders.	Widespread consultation
The centre uses KPIs for measurement of its performances regarding objectives, goals, mission, and vision.	Strategy / KPIs alignment
The centre's KPIs cover impact areas, including economic, commercialisation and academic.	KPIs aligned with funders' agenda
Operationalised plans are aligned with KPIs.	other issues KPIs
Decision making through consensus: a structured process to enable achievement of consensus.	Decision Making

2.2. Governance & Structure

2.2.1. Governance

The definition of governance in the context of BDAICoE framework is:

"Governance in Centres of Excellence refers to the level of decision-making and operations."

Within the studies, examples of good practice depend on the type of institutions and the level of decision making. The practices are captured in Table 3.

2.2.2. Structure

The definition of structure in the context of BDAICoE framework is:

"The structure is how a Centre of Excellence is designed (i.e., levels, roles, units, decisions rights, and accountability)."

The practices are captured in Table 4.

Table 3: Summary of Governance

Practice	Keyword
Governance that emphasises accountability and openness.	Accountability /openness.
The Governance Board chaired by an external representative. The Board meets on a quarterly basis for strategic oversight of all activities.	GC's responsibilities
Bi-annual reporting on the strategy, operations, financial & risk management, research programme, industry partners, funding, technology transfer, and communications.	Bi-annual reporting arrangement plan
Centre has an academic advisory committee and industry advisory committee.	IAC, SAC & IIC support GC
Reporting demonstrates to the stakeholders the fulfilment of accountability, openness, and transparency. Regular feedback meetings are hosted.	Reporting
The Centre's director is supported by a Centre Steering Committee composed of Principal Investigators and industry representatives, representatives of the Host institute, and representatives of funders.	Decision-making
The centre's Steering Committee actively monitors the KPIs.	Decision-making
The executive management team comprises the centre's Director, Senior Staff, and Principle Investigators, and operations managers who are responsible for the day-to-day operations of the centre and its research programmes.	Composition
The General Assembly (GA) consists of high-level officials of the centre and its centre partners ▪ The GA makes the final decisions for the centre. ▪ The members are made up of a representative from each partner of the centre, including academics and industry.	Decision-making GA
The Strategy Board (SB) draws the strategic plan, which is used in approving projects at the centre. The SB is composed of the centre's Leadership, including the Operations Manager, Scientific Coordinator, Faculty Research Strategist, Pilot Strategy Coordinator, Intellectual Property Manager, and Education Coordinator.	Strategy

Table 4: Summary of Structure

Practice	Keywords
The structure provides for the centralised coordination and integration of the activities (i.e. business development) across sites for consistency and synergy across the centre sites.	Centralisation, coordination, integration
At each site, the structure facilitates collaboration with the creation of research-specific groups (i.e. Natural Language Processing, Information Reterival, and Distributed Systems)	Research groups
The structure allows the independent organisation of each site as well as enables decentralisation of site governance.	Decentralisation
The centre's Director and PIs form a flat team structure.	Structure
The operations support personnel include: ▪ A Centre Director ▪ Principal Investigators ▪ An Office Manager ▪ Collaborators ▪ Researchers	Roles
The team members are flexibly assigned to project teams.	Research Team
The Operation Committee takes care of the daily operations of the centre from planning to implementation.	Operation board's role
The operation committee is composed of the centre's Leader, Administration Manager, and Education Coordinator.	Operation board's composition
The centre is structured comprising two categories of teams: ▪ Research groups focusing on a specific topic to attain scientific excellence, ▪ Industry focused groups representing appiled researchers interfacing with business partners and producing their needs with the help of the Research group.	Mixed Teams

2.3. Funding

The definition of funding in the context of BDAICoE framework is:

"Funding refers to the availability, diversity, and sustainability of the monetary support for carrying out research and educational activities in the centre of excellence."

The practices are captured in Table 5.

2.4. People and Culture

2.4.1. People

The definition of people in the context of BDAICoE framework is:

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

(Schmidt & Krogh Gravesend 2017) have identified a set of best practices for people management within a research environment:

- priorities development of scientific elites

Table 5: Summary of Funding

Practice	Keywords
The funding model is for a long-term (5-8 years) cycle and addresses long-term objectives, e.g. Core research services that provide industry partners' technology and intellectual property needs.	Long-term funding
Targets a mixed model of diverse funding sources: national, industrial, and European funding.	Funding diversification
Pursues research commercialisation opportunities, including licensing and spinouts.	Commercialisation opportunities
Collaborative projects with industry sponsored by the partner.	Collaborative contract
Funding comes from consultancy services.	Other funds
Industry membership model.	Other funds
Directly funded contract research with individual member companies.	Other funds
Funding through in-kind arrangements (People, Infrastructure, Hardware).	In-kind funding
The funding policy demands the centre to provide a percentage (20-30%) of its funding needs from industry partners.	Funding policy impact

- supports young researchers' career development
- priorities competence development among researchers
- is attractive for early-stage (international) researchers
- has a well-defined and transparent human resources management profile
- strong research competencies justify manager's right to manage
- creates excellence in research through recruitment of the best researchers
- has a clear recruitment policy
- recruitment policy builds on senior core competencies
- has a diverse staff composition (young, old, women, men, local and international)

Within the case studies, we observed many examples of practices which followed these and other approaches, including:

- **Diversity of staff:** The centres employs a diverse range of people at the research and management level. The 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.
- **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:** Many of the centres have or plan to achieve the HR Excellence in Research awards from the EU in recognition of best practice policies and procedures. To recruit high-quality researchers, the Centres advertises open positions in international forums.
- **Supporting female staff:** The Centres implement specific policies to support female staff, from maternity leave to career development and mentoring. Furthermore, the host institutions of centre hold the Athena SWAN awards for positive gender practice in higher education.

2.4.2. Culture

The definition of culture in the context of BDAICoE framework is:

"Culture represents the underlying values, beliefs, and norms that drive the teams and the centre of excellence as a whole."

Within the case studies, we observed many examples of practices which support the culture of the CoE; these include:

- **Integration of new in-take:** Some centres provide cultural practices that aim to give orientation through mentorship to new

Table 6: Summary of People

Practice	Keywords
The host institutes provide core HR policies.	People
Staff diversity – catering for right gender mix among researchers and students and local/international personnel proportions.	People
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.	People support
PhD members are offered financial support during maternity leave.	Support
Attract international researchers and develop the careers of young researchers.	People
Personal skills development, e.g. public speaking, person-to-person communication, language training, unconscious bias, and cultural awareness.	Training
Advertisements of vacant positions in both local and international forums.	HR sourcing
Industry partners have opportunities to place their postgrads on internship programmes with the centre.	People
The centre is building a common team identity by the creation of an enabling environment using informal meetings such as team lunches meetings, kick-off meetings, and poster sessions.	People
A mentorship programme is personalised for each intake of students and researchers: ▪ Mentor-mentee matching is based on their profiles. ▪ Mentors are industry leaders. ▪ Mentor/mentee gains from the professional/personal goals of the mentorship programme. ▪ The programme promotes mutual understanding and collaboration between the centre, partners, and staff.	People development
A mentorship programme to support female careers.	People

members. For example, weekly meetings promote the spirit of togetherness and an onboarding programme is a cultural practice aimed at providing new in-takes detailed orientation support.

- **Collaboration and teamwork:** These are essential elements of success. Research centres tend to find ways to integrate and boost the spirit of oneness in shared objectives through cultural practices, like various cultural practices such as formal and informal meetings, symposia and centres' communication systems to promote awareness, regular contact and teamwork, interpersonal interaction, communication and information dissemination activities. Centres provide social mechanisms for understanding social forum and building a good rapport within the centres. They use informal, non-project related meetings such as kick-off meetings, poster sessions and lunches, which features guest speakers to create home-at-home for researchers to experience freedom and a feeling of belonging to a team.

- **Welfare programmes:** Welfare programmes are meant to cater to the mental and socio-psychological wellbeing of staff and researchers of a research centre, like organising a talk on mental health, societal health and other related issues such as waste recycling and environmental health. Listening lunches, Unconscious Bias programmes are specialised programmes categorised under culture in some centres. Through these programmes, attendees (staff and students) gain welfare benefits. Besides these two principal programmes, they are organising social events such as cycling or walking tours to remote areas or heritage sites to provide a sense of awareness about the physical environment and well-being for participants.

- **Researchers/staff personal skills development:** Extra activities are used as training programmes for the development of public speaking, presentations and personal skills, and interpersonal communication capabilities. One centre organises presentations on selected weekly meetings and invites guest speakers to deliver talks on essential topics to the people in the centre. This can also be done through informal non-project related meetings and kick-off meetings, lunches and postal sessions.

- **Inclusivity and voice:** All case study centres employ cultural practices to achieve inclusivity of members into decision-making and driving productivity. For example, they provide feedback from weekly meetings via the centre's Management body to the Governing board. Some use a "Flat Management Structure" which gives everyone a voice (that is an opportunity for members to air their concerns and opinions) and to contribute to the friendship and excitement in the centre which has been traced to the success of the centre. Onboarding programmes are recognised as a good initiative that helps new members adjust to the working environment, and it also serves as a mechanism for understanding social forums and building a good interaction with partner companies.

- **Support for outreach:** Besides research, science and innovation development, research centres have other mandates such as spreading their inventions and technological breakthroughs to society. This is an outreach programme aimed at educating members of the society about technology developments and their place in the development trend. Research centres use (in some situations) cultural practices to drive information dissemination above science and technology developments. Public outreach programmes can incorporate cultural practices to achieve the desired aim of spreading scientific outcomes and achieves a shared understanding and inclusive participation of all members of society. The scope of the society in this context can include the young and old,

Table 7: Summary of Cultural Practices

Practice	Keywords
Distributed geographically centres maintain a culture that enables collaboration on works that mutually benefit all sites.	Collaboration
Cultural practices promote awareness, regular contact, and teamwork, communication, and dissemination activities (meetings, symposia & centre communication systems, annual intercultural day).	Workforce inclusivity, communication, and dissemination
Staff and student welfare programmes are employed, i.e. *Listening lunches,* allowing members to voice concerns, talks on mental health, and other issues.	Welfare programmes
An Unconscious Bias training is done in the centre to eliminate preferential treatment.	HR practices
Encouragement of social events such as cycling or walking tours.	Socials for well-being
Support for 'inclusivity' in recognition of the benefit of diversity and support gender equality.	Inclusivity & Equality
The weekly centre meeting is used to promote the spirit of togetherness.	Meetings
The community volunteering may overlap with Education and Public Engagement.	Volunteering
A result-orientated environment. People are always conscious of the deadline, and they must work hard to deliver.	Culture
The new member programme is a cultural practice aimed at providing new in-takes detailed orientation experience and support to adjust to the working environment.	Onboarding culture
The new members are assigned a 'buddy' (a Post-doc or a PhD student) that offers orientation and mentor support to the new intake.	Onboarding culture
The centre provides researchers with a mechanism for understanding social forums and building a good rapport with the company representatives.	Mentoring
Informal non-project related meetings are held, and they include kick-off meetings, poster sessions, lunches.	Informal gathering
Office space is designed to facilitate cultural evolvement of the people in the centre and make them feel part of the centre.	Cultural support

school-age people and adults as well as remote communities.

- **Elimination of preferential treatment and achieving gender equality:** These are practices that help to prevent fraud or inadequate representations through training that is provided to members, particularly leaders and recruiters. Unconscious Bias practises discouraging leaders from treating other members of the centre with personal biases based on ethnicity, race, and religion. While European initiatives such as the Athena Swan include practices that help to equalise gender representation in adequate proportions.

3 About

3.1. 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.

3.2. 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.

3.3. 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.

3.4. 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.

3.5. 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

3.6. BDAICoE Framework Team

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3.7. 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.