Big Science, Big Data, Big Innovation?

ERIC Policies on IP, Data and Technology Transfer

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Big Science, Big Data, Big Innovation? Comparative Analysis of Policies on Intellectual Property, Data and Knowledge & Technology Transfer at the European Spallation Source and Remaining European Research Infrastructure Consortia

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Abstract:
Science originates knowledge and downstream innovation. "Big" science is likely to, along the line, give rise to "big" innovation. Large research infrastructures are characterised by containing a large number of partners involved in complex networks of internal and external collaborations. This chapter explores how large research infrastructures (broadly defined) manage internally and externally the innovation they produce. It is the result of a comparative analysis of statutes, policies and other publicly available documents of the current twenty-one large research infrastructures granted the legal status of European Research Infrastructure Consortium (ERIC). It uses ERIC as an example to explore how large research infrastructures manage internally and externally the innovation they produce. In particular, it analyses knowledge transfer and technology transfer policies covering issues such as patent ownership, registration, licensing and enforcement, and data-related issues.

Key words: Big Science; Large research facilities; Innovation; ERIC statutes and policies; Patent policies; Knowledge and technology transfer.

1. Introduction: Big Science and Innovation

Science originates downstream innovation. What is often called basic research or theoretical science[1] provides the foundations for innovation with applications and implication in everyday technology. *Big science* is expected to give rise to *big innovation* in the future. Innovation is more a process than an activity, sometimes the link between research and subsequent innovation is immediately apparent, while at other times it only appears downstream. Effects can also be immediate or deferred and can range from small incremental improvements to something that has an overarching impact in our civilization, as for example the *World Wide Web*, invented by British scientist Tim Berners-Lee in 1989, and initially created at the European Organization for Nuclear laboratory (CERN) to be an internal communication tool.[2]

Traditionally, innovation in an economic sense refers to bringing products and processes to market. In the current increasingly digital society, the notion of products is expanding to include a very valuable new type of product: data. *Big science* often also originates *big data*.

[1] Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. See: Eurostat, 'Glossary: basic Research'. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Basic_research

[2] The software was released to the public by CERN on 30 April 1993, and later made available under an open licence, allowing its disseminated use. CERN, 'The birth of the web'. Available: https://home.cern/science/computing/birth-web.

Big science depends on critical volumes of resources and infrastructures. Large research infrastructures[3] are heterogeneous and can be classified using different taxonomies.[4] In general terms, they often involve a large number of researchers and partners and originate complex networks of internal and external collaborations. Often these collaborations and projects include a variety of actors (public or private), with a variety of legal configurations (companies, foundations, universities, etc.) and purposes (commercial, research or mixed). Large research infrastructures can be single site facilities or have infrastructures that are distributed geographically in one single country or several. Some are established by a single country, but most large research infrastructures are the fruit of European or international collaboration.

This chapter is the result of a legal research study into the legal framework governing European Research Infrastructure Consortia (ERIC). It analyses the ERIC Regulation and its implementation in each consortium, comparing all the statutes and other regulatory internal documents. The specific focus of this research has been to explore how large research infrastructures manage, internally and externally, the scientific production and other immaterial assets directly or indirectly created using the infrastructure facilities and resources by their partners, users and employees. In particular, it analyses technology transfer policies (in a broad sense) covering issues such as patent ownership, registration, licensing and enforcement. The study provides a legal background to European Spallation Source ERIC (ESS) and as a methodologic perspective has used ESS as a starting point of comparison with other ERIC, since it is not only the main focus of this book, but also one of the earlier consortia, the largest project and one of the top priorities of the European Commission's European Strategy Forum on Research Infrastructures (ESFRI) Roadmap.

The chapter is organised in five sections. It starts with the introduction in section 1, followed by a brief overview of the historical and legal context of large research infrastructures in the EU in section 2. The third section analyses intellectual property and data provisions in the ERIC Regulation and its specific implementation in each consortia's statutes and other documents. Both general IP issues and specific rules for patents are considered, with special attention to ESS pioneer IPR policy. This section also presents an analysis of the contentious issues of data 'ownership'. Knowledge and technology transfer policies of ERICs are the subject of section 4 and the conclusions are presented in section 5.

2. European Research Infrastructures: historical context and legal framework

The support and development of research infrastructures in Europe has been on the political agenda since the beginning of the European integration project,[5] albeit indirectly.[6] Each of the treaties establishing the original Communities already included one or more provisions addressing research: the European Coal and Steel Community (Article 55);[7] the European

[3] The qualitative 'large' here refers to either volume of scientific data, facilities and resources, network, institutional participation, collaborations, industry partnerships or users.

[4] OECD, International Distributed Research Infrastructures: Issues and Options (2014) .http://www.oecd.org/sti/inno/international-distributed-research-infrastructures.pdf

[5] European integration project refer here to the ongoing efforts directed to a shared European political, legal, economic, cultural and ethical identity, through the creation, development or convergence of legal rules, institutions, governance structures, ethical principles and cultural norms. See: Preamble, Treaty on European Union, *OJ C 202, 7.6.2016, p. 15–16 (consolidated version).*

[6] For a political science perspective on the historical evolution of European research facilities, see: Katharina Cramer (Ed.) (2020), A Political History of Big Science, Palgrave.

[7] Treaty establishing the European Coal and Steel Community (no longer in force). ELI: http://data.europa.eu/eli/treaty/ceca/sign ECSC Treaty

Atomic Energy Community (Articles 4 to 11);[8] the European Economic Community (Articles 41 and 235).[9] However, the involvement of European institutions dates from the 1970s, when a common research policy was developed. Until then most of the initiatives were either national, or at best regional, or spearheaded by national governments and institutions. Efforts towards institutionalised pan-European or international collaborative research are part of a relatively recent and ongoing process, with ups and downs and shifts in velocities reflecting flickering political and economic conjunctures. In legislative terms, this has been reflected in Decision 1982/2006/EC of the European Parliament and the Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)[10], in Council Decision 2006/974/EC of 19 December 2006 on the specific programme 'Capacities',[11] and finally in Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC).[12]

The term 'research infrastructure', in its legal sense, is not uniformly and globally defined.[13] Different funding agencies provide very different characterisations of the term infrastructure. An EU legal definition of research infrastructure is advanced by Article 2 (a) of the ERIC:

> 'research infrastructure' means facilities, resources and related services that are used by the scientific community to conduct top-level research in their respective fields and covers major scientific equipment or sets of instruments; knowledge-based resources such as collections, archives or structures for scientific information; enabling Information and Communications Technology-based infrastructures such as Grid, computing, software and communication, or any other entity of a unique nature essential to achieve excellence in research. Such infrastructures may be 'single-sited' or 'distributed' (an organised network of resources).

In Sweden, it is common for national institutions either to opt not to work with sharp definitions of what constitutes infrastructure[14] or to use additional internal definitions and requirements for funding research infrastructures, such as openness, transparency, quality and sustainability.[15] This implies being open to users not connected with the institution; having clear and transparent access policies, where academic research is prioritised and the selection of access is based on research quality; leading to and supporting high quality research; providing users with support services on how to use the infrastructure; having a long-term operational and funding plan (at least 3 years); and strategic importance at general establishment level. If we exclude the additional challenges and opportunities presented by

[8] Treaty establishing the European Atomic Energy Community (EURATOM), concluded in Rome 25/03/1957, UNTS Volume Number 294 (p.261), 295 (p.259), 296 (p.259), 297 (p.259), 298 (p.169).
[9] Treaty establishing the European Economic Community, concluded in Rome, 25/03/1957, UNTS Volume Number 294 (p.3), 295 (p.2), 296 (p.2), 297 (p.2), 298 (p.3).
[10] OJ L 412, 30.12.2006, p. 1.
[11] OJ L 54, 22.2.2007, p. 101.
[12] OJ L 206, 8.8.2009, p. 1–8.
[13] Some might argue that research infrastructure is rather a political construct. See: Hallonsten, O. (2020). "Research infrastructures in Europe: The hype and the field." European Review 28(4): 617–635.
[14] See https://www.su.se/english/research/research-infrastructure ; https://www.uu.se/en/research/infrastructure/ and?
[15] https://www.gu.se/english/research/research-organisation/research-infrastructures/definition-and-policy and https://www.med.lu.se/english/intramed/teaching_research/research/infrastructures/call_funding_for_infrastructure_investments

the ERIC pan-European nature, these are similar to the requirements established in Article 4 of the ERIC Regulation:

- it must be a European joint venture (participation of other countries is possible)
- the infrastructure is necessary to carry out European research programmes and projects
- it represents added value in the strengthening and structuring of the European Research Area (ERA) and significant improvement in the relevant scientific and technological fields at international level
- effective access is granted to the European research community
- it contributes to the mobility of knowledge and/or researchers within the ERA and increases the use of intellectual potential throughout Europe
- it contributes to the dissemination and optimisation of the results.

Despite some initial difficulties and scepticism concerning the ERIC model, namely regarding its non-commercial nature imposed by the ERIC Regulation,[16] which was criticised as being a potential hindrance for technology transfer,[17] the ERIC legal model is considered a success.[18] Indeed, the present review of the ERIC landscape revealed that since the regulation was enacted in 2009, twenty-one large research infrastructures have been created or transformed into an ERIC. These currently cover a broad range of scientific areas and geographical locations and serve a growing number of users and established partnerships, indicating a degree of acceptance in the scientific community.

3. ERIC Intellectual Property and Data Policies

The legal purpose of an ERIC, according to the legislative intent, is understood as being linked to the safeguarding of the scientific excellence of EU research and the competitiveness of the EU.[19] ERICs have a cross-border structure in terms of membership, since an ERIC should comprise at least three EU member states and may include qualified associated countries and third countries, as well as specialised intergovernmental organisations.[20] ERICs should also be effectively open to the European research community at large and cater to their needs, with the aim of enhancing European scientific capabilities beyond the state of the art and contributing to the development of the European Research Area.[21] Simultaneously, intellectual property rights are closely linked with research, knowledge and technology transfer and innovation.[22] These are partially harmonised, but still subject to national law, meaning that in a complex setting IPR and data policies are necessary instruments.

3.1. Intellectual Property Provisions in the ERIC Regulation

The ERIC Regulation requires that the statutes of an ERIC contain provisions setting up basic principles covering the infrastructure's scientific evaluation policy, the dissemination policy,

[16] Article 3(2), ERIC Regulation.
[17] See: ESFRI, page 113 concluding that such is unwarranted.
[18] Para. 7 'Initial Conclusions', REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Second Report on the Application of Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC) COM/2018/523 final.
[19] Recital 9, ERIC Regulation.
[20] Article 9 and Recital 13, ERIC Regulation.
[21] Article 4 and Recital 9, ERIC Regulation.
[22] Concerning openness and IPR in the context of the ESS, see with further references: Helen Yu, Jakob Blak Wested, Timo Minssen, 'Innovation and intellectual property policies in European Research Infrastructure Consortia—Part I: The Case of the European Spallation Source ERIC', *Journal of Intellectual Property Law & Practice* 2017 Volume 12, Issue 5, pp 384–397.

and the intellectual property rights policy.[23] Recital 8 indicates that it is the legislative intent that this type of large research infrastructure should operate on a non-economic basis, but should be able to conduct 'limited economic activities' in order to promote innovation and knowledge and technology transfer, provided that these 'are closely related to its principal task and they do not jeopardise its achievement'.[24] Recital 9, however, explains that the purpose of research infrastructures is not only to help safeguard the scientific excellence of EU research, but also to help safeguard EU economic competitiveness, understood in both a medium and a long-term perspective,[25] assuming a general function of 'efficient support of European research activities'.[26] Openness is mentioned as a necessity imposed by such an efficient support function. Research infrastructures should not only be open to the research community that they are intended to support, but such openness should be effective and reflected in rules established in the infrastructure statutes. Openness is linked to the aim of enhancing European scientific capabilities beyond the current state of the art and presented as a contribution to the development of the European Research Area.[27] Currently, the European large research infrastructures landscape includes twenty-one entities with ERIC status.[28] Analysis of their statutes and other publicly available official documents reveals different approaches and that the manner in which these research infrastructures have responded to the above-mentioned requirements varies.

3.2. Intellectual Property Provisions in ERIC Statutes and other Governance Documents

All ERIC statutes contain one or more articles concerning IP and data policy, in accordance with the ERIC Regulation. Some, for example the ESS European Spallation Source Statutes,[29] contain two provisions, addressing the IP and data policies respectively – Articles 21 and 22. Others, such as CERIC or DARIAH address the regulation of IP in combination with confidentiality and data in a single policy norm.[30]

In addition to the statutes, many ERICs have also developed more detailed policies. To date, the ESS European Spallation Source, EU-OPENSCREEN and INSTRUCT are the only ERICs to have published an *Intellectual Property Rights Policy* document.[31] However, analysis of available information and documentation reveals that it is possible that some ERICs may have detailed intellectual property policies that are not disclosed to the public.[32] It

[23] Article 10 (g) (ii), (iii) and (iv), ERIC Regulation.
[24] Recital 8, ERIC Regulation.
[25] Recital 9, ERIC Regulation.
[26] *Ibidem*.
[27] Recital 9, ERIC Regulation.
[28] ERIC Landscape, available at https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures/eric/eric-landscape_en#bbmri
[29] Statutes of the European Spallation Source ERIC, Annex to Commission Implementing Decision (EU) 2015/1478 of 19 August 2015 on setting up the European Spallation Source as a European Research Infrastructure Consortium (European Spallation Source ERIC).
[30] Article 19, 2014/392/EU: Commission Implementing Decision of 24 June 2014 on setting-up the Central European Research Infrastructure Consortium (CERIC-ERIC) *OJ L 184, 25.6.2014, p. 49–62; A*rticle 27, 2014/526/EU: Commission Implementing Decision of 6 August 2014 setting up the Digital Research Infrastructure for the Arts and Humanities as a European Research Infrastructure Consortium (DARIAH ERIC) OJ L 239, 12.8.2014, p. 64–80.
[31] EES Intellectual Property Rights and Inventions Policy. Available at: https://europeanspallationsource.se/legal-ip; Annex 4 to the Statutes of the European Infrastructure of Open Screening Platforms for Chemical Biology — European Research Infrastructure Consortium (EU-OPENSCREEN ERIC) C/2018/1482 OJ C 111, 26.3.2018, p. 1–20; Instruct-ERIC IPR Policy and Guidelines. Available at: https://instruct-eric.eu/ipr-policy.
[32] For example: ECCSEL.

is also apparent that some ERICs have chosen to complement the statutes with additional IPR policy provisions included in separate documents, with different official denominations, such as *Terms of Use and Conditions*,[33] *Rules of Procedure*,[34] *Conditions of Use*,[35] or *Standing Orders*.[36] From this analysis it is possible to put forward the hypothesis that some ERICs may attach greater importance to IPR than others, due to the nature of research produced, while the remainder may consider IP to be less relevant. This is particularly noticeable in cases where everything that is produced, including patentable inventions, is allocated to the person or entity responsible for its creation and never to the ERIC, as examined below.

3.2.1. Definitions of Intellectual Property Rights

Several ERIC statutes define IPR with reference to the convention establishing the WIPO[37], where IP and IPR are defined in broad terms:

> "intellectual property" shall include the rights relating to:
> – literary, artistic and scientific works
> – performances of performing artists, phonograms and broadcasts
> – inventions in all fields of human endeavour
> – scientific discoveries
> – industrial designs
> – trademarks, service marks and commercial names and designations
> – protection against unfair competition
> and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields.[38]

This is a pragmatic option, in this author's view, since there is no other general definition of IPR in either international treaties or in EU law. For example, it is notable that both the TRIPS Agreement and the Enforcement Directive [39] often mention the concept of IP and IPR without offering a statutory definition. This definition of IPR has been also employed by nine other entities with ERIC status.[40] In Article 3 of its PR Policy and Guidelines, INSTRUCT ERIC advances a more comprehensive and contemporaneous definition:

> "IP" means all copyright, database rights, rights in designs, rights in trademarks and service marks, rights in inventions, rights to apply for patents, rights in patent applications and granted patents, rights in and in relation to patents, topography rights, semi-conductor rights, rights in plant varieties; and any rights of similar kind in any jurisdiction, in all cases whether registered or not, and whether or not capable of registration; all rights in relation to know-how, techniques and results.

At the same time, the EU-OPENSCREEN ERIC statutes distinguish between two 'types' of IP (foreground and background) and include in the concept of foreground IP 'the results, including information, materials and knowledge, generated in activities of EU-

[33] EATRIS; ECCSEL; Euro-BioImaging.
[34] ECRIN; EU-OPENSCREEN.
[35] SHARE.
[36] ESS- European Social Survey.
[37] Convention Establishing the World Intellectual Property Organization, signed in Stockholm on 14 July 1967 and as amended on 28 September 1979.
[38] Article 2 (viii), WIPO convention.
[39] Directive 2004/48/EC of the European Parliament and of the Council of 29 April 2004 on the enforcement of intellectual property rights (OJ L 157, 30.4.2004).
[40] CERIC ERIC; CESSDA ERIC; EATRIS ERIC; ECCSEL ERIC; ECRIN ERIC; EMSO ERIC; EPOS ERIC; EU-OPENSCREEN ERIC; and SHARE ERIC.

OPENSCREEN ERIC, whether or not they can be protected'.[41] Prima facie, it appears that a privative intellectual property classification is created among the parties, outside the boundaries of legally enforceable rights. The provision further adds that IP is understood as including both 'intellectual property rights (IPRs such as rights resulting from copyright protection, related rights, design rights, patent rights, plant variety rights, rights of creators of topographies of semi-conductor products), similar forms of protections (e.g. sui generis right for databases) and unprotected know-how (e.g. confidential material).'[42] It is not a particularly well-formulated definition. The sui generis databases right is a copyright-based intellectual property right, and not a 'similar form of protection', and 'unprotected know-how' probably means undisclosed information and know-how or trade secrets.[43]

In general, the concept of intellectual property and intellectual property rights used in some statutes and other governance documents of the 21 ERIC analysed is often fragmented, indicating a lack of awareness, or perhaps necessity, to consider and regulate all intellectual property rights equally. It was also observed that, in certain cases, the conceptualisation of intellectual property rights does not fully conform to the legal and legal doctrinal understandings, which may be a potential source of misunderstandings and disputes.

3.2.2. IPR Ownership Allocation

IPR apply equally to all areas of innovation and human creativity. However, in each sector of activity, economic structures, market innovation cycles and processes and applicable regulatory frameworks vary considerably. Translating big science into big innovation requires adaptation and coordination. The question of allocation of IPR generated by or through the use of the research infrastructure is a complex matter, in particular in infrastructures that are open to users, such as ESS.

IP law creates entitlements in a logic of providing economic incentive to creators and innovators. These are conceptualised in legal texts as a single person or legal entity – the author or the inventor – or, at best, a combination of a limited number of single persons or entities. Large research infrastructures often have a cross-border nature, involving delocalisation of facilities over many countries, and include a long list of members, observers and partnerships, resulting in the direct and indirect involvement of several research communities and institutions, often across disciplinary fields. The volume and heterogeneity of projects, entities and individual researchers involved create IP allocation complexities that are not completely regulated by statutory IP law, leaving ample space for specific determination in consortia statutes and other governance documents, such as user agreements and contracts.

The legal nature of big science in ERIC, that are, according to the regulation, mostly devoted to non-commercial activity, is at odds with the traditional IP law function and structure intended to provide economic incentive to innovation, understood as an economic activity of bringing new and substantially improved products and processes to the market. However, despite their non-commercial nature, large research facilities contribute to *big science* and *big data* and thus often, directly or indirectly, *big science* translates into *big innovation*.

[41] Article 9 (1), Statutes of the European Infrastructure of Open Screening Platforms for Chemical Biology — European Research Infrastructure Consortium (EU-OPENSCREEN ERIC) C/2018/1482 OJ C 111, 26.3.2018, p. 1–20.
[42] Ibidem.
[43] Directive (EU) 2016/943 of the European Parliament and of the Council of 8 June 2016 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure (Text with EEA relevance) OJ L 157, 15.6.2016, p. 1–18.

Landscape approaches concerning IPR ownership vary over the ERICs (see Table 2), something that is doubtless related to the nature of the activities of the infrastructure and projects developed. The model statutes template provided as an annex to the ERIC Practical Guidelines[44] recommends that statutes should contain a provision on IPR policy. However, the model statutes provided two alternative standard legal formulations to ownership allocation: a) 'Subject to the term of any contract between {name} ERIC and the users, intellectual property rights created, obtained or developed by users shall be owned by those users', and (b) '{name} ERIC may own intellectual property rights…}'.[45]
European Spallation Source ERIC establishes ownership of the ERIC in all IP 'emanating from setting up and running the ESS including, but not limited to, Intellectual Property produced by staff except where covered by separate contractual agreements or where mandatory legislation or these statutes state otherwise.'[46] In practice, this means that ownership of IPR is to be determined in accordance with the applicable national law applicable to labour relations and their respective provisions on ownership of IPR produced by employees and any contractual arrangements valid under such law.[47] A similar approach is shared by the majority of ERIC – IPR ownership is vested in the infrastructure consortium – while a few ERICs, e.g. EPOS, Euro-BioImaging and ICOS, instead allocate ownership to the 'entity of person that has created it'.[48] In general, the ERIC statutes surveyed make no distinction concerning ownership of IPR over different types of subject matter, nor between economic and moral rights. Furthermore, it is relatively common that provisions concerning IPR ownership are coupled with mentions of data ownership.

3.2.3. Specific Intellectual Property Policies: Patent Rights

Awareness of patent and patenting policy depends largely on the type of activities developed by the research infrastructure, the scientific field and nature of area. European Spallation Source is the only ERIC whose statutes specifically single out patent issues, devoting a provision to address inventions.[49] It is also one of the few ERICs that have publicly available IPR policy documents, interestingly called 'Intellectual Property Rights and Inventions Policy', and the only such IPR policy documents containing detailed clauses on different types of protected subject matter, including inventions. This document does not follow a strict traditional legal logic and classification of IPR, instead mentioning the following categories separately: 'Publications';[50] 'Inventions',[51] 'Proprietary Information'[52] and 'Trademarks and Images'[53]. In terms of content, the European Spallation Source IPR Policy restates rules already determined by applicable laws and international conventions. It has, in this sense, an

[44] On page 41.
[45] Idem.
[46] Article 21 (2).
[47] According to Article 28 European Spallation Source ERIC, Employment contracts are 'governed by the law of the country in which the employee habitually carries out his work in performance of the contract.' See above/below chapter ??.
[48] Article 16 (1), Commission Implementing Decision (EU) 2015/2097 of 26 October 2015 on setting up the Integrated Carbon Observation System European Research Infrastructure Consortium (ICOS ERIC) (Text with EEA relevance) OJ L 303, 20.11.2015, p. 19–34. Concerning labour issues see chapter ??
[49] Article 22 'Inventions' ESS Statutes 'The Organisation shall be subject to applicable legislation and regulations on inventions and adopt its own Inventions Policy'.
[50] Article 3.3 European Spallation Source ERIC Intellectual Property Rights and Inventions Policy, ESS Statute Policy Document Number ESS-0036412, Date 6 December 2016.
[51] Article 4, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[52] Article 5, ESS ERIC IPR Policy.
[53] Article 6, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.

important pedagogic and informative value, as it allows all parties involved to easily access their legal obligations and rights. This effect is reinforced by the fact that it is structured and written in a language that is less common in IP law scholarly circles, but probably more familiar and accessible to non-legal researchers and commercial actors.

Concerning patents, two different approaches can be described: one applies to the external users of the facility and the other applies internally to the staff of the facility. Concerning patent ownership allocation involving external entities or facility users, the European Spallation Source IPR policy states that 'ESS shall not seek to limit or obtain ownership rights to research results, associated IPR or know-how created by users of the ESS facility, unless this forms part of the user agreement'[54], or when a partner institution intends to waive IPR over subject matter created in connection with a collaborative project involving the European Spallation Source.[55] This means that as a facility open to users, as a rule and unless otherwise provided in specific user agreements, European Spallation Source will not claim ownership or co-ownership of research results, nor eventual patent rights and trade secrets generated by users.

Internally, the European Spallation Source reserves ownership rights over inventions created by its employees in the course of their duties. In such cases, ex gratia compensation determined in reasonable and proportionate terms may be provided at the discretion of the Director General.[56] Although Swedish law might be applicable to European Spallation Source ERIC employees working at the facility in Lund, Sweden,[57] the so-called *professor's privilege*, an exception granting ownership over their own patented inventions, only applies to inventors employed by universities, research institutes and other educational institutions.[58]

Even when ownership is established in the European Spallation Source ERIC, the ERIC will not always seek patent protection. A number of specific rules determine what inventions to patent and under what circumstances patents will be applied for. European Spallation Source may only submit patent applications when one or more of the following three conditions are met: (a) when it is a particularly important invention and where patent protection will maximise the impact and visibility in the relevant scientific community; (b) when there is substantial potential for commercial exploitation, supported by business case analysis; (c) when patenting is necessary for cross-licensing, technology exchange or for security-related reasons.[59] Furthermore, patent applications will not be pursued if the inventors are not clearly identified and there are disagreements or disputes concerning ownership.[60] The geographic scope of protection and decisions on renewal of fees will depend on a regularly updated assessment of the ERIC objectives while seeking patent protection, their degree of success and associated costs.[61]

The situation of employees of European Spallation Source partners seconded to ESS concerning invention ownership is differentiated from the ERIC staff, as the first is entirely dependent on each contractual arrangement between the European Spallation Source and its partners. Similar arrangements also apply concerning ownership of inventions created in joint

[54] Article 4.6, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[55] Article 4.7, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[56] Article 4.4, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[57] Article 28 (1), , Statutes European Spallation Source ERIC.
[58] Right to Employee's Inventions Act (SFS 1949:345) – Lag (1949:345) om rätten till arbetstagares uppfinningar.
[59] Article 4.1, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[60] Article 4.2, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[61] Article 4.3, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.

projects,[62] although it is also stated that the decision to apply for patents will conform to the rules previously stated, presumably if ownership determined in contractual clauses is vested completely or partially in the European Spallation Source.

Another interesting set of provisions in the European Spallation Source IPR Policy concerning inventions and patent rights are the rules concerning licensing. ERICs operate under an ethos of openness and shared resources. Access to background IP, pre-existing patents and other IP rights can often be vital resource. The European Spallation Source IPR Policy imposes an obligation on ESS Partners to grant ESS a non-exclusive, non-transferable, royalty-free perpetual and irrevocable licence, including the right to sub-license, to their IPRs that are related to their contribution to the ESS Project, but have not been created as a result of work carried out in connection with the ESS Project (known as Background IP).[63] Such obligation to license is conditional on the background IP being necessary for the ESS Project.
A similar obligation to license is imposed concerning IPR generated by ESS Partners, either independently or jointly with ESS, in the course of and in connection with the ESS Project (known as Foreground IP).[64] In turn, a similar obligation to license is imposed on both background and foreground ESS ERIC-owned intellectual property rights.
These provisions on mandatory cross-licensing, however, only apply to IP rights necessary to the ESS project, meaning 'to all aspects of the design, construction, installation, operation and decommissioning phases of ESS.'[65] Cross-licensing rights and obligations do not extend to users of the facility during its operational phase. These are imposed only upon ESS partners,[66] meaning 'entities, including representing entities and in-kind partners that provide funding, contributions or otherwise collaborate through scientific or technical activity with ESS in connection with the ESS Project.'[67] The questions of freedom to operate and licensing once the facility is fully operational, and concerning partners' and users' foreground and background IP rights, will remain a matter for separate contractual determination. However, since these are not uncommon stipulations in research collaborations, it is possible that the present cross-licensing rights and obligations will impart a pedagogical effect, becoming accepted ESS praxis in future user agreements.[68]

3.3. ERIC Data Policies and their legal context

European research infrastructures generate large quantities of data. Several offer real-time data services. Today's science is driven by data,[69] processing large amounts of data, and for this reason these large infrastructures perform a vital function for the advancement of science. The ERIC Regulation determines that statutes shall contain the basic principles governing the data policy.[70] It is, however, unclear if this is a reference to the implementation of data protection rules or if, as it has been interpreted, it is a call for rules on data 'ownership'

[62] Article 4.5, European Spallation Source ERIC Intellectual Property Rights and Inventions Policy.
[63] Articles 2.1 and 3.1.1, European Spallation Source IPR Policy.
[64] Articles 2.6 and 3.1.3, European Spallation Source IPR Policy.
[65] Article 2.5, European Spallation Source IPR Policy.
[66] The European Spallation Source has nearly 130 institutional partners worldwide through in-kind agreements, grant consortiums and other research collaborations. See full list at: https://europeanspallationsource.se/sites/default/files/files/document/2017-09/global_collabs_mid2017.pdf.
[67] Article 2.4.
[68] The user programme is expected to begin in 2023. Standard user agreements have not yet been published.
[69] Hanson, Brooks, Andrew Sugden, and Bruce Alberts. 2011. "Making Data Maximally Available." Science 331 (6018): 649–649. doi:10.1126/science.1203354.
[70] Article 10 (g) (viii), ERIC Regulation.

allocation. As such, it contrasts with the emphasis placed on fair and equitable access to services, open access to scientific results and data, a recurrent listed main task listed in ERIC statutes as shown in Table 3. However, due to the vital nature that data has assumed in recent years, it is not surprising that data policies and other documents detailing the use and entitlements to data generated in connection with the use of the ERIC were prioritised. In particular, clauses with references to 'ownership of data' are common. For practical purposes, data are treated as property in ERIC statutes, agreements and contracts. However, data as an object of rights and obligations may correspond to an IPR, trade secrets or an independent category. The following subsections analyse these data-related rules in all ERICs surveyed, framing these in existing law and legal discussions concerning data 'ownership'.

3.3.1 ERIC Statutes Provisions

Several of the ERIC statutes analysed contain provisions on the ownership of data, often understood as an intellectual property right and presenting its allocation as a matter of IP policy. Article 27 (2) of the Instruct-ERIC Statutes under the heading Data Management, Intellectual Property and Biologicals Policies, prescribes the following: 'All data generated as a result of Instruct-ERIC activities should, in the first case, remain the property of the originating scientist or his/her employing institution.'[71] In another example, Article 22 (2) of the EPOS ERIC Statutes, under a similar heading, Intellectual Property Rights Policy, maintains that 'The intellectual property rights of EPOS ERIC data and other knowledge produced and developed within the activities of EPOS ERIC shall belong to the entity/ies or to the person/s that/who has generated it.'[72] ICOS ERIC Statutes regulate ownership of' data, as well as intellectual property rights and other knowledge that is related to the ICOS RI data and produced and developed within the ICOS RI',[73] while in JIV-ERIC Statutes, Article 23 (2) Intellectual Property Rights (IPR) Policy, declares that 'JIV-ERIC is undertaken within a framework that recognises the property rights of data owners.'[74] LifeWatch ERIC Statutes also contain a similar formulation mentioning the need to make sure that users respect 'the rights of data owners and privacy of individuals'.[75]

However, despite these provisions there is no mention of any legal instrument, either at international, EU or national level, that directly allows and regulates such 'ownership'. Legal entitlements over non-corporeal or immaterial objects are created as an exception. The noun *data* is defined in a general literal sense as 'facts or figures, especially when examined and used to find out things or to make decisions'.[76] It is also commonly used in popular literature as synonym of information, but in a technical sense *data* does not need to have an immediate informational content. Raw unstructured data only becomes information when placed in a

[71] Statutes of Instruct — European Research Infrastructure Consortium (Instruct-ERIC) C/2017/4507 OJ C 230, 15.7.2017, p. 1–22.
[72] Statutes of the European Plate Observing System — European Research Infrastructure Consortium (EPOS ERIC) C/2018/7011 OJ C 423, 23.11.2018, p. 1–16.
[73] Article 18 (1) Commission Implementing Decision (EU) 2015/2097 of 26 October 2015 on setting up the Integrated Carbon Observation System European Research Infrastructure Consortium (ICOS ERIC) (Text with EEA relevance) OJ L 303, 20.11.2015, p. 19–34.
[74] 2014/923/EU: Commission Implementing Decision of 12 December 2014 on setting up the Joint Institute for Very Long Baseline Interferometry as a European Research Infrastructure Consortium (JIV-ERIC) OJ L 363, 18.12.2014, p. 156–169.
[75] Article 17 (2) Statutes of the e-Science and Technology European Infrastructure for Biodiversity and Ecosystem Research — European Research Infrastructure Consortium 'LifeWatch ERIC' C/2017/1648 OJ C 89, 22.3.2017, p. 1–15.
[76] Definition of data noun, In *Oxford Learner's Dictionary of Academic English* (Oxford University Press, 2020) Available: https://www.oxfordlearnersdictionaries.com/definition/academic/data. Retrieved: January 2020.

contextual setting. There is no legal entitlement granting private exclusivity, let alone property rights in a strict technical sense, either to unstructured informational elements (facts and figures) or information (news, scientific theories and knowledge, ideas). Fundamental rights, such as the freedom of expression and information,[77] and also academic freedom[78] and the right to education,[79] preclude, or at best severely limit, such enclosures. For this reason, IPR generally exclude *data*, as such, from the object or subject-matter of protection.

3.3.2. Copyright and Data

A possible way to establish IPR in data would be through copyright. However, copyright protects an artistic expression, but does not extend to the underlying 'ideas, procedures, methods of operation or mathematical concepts as such'.[80] The same facts and figures can be used as the basis for an additional infinite number of artistic expressions. Sui generis copyright protection is additionally offered to both computer programs[81] and databases,[82] although protection here is also limited and does not extend to data, as such.

Computer program copyright protection applies only 'to the expression in any form of a computer program. Ideas and principles which underlie any element of a computer program, including those which underlie its interfaces, are not protected by copyright' under EU law.[83]

Databases or 'compilations of data or other material, whether in machine readable or other form, which by reason of the selection or arrangement of their contents constitute intellectual creations' are protected as such, but protection does 'not extend to the data or material itself'.[84] In accordance with EU law, databases are protected by copyright.[85] The object of protection is restricted to 'databases which, by reason of the selection or arrangement of their contents, constitute the author's own intellectual creation'.[86] The object of protection does not extend to the content.[87]

It is also often debated whether research databases are able to enjoy legal protection since their structure is often created and filled in accordance with a general standard and scientific

[77] Article 11, Charter of Fundamental Rights of the European Union OJ C 326, 26.10.2012, p. 391–407.
[78] Article 13, EU Charter.
[79] Article 14, EU Charter.
[80] Article 9 (2) TRIPS Agreement. On international copyright see: Blomquist, Jørgen. 2014. Primer on International Copyright and Related Rights. Cheltenham: Edward Elgar.
[81] Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs OJ L 111, 5.5.2009, p. 16–22; Article 10 (1), TRIPS Agreement.
[82] Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases OJ L 77, 27.3.1996, p. 20–28; Article 10(2) Trips Agreement.
[83] Article 1(2), Directive 2009/24/EC.
[84] Article 10 (2), TRIPS Agreement.
[85] On Database protection see for example: Grosheide, F. Willem. 2000. "SUI Generis Protection for Databases the European Way: An Analysis." In International Intellectual Property Law & Policy, edited by Hugh C. Hansen, 68-1–68-16. London: Juris Publishing; Sweet & Maxwell; von Lewinski, Silke. 2010. "Database Directive." In European Copyright Law: A Commentary, edited by Michel M. Walter, and Silke von Lewinski, 678–828. New York, NY: Oxford University Press; Derclaye, Estelle. 2014. "Database Directive." In EU Copyright Law: A Commentary, edited by Irini A. Stamatoudi, and Paul Torremans, 298–354. Elgar Commentaries. Cheltenham: Edward Elgar; Hugenholtz, Bernt, 'Database Directive' in Thomas Dreier and P. Bernt Hugenholtz (Eds.) *Concise European Copyright Law*, 2nd ed. 379–420 (Alphen aan den Rijn: Kluwer Law International, 2016).
[86] Article 3 (1), Directive 96/9/EC. For databases, the requirement of originality was confirmed and explained by the CJEU extensively in Football Dataco (C-604/10). The term 'author's own intellectual creation' was interpreted as being fulfilled when 'the selection or arrangement of the data which it contains amounts to an original expression of the creative freedom of its author'.
[87] Article 3 (2), Directive 96/9/EC.

criteria, and not much room is left for 'free and creative choices' in the meaning of the CJEU interpretation in *Football Dataco*.[88] The protection of non-original databases has been raised at WIPO level, so far unsuccessfully, including the idea of a database treaty, which has been abandoned.[89] Another point of contention is the issue of third-party access to and use of online databases. In this regard, the CJEU held in *Case C-30/14 Ryanair* that the Database Directive only applies to databases protected by copyright or the sui generis right, and that the holder of a publicly accessible database is free to determine by contract and in compliance with the applicable national law the conditions of use of its database.[90] This interpretation is relevant as it favours the possibility of establishing *inter partes* recognition of rights in databases and conditions of use in the absence of an *erga omnes sui generi* database right, meaning in cases where it is not certain if a database qualifies for IPR protection as such under the directive.

3.3.3. Trade Secrets and Data

Trade secrets, or undisclosed business information and know-how, offer a legal entitlement of information. In some cases this may be applicable to data, provided that the data can be qualified as being included in the object of protection, and requirements for protection are present.

Despite the title 'undisclosed business information and know-how', protection under the Trade Secrets Directive[91] is not restricted to commercial entities. Any natural or legal person lawfully controlling a trade secret is recognised as a trade secret holder.[92] Reinforcing this idea, the Recitals start by referencing the relevance of investment efforts made by both businesses and non-commercial research institutions alike, in acquiring, developing and applying know-how and information, as well as the important role of such information in providing competitive advantages and being 'the currency of the knowledge economy'.[93] However, the logic of trade secrets protection and its historical roots are grounded in market behaviour and commercial competition. ERICs are only allowed to pursue limited economic activities, and then only provided that these are closely related to their principal task - operating a research infrastructure – and that this does not jeopardise such a task.[94]

Trade secrets in the sense of the directive are information that meets all the following requirements:

> *(a) it is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question;*
> *(b) it has commercial value because it is secret;*

[88] Dietrich, Nils, Lucie Guibault, Thomas Margoni, Krzysztof Siewicz, and Andreas Wiebe. 2013. "Possible Forms of Legal Protection: An EU Legal Perspective."; In Safe to Be Open Study on the Protection of Research Data and Recommendations for Access and Usage, edited by Lucie M. C. R. Guibault and Andreas Wiebe, 19–92. Göttingen: Universitätsverlag Göttingen. http://webdoc.sub.gwdg.de/univerlag/2013/legalstudy.pdf, page 21.
[89] Blomqvist (2014), page 13.
[90] *In Case C-30/14 Ryanair*
[91] Directive (EU) 2016/943 of the European Parliament and of the Council of 8 June 2016 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure (Text with EEA relevance) OJ L 157, 15.6.2016, p. 1–18.
[92] Article 1 (2), Trade Secrets Directive.
[93] Recital 1, Trade Secrets Directive.
[94] Article 3 (2), ERIC Regulation.

> *(c) it has been subject to reasonable steps under the circumstances, by the person lawfully in control of the information, to keep it secret.*[95]

There is some discussion regarding the scope of trade secret protection, meaning whether it protects all types of information, even if not necessarily linked to the specific trade secret holder activity. Furthermore, and particularly relevant in the context of large research infrastructures, it is also debated whether trade secret rules also extend to the protection of data, big data and real-time data, regardless of the informational content.[96]

3.3.4. Data as (future) Intellectual Property

Prominent scholars have dismissed the idea of the creation of exclusive rights in data as neither justified nor necessary, citing a variety of concerns.[97] However, a few authors are either positive to, [98] or at least see both advantages and disadvantages in, the creation of an ownership right of information.[99] At national level, in Europe and in the EU there is also considerable discussion concerning the legal status of data, whether it can be classified as property under civil law, with the majority of authors agreeing that there is no IPR on data as such.[100] The future regulation of data has been debated in a Commission staff working document.[101] Different non-legislative and legislative options were examined, including model contract terms, default contract rules, access for public interest purposes and the introduction of an EU data producer's right to non-personal or anonymised data.[102] The EU Commission published an EU strategy for data [103] and has been taking a number of regulatory

[95] Article 2(1) Trade Secrets Directive.
[96] See Ana Nordberg (2020).
[97] Josef Drexl and others, 'Data Ownership and Access to Data - Position Statement of the Max Planck Institute for Innovation and Competition of 16 August 2016 on the Current European Debate' (Max Planck Institute for Innovation and Competition Research Paper No. 16-10, 2016) <http://dx.doi.org/10.2139/ssrn.2833165>; Josef Drexl, 'Designing Competitive Markets for Industrial Data in Europe – Between Propertisation and Access' (2017) 8 JIPITEC 257 <https://www.jipitec.eu/issues/jipitec-8-4-2017/4636> accessed 18 October 2018; Bernt Hugenholtz, 'Against Data Property' in Hanns Ullrich, Peter Drahos and Gustavo Ghidini (Eds.), Kritika: Essays on Intellectual Property (Volume 3, Edward Elgar Publishing Limited 2018); Wolfgang Kerber, 'A New (Intellectual) Property Right for Non-Personal Data? An Economic Analysis' (Joint Discussion Paper Series in Economics No. 37-2016) <https://www.uni-marburg.de/fb02/makro/forschung/magkspapers/paper_2016/37-2016_kerber.pdf> accessed 18 October 2018.
[98] Herbert Zech, 'Information as Property' (2015) 6 JIPITEC 192 <https://www.jipitec.eu/issues/jipitec-6-3-2015/4315> accessed 18 October 2018.
[99] Andreas Wiebe, 'Protection of Industrial Data – A New Property Right for the Digital Economy?'(2017) 12(1) Journal of Intellectual Property Law & Practice 62.
[100] Christopher Rees, 'Who Owns Our Data?' (2014) 30(1) Computer Law & Security Review 75; Thomas Hoeren, 'Big Data and the Ownership in Data: Recent Developments in Europe' (2014) 36(12) EIPR 751; Alexandra Mendoza-Caminade, 'La protection pénale des biens incorporels de l'entreprise: vers l'achèvement de la dématérialisation du délit' (2015) 7 Recueil Dalloz 415; Céline Castets-Renard, 'Les opportunités et risques pour les utilisateurs dans l'ouverture des données de santé: big data et open data' (2014) 108 Revue Lamy Droit de l'immatériel 38; Cf. Pierre Berlioz, 'Consécration du vol de données informatiques. Peut-on encore douter de la propriété de l'information?' (2015) 4 Revue des contrats 951.
[101] Commission Staff Working Document on the free flow of data and emerging issues of the European data economy *Accompanying the document* Communication Building a European data economy COM(2017)9final, p. 1 to 46.
[102] Ibidem, pages 31 to 46.
[103] Communication from the Commission to the European Parliament, the Council, the European Council, the European Economic and Social Committee and the Committee of Regions, *A European strategy for data*, Brussels, 19.2.2020 COM(2020) 66 final.

steps since 2014.[104] A public consultation on data regulation has been conducted, between February and May 2020, indicating that further legislative initiatives are to be expected. Meanwhile, commentators remain sceptical.[105] Data is commonly treated as a tradeable commodity and an asset, and it is common to find data treated as property and in contractual arrangements and statutes. However, these clauses are essentially only valid and enforceable between contracting parties. Further, hurdles relating to enforceability are foreseeable, since the object of protection, data, is not sufficiently defined, nor are the underlying property rights. It is particularly questionable whether an entity can claim ownership of data, where such data are not created, in the sense that they are observed, measured or the result of experimentation, but merely compiled or retrieved from existing sources. Such would certainly be the case with genetic, medical or social data, and other personal data even if anonymised. The lack of a specific harmonised EU framework for data ownership, and often not even sufficient support anchored in the applicable national legal order, complicates matters. While contractual freedom is a generally accepted principle, contractual clauses will be null and void if the object is not valid according to applicable law; for example, *data* may be considered a concept undetermined to be a valid contractual object. Enforceability of broad and vague data ownership clauses, such as those present in ERIC statutes, agreements and contracts remain uncertain.

4. Knowledge and Technology Transfer Policies

Several terms are used to describe the processes of knowledge valorisation. Technology transfer in a strict sense tends to refer only to research commercialisation and is infringingly connected with generated IPRs. Knowledge transfer is currently the preferred term in the context of publicly funded research organisations, and is currently evolved 'to a move from the more traditional concept of commercialisation and monetisation towards a more rounded approach which supports both co–creation and the dissemination of research results with, and to, non–academic third parties'.[106] In this chapter, knowledge and technology transfer refers to the process of conveying results stemming from scientific and technological research to the marketplace and/or to wider society, along with associated skills and knowledge, and technology transfer is, in this sense, an essential part of the general scientific and technological innovation process. It is also increasingly considered an important task and role of research infrastructures and even more so in the case of large research infrastructures.
Knowledge transfer is generally managed through policies concerning access to infrastructure resources and services, and use and dissemination, including publication, of results. Technology transfer is based on the ownership of exclusive legal entitlements over immaterial objects with commercial value and their subsequent direct or indirect exploitation. Traditionally, research institutions in Europe have mainly a non-commercial purpose and

[104] Regulation (EU) 2016/679; Regulation (EU) 2018/1807; Regulation (EU) 2019/881; Directive (EU) 2019/1024; Regulation 715/2007 as amended by Regulation 595/2009; Payment Service Directive Directive 2015/2366; Directive 2019/944 for electricity; Directive 2009/73/EC for gas meters; Commission Regulation (EU) 2017/1485; Commission Regulation (EU) 2015/703; Directive 2010/40/EU. 12 Directive (EU) 2019/770.
[105] Ivan Stepanov (2020) Introducing a property right over data in the EU: the data producer's right – an evaluation, International Review of Law, Computers & Technology, 34:1, 65-86, DOI: 10.1080/13600869.2019.1631621
[106] Campbell, A., Cavalade, C., Haunold, C., Karanikic, P. and Piccaluga, A., Knowledge Transfer Metrics - Towards a European-wide set of harmonised indicators, Karlsson Dinnetz, M. editor(s), EUR 30218 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18885-8 (online), doi:10.2760/907762 (online), JRC120716.

attributions. In line with such tradition, ERICs are mainly non-commercial in nature,[107] while technology transfer implies activities that can be classified as commercial acts. This apparent paradox is recognised in Recital 8 of the ERIC Regulation, which states that 'In order to promote innovation and knowledge and technology transfer, the ERIC should be allowed to carry out some limited economic activities if they are closely related to its principal task and they do not jeopardise its achievement.'[108] Recitals have interpretative value as sources of law and can be used to clarify legislative intent, but are not dispositive. The ERIC Regulation clearly states that establishing and operating a research infrastructure is the principal task of an ERIC and that such shall be pursued on a non-economic basis. Limited economic activities may be carried out, but only as long as these remain closely related to the establishment and operation of the research infrastructure.[109] What can still be considered part of normal operative tasks is left to interpretation. The tasks and activities of the ERIC are determined in the statutes of each ERIC.[110] Generally, it can be argued, considering the above mentioned Recital of the ERIC Regulation, that the legislator considered technology transfer activities to be part of such activities. This is further supported by the EU Commission's ERIC Practical Guidelines, which lists 'supporting technology transfer activities' as a core task in the operation of an ERIC while advising that an ERIC's statutes should be adapted to the characteristics of the infrastructure and should have a clear mission and responsibility for the operation of the infrastructure and listing a number of core tasks.[111] Table 3 presents a summary of examples of tasks and activities mentioned in ERIC statutes, and, as will be further developed below, knowledge dissemination and technology transfer often feature in various formulations.

The second EU Commission official report on the application of the ERIC Regulation, published in 2018, recognises that the need for further clarification on this matter is a recurrent issue and appears to link it to difficulties in technology transfer, concluding that 'The question of economic versus non-economic activities remains also to be further clarified as there are increasing demands for 'innovative' and 'socio-economic' impacts of the activities of the research infrastructures justifying the investments to be made by the members.'[112]

All ERIC statutes describe tasks and activities of the infrastructure consortium and delimiting the ERIC mandate. Analysis of the statutes of all the current ERICs shows that the tasks and activities mentioned can be grouped in six categories: (1) main tasks – operating a research facility; (2) providing information for policy and decision-making; (3) providing access to the infrastructure and its services; (4) developing standards and interoperability; (5) use and dissemination of knowledge; (6) integrating research with teaching, training and learning; (7) collaboration with industry and exploitation of IP and data.

The main task of all ERICs is to establish and operate a research infrastructure. Depending on the ERIC, this infrastructure can consist of building one or more facilities of their own, and/or

[107] Article 3(2) ERIC Regulation.
[108] Recital 8, ERIC Regulation.
[109] Article 3 (1) and (2) ERIC Regulation.
[110] Article 10 (b), ERIC Regulation.
[111] EUROPEAN COMMISSION Directorate-General for Research and Innovation 'ERIC Practical guidelines: Legal framework for a European Research Infrastructure Consortium', (Brussels, 2015), Page 14.
[112] REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Second Report on the Application of Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC) COM/2018/523 final, in paragraph 8, page 8.

developing, maintaining and operating infrastructures; or it can consist of establishing and operating a distributed research infrastructure as a central hub coordinating several pre-existing facilities. Statutes also mention, expressed in various ways and in a prominent place, tasks and activities related to performing or offering research services for public and private institutions; providing information, advice and services to investigators and sponsors of multinational studies, as well as advice to national and European authorities and policymakers; and also the contribution of timely information relevant to policy and to supporting knowledge-based decision-making.

A third recurrent group of tasks and activities is related to providing access to the infrastructure, its services tools and data. This is often subject to specific detailed policies and additional documents. These policies vary, and ERIC statutes contain references to 'free access', 'open access', 'effective access or 'fair and equitable access'. Generally, there is a preference for open access publication of results, open licensing software models and F.A.I.R data management principles. Some of the F.A.I.R. principles proposed by Wilkinson et al. in 2016 - findability, accessibility, interoperability and reusability[113] - are also expressly mentioned in ERIC statutes[114] and documents.[115] The OECD Principles and Guidelines for Access to Research Data from Public Funding are also mentioned.[116] The EU Commission Directorate-General for Research and Innovation has issued a collection of non-regulatory principles and guidelines to be used as a reference when defining access policies for research infrastructures and related services, in the form of the European Charter for Access to Research Infrastructures.[117] Its first principle, or recommendation, is precisely that 'Research Infrastructures should have a policy defining how they regulate, grant and support Access to (potential) Users from academia, business, industry and public services.'[118] All ERIC statutes contain provisions concerning *access policy for users*, since such is mandated by Article 10 (g)(c) of the ERIC Regulation.

A fourth group of tasks and activities is linked to standards and interoperability, with several statutes mentioning activities to improve or provide interoperability, data management and access to services, as well as the need to implement quality management including standardised procedures, best practices and appropriate tools to increase the quality of the resources collected and associated data.

The use and dissemination of knowledge also appears to be a main concern, with statutes mentioning, inter alia, tasks and activities to ensure an efficient internal and external communication: exchange knowledge, expertise, methodologies and practices across domains and disciplines/advance translational research; contribute to the dissemination of scientific results and make optimum use of resources and know-how; and share expertise, provision of infrastructure to the user community and other training, networking and dissemination activities. Another closely related group of tasks concerns knowledge dissemination through the integration of research with teaching, professional training and learning, including, for

[113] Wilkinson, Mark D et al., 'The FAIR Guiding Principles for scientific data management and stewardship' *Scientific Data* vol. 3 160018. 15 March 2016, doi:10.1038/sdata.2016.18
[114] For example, Article 19(2) EPOS ERIC.
[115] Article 6(B) Data management plan EMBRC ERIC.
[116] Article 14 (1) CESSA ERIC Statutes.
[117] Directorate-General for Research and Innovation, 2016, 'European Charter for Access to Research Infrastructures: Principles and Guidelines for Access and Related Services', Luxembourg: Publications Office of the European Union, ISBN: 978-92-79-45600-8 doi:10.2777/524573.
[118] Idem, Paragraph 4(a).

example, training courses and workshops on techniques and relevant methods, enabling the dissemination of expertise, the stimulation for exchange and co-development with industry.
Finally, as the last group of tasks and activities, ERIC statutes contain references to collaboration with industry and exploitation of IP and data. ERIC statutes mention, in different wordings, the possibility of conducting limited economic activities to further promote innovation as well as the transfer of knowledge and technology. Tasks and activities mentioned concern establishing, implementing or coordinating development of relevant technologies related to the resources and services; developing a common strategy and policy for intellectual property and know-how protection and exploitation, and creation and maintenance of a licensing, access and authentication framework; and providing services and engaging in partnerships with industry.
The European Strategy Forum on Research Infrastructures (ESFRI) puts forward two main models of interaction between research infrastructure and industry: (a) industry as a supplier: the upstream business model; and (b) industry as a user: the downstream business model.[119] In the upstream business model, industry acts mainly as a provider of state of the art technologies. Technology transfer is more likely to happen in the construction / upgrade stages, where scientific and industrial partners develop solutions to shared problems. In the downstream model, the emphasis is on knowledge transfer and on a medium to long-term aim to create – rather than transfer – new technology. This model is based on open innovation and co-creation, but also on protection of innovation results and commercialisation through spin offs and licensing.
The ERIC Practical Guidelines recommend that 'If an economic activity becomes successful enough to be no longer considered as secondary, an ERIC may consider creating a spin-off company for example.'[120] This is a common solution within research institutions, and is likely to also occur in the surveyed ERICS. However, sufficient data could not be found concerning whether innovation and technology transfer is being accomplished following this model and how successful it has been so far.
A recent report has presented a study on technology transfer metrics. It was conducted between September 2019 and February 2020, and prepared by an Expert Group on Knowledge Transfer Metrics appointed by the Competence Centre on Technology Transfer of the EC's Joint Research Centre in partnership with the Association of European Science & Technology Transfer Professionals (ASTP).[121] The study concluded that there is a need to generate consensus and adopt EU-wide indicators, definitions and mechanisms to implement and consistently report. In practice, the different knowledge transfer indicators that have been adopted internationally are very diverse and offer a broader range than the traditional measures of number of patents, licensing agreements, total spin–off companies and monetarisation. These often extend to considering different channels of engagement with industry, such as research collaborations, and even move beyond the dichotomy of research institution-industry to also consider other "non–academic" users and stakeholder engagement. This resonates with the different tasks and activities considered relevant enough to be mentioned in the statutes of the various ERICS and other policy documents, as mentioned above and in Table 3.

[119] European Strategy Forum on Research Infrastructures Innovation Working Group, (2018) 'Innovation-oriented cooperation of Research Infrastructures' In Jean Moulin (Ed.), ESFRI Scripta Volume III. Available: https://www.esfri.eu/sites/default/files/u4/ESFRI_SCRPTA_VOL3_INNO_single_page.pdf.
[120] ERIC Practical Guidelines, page 15.
[121] Campbell et al., 2020, pages 17-23.

5. Conclusion

All ERIC have IP clauses in their statutes, since this is an obligation contained in the ERIC Regulation. A few have publicly available IP policy documents with more detailed rules. The level of detail and how comprehensive these are vary depending on the field of science, structure and type of infrastructure. As of July 2020, only European Spallation Source ERIC had a patent policy. This patent policy has important rules on cross-licensing of background and foreground intellectual property rights but is only applicable between partners and during the facility set up phase. Once the facility is in operation, user agreements will be necessary, and might present similar provisions. The remaining ERICs surveyed devote the bulk of their attention to data, and assuming that the statutes and other publicly available policy documents can be used as an indicator, most ERICs seem to consider data ownership and data use rights more relevant than intellectual property rights in general, and patents in particular. Data 'ownership' is often considered an IP right as such, and a research asset, despite the lack of sufficient support in the applicable law. This reveals a trend in industry and research institutions to contractualise 'new' intellectual property rights. Finally, the analysis has also revealed that a strong link is made between knowledge dissemination and technology transfer in ERIC statutes, as opposed to a narrower focus on IP licensing. At the same time, a preference for open access publication of results, open licensing software models and F.A.I.R. data principles licensing models also emerged.

ANNEX Tables

Table 1: List of European Research Infrastructure Consortia (ERIC)

Year	European Research Infrastructure Consortium
2011	SHARE - Survey of Health, Ageing and Retirement in Europe
2012	CLARIN - Common Language Resources and Technology Infrastructure
2013	EATRIS - European Advanced Translational Research Infrastructure in Medicine ESS - European Social Survey BBMRI - Biobanking and Biomolecular Resources Research Infrastructure ECRIN - European Clinical Research Infrastructures Network
2014	EURO-ARGO - European Contribution to the Argo Programme (Global Ocean Monitoring System) CERIC - Central European Research Infrastructure Consortium DARIAH - Digital Research Infrastructure for the Arts and Humanities JIV - Joint Institute for Very Long Baseline Interferometry
2015	ESS - European Spallation Source ICOS - Integrated Carbon Observation System
2016	EMSO - European Multidisciplinary Seafloor and Water Column Observatory
2017	LIFEWATCH - e-Science and Technology European Infrastructure for Biodiversity and Ecosystem Research CESSDA - Consortium of European Social Science Data Archives ECCSEL - European Carbon Dioxide Capture and Storage Laboratory INSTRUCT - Integrated Structural Biology Research Infrastructure
2018	EMBRC - European Marine Biological Resource Centre EU-OPENSCREEN - European Infrastructure of Open Screening Platforms for Chemical Biology EPOS - European Plate Observing System
2019	EURO-BIOIMAGING - European Research Infrastructure for Imaging Technologies in Biological and Biomedical Sciences

Table 2: IPR ownership allocation rules in European Research Infrastructure Consortia (ERIC)

CONSORTIA	Generated IPR ownership allocation rules
BBMRI	ERIC may claim IPR over results developed or generated by the ERIC while carrying out its Work Programme (Article 19 (2) of the Statutes).
CERIC	IP generated as a result of activities funded by the ERIC shall be its property (Article 19 (3) of the Statutes).
CESSDA	IP that Members or Service Providers contribute to the ERIC shall remain property of the respective

	right holder. IP originating from ERIC funded work (direct contribution or in kind) shall be property of the ERIC (Article 16 (3) and (4) of the Statutes).
CLARINS	IPR created by the ERIC shall be its property – Statutes Article 22 (1).
DARIAH	IP (including its ownership) shall be regulated the national legislation of the Members or Observers and by international agreements to which Members or Observers are parties (Article 27(1) of the Statutes).
EATRIS	Prior IP belongs to the right holder; service does not include transfer of ownership nor any rights to use, modify, alter or apply ERIC Copyrighted materials and Trade marks. Copyright in results of the ERIC activities shall be owned by the ERIC - Article 6 of the Terms and Conditions.
ECCSEL	IP that Members provide to ECCSEL ERIC shall remain the property of the original right holder. IPR originated from ECCSEL ERIC funded work (direct contribution or in kind), shall belong to the ERIC, unless otherwise agreed (Article 20 (3) of the Statutes).
ECRIN	The ERIC may own appropriate IPR whenever the ERIC contribution covers the innovation process (Article 12 (2) of the Statutes).
EMBRC	IPR which arise, are created, obtained or developed by the ERIC Staff shall vest and be owned by the ERIC (Article 21 (4) of the Statutes).
EMSO	IPR created, obtained or developed by the ERIC shall vest in and be owned by the ERIC (Article 21 (2) of the Statutes.
EPOS	IPR over subject matter produced and developed within the activities of the ERIC shall belong to the entity/ies or to the person/s that/who has generated it. IPR generated as a result of activities funded exclusively by the ERIC shall be its property (Article 22 (2) and (4) of the Statutes).
ESS	The ERIC shall own IPR in its work (Article 23 (1) of the Statutes).
ESS - EUROPEAN SPALLATION SOURCE	The ERIC owns all IPR emanating from setting up and running the ERIC, IP produced by employees, except where covered by separate contractual agreements or mandatory legislation (Article 21(2) of the Statutes).
EU OPENSCREEN	IPR owned by the ERIC whenever their contribution covers the innovation process (Article 25 (2) of the Statutes).
EURO-ARGO	IPR created, arisen, obtained or developed by the ERIC in the course of its activities shall be owned by the ERIC. IPR created, arisen, obtained or developed by a Member or Observer or representing entity shall be owned respectively by them (Article 24 (1) and (2) of the Statutes).
EURO-BIOIMAGING	IPR created by users shall be owned by them. The ERIC owns IPR entirely or partly created, obtained or developed by the ERIC (Article 9 (1) and (2) of the Statutes).
ICOS	IPR shall belong to the entity or to the person who has generated it (Article 18 (1) of the Statutes).
INSTRUCT	IPR based on data generated as a result of ERIC activities is owned by the scientist or his/her employing institution. Where access to Instruct-ERIC infrastructure is provided for collaborative projects, the users shall agree to shared ownership. Any innovation regarding the experimental technology and resulting from the use of the facility remains the entire property of the hosting facility (Article 27 (2), (3) and (7) of the Statutes).
JIV	IPR generated by research and development of the JIV-ERIC correlator, the principle of ownership is recognised (sic), but it may be shared by all active participants contributing to the research (Article 23 (1) of the Statutes).
LIFEWATCH	No information on generated IPR ownership allocation.
SHARE	The ERIC is the owner of all IPR emanating from setting up and conducting the Survey (Article 13 (2) and (3) of the Statutes).

Table 3: Tasks and Activities in European Research Infrastructure Consortia (ERIC)

Examples of Tasks and Activities in ERIC Statutes	
1) Main task – operating a research facility;	- Develop, maintain and operate an infrastructure. - Establish and operate a distributed research infrastructure as a central hub coordinating several facilities. - Establish and operate services for the relevant European research community.
(2) Information to policy and	- Perform research services for public and private institutions - Provide information, advice and services to investigators and sponsors of studies.

decision-making;	- Advise national and European authorities and policymakers - Information to support knowledge-based policy and decision-making
(3) Access to the infrastructure and its services;	- Effective access to resources and services - Provide researchers with unified access - Offer free open access to users - Assure international open access to the infrastructure - Disseminate tools and data for the use of the public - Supervise and organise data processing, quality control, and access to ensure easy and timely availability to all - Promote fair and equitable access to services, open access to scientific results and data, transparency, equal treatment and non-discrimination - Access to measurement protocols, long-term data and data products
(4) Standards and interoperability;	- Improve/provide interoperability, data management and access to services. - Implement quality management including standardised procedures, best practices and appropriate tools to increase the quality of the resources collected and associated data. - Provide quality-controlled data and access to the data sets and data products to the research and Communities.
(5) Use and dissemination of knowledge;	- Ensure an efficient internal and external communication. - Exchange knowledge, expertise, methodologies and practices across domains and disciplines/advance translational research. - Contribute to the dissemination of scientific results and make optimum use of resources and know-how - Share expertise on all scientific/technological developments - Provision of infrastructure to the user community and other training, networking and dissemination activities.
(6) Teaching, training and learning	- Facilitate teaching and learning in the relevant scientific area - Integration of research, training, and information dissemination activities - Fostering training, outreach and international cooperation - Promote technological developments and demonstrations by linking research, education and innovation - Coordination of training courses and workshops on techniques and relevant methods, enabling the dissemination of expertise, the stimulation for exchange and co-development with industry
(7) Collaboration with industry and exploitation of IP and data	- Conduct limited economic activities to further promote innovation as well as transfer of knowledge and technology - Establish, implement or coordinate development of relevant technologies related to the resources and services. - Develop a common strategy and policy for intellectual property and know-how protection and exploitation and creation and maintenance of a licensing, access and authentication framework. - Promote innovation and transfer of knowledge and technology, providing services and engage in partnerships with industry - Ensure full exploitation of the achievements of the new research infrastructure and exploitation of data and products