ESFRI
ICOS RI
LANDMARK
MONITORING
Report of the Monitoring Panel

May 2023

PART A – SUMMARY AND RESULT OF THE ANALYSIS

The operation of ICOS is entirely in line with the mission of this infrastructure since it provides standardized, long-term data on greenhouse gases. A labelling system for monitoring stations ensures high-quality monitoring of Greenhouse Gases (GHG) data supporting critical aspects of climate science in the atmosphere–biosphere–hydrosphere continuum. Facilities constituting this advanced infrastructure research on the carbon cycle provide a rationale for European climate policy and underpin the European pillar of the global observation system.

The elevated ICOS's position can support creating a network covering the whole of Europe for monitoring GHG with a particular emphasis on the anthropogenic component. Such a network could support the European climate policy based on comprehensive data on GHG. From this point of view, it is so important to attract new ICOS ERIC members.

Covering the three domains: atmosphere, terrestrial ecosystems and marine realm, ICOS is predestined to play a leading role in supporting the cooperation within the environmental area. Many measuring stations are co-located with monitoring stations of other RIs, creating conditions for an integrative approach to monitoring different ecosystem components. It suggests considering how far it is possible to shift to a service-oriented rather than a data-oriented operation.

The RI has proven its excellent activity in the dissemination of obtained results. The Carbon Portal plays a unique role as a platform that provides free access to received data, is open to any user and is available for any use. Against this background, the RI rightly suggests developing standards within ESFRI to ensure appropriate credit attribution at publications using data obtained from RIs. The monitoring process convinced the Panel that how ICOS ERIC deals with its e-infrastructure needs should be highly appreciated.

The information provided and published annual progress reports indicates appropriate practices for preparing yearly planning and reporting, allowing to record of the results obtained and detect emerging challenges early. Concerning KPIs, it is very positive to record trends over time for individual KPIs. For this reason, it is essential to maintain a stable set of KPIs.

After over five years of operation, ICOS RI is on the right course and moving towards sustainability. The ICOS-RI has correctly identified financial, operational, and managerial risks; however, it would be beneficial to elaborate more specific mitigation processes, including medium- and long-term perspectives. Keeping in mind the development of ICOS RI to date and the excellent prospects for a leading role within the framework of integrating European research infrastructures, ICOS RI is invited to consider the evolution of its governance structure towards maintaining the high quality of the created value chain under dynamically changing conditions.

In conclusion, the Monitoring Panel would like to emphasize the accuracy with which ICOS ERIC produced the monitoring questionnaire, including attachments, and very constructive cooperation with RI in preparing and conducting the hearing.

PART B – SCIENTIFIC PART

1. SCIENTIFIC EXCELLENCE

Keep scientific and technical leadership and impact visible at European and global level

Summary of Performance:

ICOS RI provides in situ observation and information system to support key aspects of climate science in the atmosphere–biosphere–hydrosphere continuum. The infrastructure strongly rooted its development on the standards and protocols to ensure high quality and accurate data on sources, sinks, and cycling of greenhouse gases. ICOS developed. Furthermore, ICOS established the data infrastructure, through the platform Carbon Portal, to provide access to (1) near-real time data which are processed and partly quality controlled (maximum one day delay), (2) highly quality controlled final data ("Level 2 data") that are released for an entire year in the following spring, and (3) raw data for specific scientific projects or checks.. This data infrastructure enables excellent research by providing free and easy open access to GHG data with a wide spatial coverage and high temporal resolution, measured with the same quality standards.

The success of the RI as a Landmark is revealed in several aspects, and supported by KPIs:

- Based on the standards and protocols developed by the community, ICOS is certifying and labeling field stations for in situ observation. The high quality certification and associated services by thematic centres continue to be an attractive value proposition to new country members, seven of which joined after the initial establishment of the ERIC.
- ICOS data serves a relevant and active researcher community, revealed by steady increase of data downloads, which produced a consistent number of yearly scientific publications, currently around 200, and an accumulated number of more than 1700 publications since 2009, including more than 136 in the high impact journals Nature.
- The network of about 120 participant stations (class 1 or 2) span over 16 European countries, providing both spatial and temporal coverage of ocean, ecosystem and atmosphere environments. Many ecosystem stations are co-located with ecological monitoring stations, enabling integrative monitoring with other ecosystem components.
- The value proposition of ICOS continues to be high in the context of climate change, attracting four new country participants, after the establishment of the ERIC. The role of ICOS in the international landscape has gained high relevance with integration, expertise and service provision to international programs or organizations like Copernicus, WMO, IPCC.
- The scientific activity, research advances and engagement with the community is supported by several research project participation, including with other RIs in the European landscape, a conference series which adapted to include online participation, and support through data and resources to graduation and post-graduation programs.

Some challenges exist, nevertheless, for the further development of ICOS. The spatial coverage of the station network is one, considering the addition of new stations is a result of national priorities. Although some steps already exist towards a characterization of the coverage for atmospheric stations, an overview analysis and strategy that could facilitate the alignment of country decisions for the implementation of new stations with regional or global priorities could be a helpful instrument.

Another challenge relates to data usage reporting, including citation in scientific publications and reports. ICOS provides DOI or handles for each dataset, but users need to include them in the citation, to facilitate tracking. To ensure this, it would be important to include DOI or handle in the dataset download in the Carbon Portal, for example, as a metadata file, and also raise awareness to the user for the importance of the proper citations. Another issue is when data from a large number of different datasets is used, implying the inclusion of many citations. Finally, data products with aggregated data may also lose the reference to the original datasets. These issues require a

substantial effort to identify a solution, but it is important to ensure proper credits attribution to both ICOS thematic services and partner stations, as an indicator of scientific impact.

R1. It is recommended to develop a guiding instrument to support investment decisions by member participants, based on an overview on the spatial coverage of monitoring stations of ecosystem and ocean stations to identify gaps and strategic priorities,

R2. Reporting of data usage is critical to demonstrate impact of the investment and provide credits. In order to facilitate reporting of data usage, it is recommended to ensure mechanisms to:

- provide recommended citations with data downloads, including DOI or unique handles, for both single or aggregated dataset downloads on the Carbon Portal;

- ensure that citation of the individual original datasets is possible in data products aggregates by ICOS or other;

- establish tracking mechanisms to identify data citation in scientific publications and provide means for voluntary identification of citations by users.

2. PAN-EUROPEAN RELEVANCE

Clear position in the EU RIs landscape and cooperation/synergies with other RIs

Geographical distribution consolidated/expanding (if relevant)

Summary of performance:

ICOS RI has an influential position within the European RI ecosystem. Covering the three domains: atmosphere, terrestrial ecosystems and marine realm, ICOS is predestined to play a leading role in supporting the cooperation within the environmental area. This role is reflected in the fact that ICOS RI chairs the Board of European Environmental Research Infrastructures (BEERI) and represents the ENVRI area within the executive board of the ERIC FORUM. Concerning the geographical distribution of the measurement network, its expansion through access to a consortium of new partners from Eastern and Southern Europe is very positively assessed. Attracting new partners is still desirable.

It is worth emphasising that ICOS RI becomes a coordinated and unified observation system covering most EU Member States. It makes ICOS a key partner for the European Commission, cooperating with WMO and IPCC in activities towards a Monitoring, Verification and Support system for recording anthropogenic emissions of GHGs on a global scale. It indicates the central position of ICOS RI as a source of reliable and standardised data underpinning European climate policy and as the European Pillar of the global observation system. So elevated ICOS's position should be an incentive to cover the entire territory of the EU with a network of observation stations.

The evidence of using ICOS data (KPI 7) shows that most users are from EU27 countries, and the USA and China stand out. Such a spatial structure of users is understandable, considering the distribution of observation stations and the research potential.

The cooperation between ICOS and other RIs in Europe is developing intensively. In the organisational sphere, it manifests itself in sharing experiences and good practices with emerging RIs and engaging their representatives in training activities. On the operational level, the large and growing number of common observational sites with other RIs as eLTER (40), ACTRIS (31), and others, incl. EMSO and AnaEE (22) deserve special mention (KPI 20).

The documentation submitted and the discussion during the hearing show that the considerable heterogeneity of terrestrial ecosystems is challenging.

R 3. It is suggested to reinforce the top-down approach stimulating focus on critical aspects of carbon-climate feedback in crucial types of European ecosystems. It might be a factor in strengthening pan-European relevance and extending collaborations. An excellent example is the ICOS Cities project, which engages citizens, policymakers and top scientists in co-designing measurement methodologies and services for cities to support climate action.

3. SOCIO-ECONOMIC IMPACT

Social and/or economic impact and how this is measured

Summary of performance:

Unquestionably, the ICOS ERIC pays great attention to the socio-economic impact analysis. It is reflected in the ICOS Strategy and the development of relevant KPIs. In addition, this sphere was adequately included in the Impact Assessment Report (2018) and the periodic RI evaluation (2020).

The socio-economic impact is primarily associated with the assimilation and use of standardized observational data by users, who are researchers, non-professional society, as well as policy and decision-makers. The systematic increase in publications and citations using ICOS data (KPI 8) should be appreciated. The reported use of RI's data in publications from a very wide range of research areas (KPI 9) proves the value of ICOS products. In recent years, the usage of ICOS data in education, measured by the number of PhD, MSc and BSc theses (KPI 12), has significantly increased. This form of data use combines education and science and is vital for RI's sustainability. Efficient ICOS activities related to reaching outside the scientific domain are crucial. A promising way of knowledge transfer to society is the launch of FLUXES, the European Greenhouse Gas Bulletin. The ICOS Cities project has great potential for social and economic impact since an essential part of this is the co-creation of measurement methodologies and services supporting climate action with the participation of citizens and policymakers.

When assessing the socio-economic impact, the distinction between RI's activities towards reaching a broad audience and using standardized and scientifically interpreted measurement data at the economic and social decision-making is fundamental. These are two terminal elements of the value chain that determine the social significance of research infrastructure.

Undoubtedly, ICOS RI has documented its excellent activity in disseminating the obtained results. A separate issue is the use of the knowledge received in the decision-making process. This sphere is critical, but decisions affecting society and the economy are made outside the RI.

In this regard, the following general assumption can be made:

If RI makes due efforts to disseminate the obtained measurement data

and

If policy- and decision-makers are open to using the evidence that RI provides through their observations

then

RI's social and economic impact reflects the public relevance of RI's research programme.

With this in mind, the standardized and scientifically interpreted measurement data provided by ICOS RI play an essential role as a rationale for European climate policy, significantly contributing to global policy action.

4. USER STRATEGY & ACCESS POLICY

Solid access management system including:

- solid mechanism of exchange with users (e.g. operational single entry point for access, assistance to users; established catalogue of services for users),
- IPR policies fully established,
- dissemination programmes in place.

Summary of performance:

The main service provided by ICOS is access to station data, provided by the Carbon Portal. The datasets are available in different quality-level formats, from raw, near real-time data for ground-based stations, to reviewed and accuracy certified data and products. Generally, the full series of data are available for each labeled station. The access to any of this data is free and open to any user, and available for any use, as defined by the license adopted (Creative Commons Attribution 4.0 International license (CC BY 4.0)) in the Data Policy.

In addition, data products are created for different audiences, widening the target users from non-experts to advanced users. This is the case of the implementation of data access and analysis in a Virtual Research Environment based on Jupyter Hub, making use of Restful API services, which facilitated computational intensive analysis, and interoperability with other systems. ICOS is well positioned to comply with FAIR principles, which is a priority for the RI.

Regarding the Intellectual Property Rights, it is clearly defined that ICOS Data, databases and ICOS data related tools that the ICOS National Facilities and the ICOS Central Facilities have collected, organized and/or created to fulfill the requirements of ICOS Data generation and processing belong to them.

ICOS doesn't provide or promote physical access to measurement stations as a service due to the concern of creating local disturbance; however, the RI makes stations available for co-location with other RIs or for instrumentation to support related research.

5. E-NEEDS

Data Management Plan (DMP) implemented and security policy deployed

Operational application of FAIR principles

Summary of performance:

ICOS has a very well documented data management policy (DMP: "ICOS improved data lifecycle' – November 2020), which addresses all relevant topics extensively and adequately. ICOS handles handles its data services in a very mature way.

The DMP also contains a comprehensive description of the data handling architecture, relying on the EUDAT set of services, known as B2SAFE and B2FIND, and using the capacities of two geographically separated datacenters (CSC, Finland, and Julich, Germany).

On request ICOS provided more detail on the resilience of this architecture and set of services. B2SAFE is a trusted repository service and is part of the EOSC e-infrastructure services. It is used in the ICOS Carbon Portal to store all data objects (currently over 2 million). ICOS keeps and actually use only the local copies stored at Carbon Portal, at each Thematic Centre, and of each of these copies ICOS keeps one or more independent copies in different servers at different buildings, so ICOS does not critically depend on the B2SAFE service, that keeps for use two copies of the data in the two separate datacenters. Each ICOS data object is identified in the ICOS data system by its own digital checksum using encryption technology, so we can always check whether a data object is a one-to-one copy of the original data by recalculating the checksum and comparing with the identifier. In the unlikely case that the B2SAFE service would stop there are alternatives and there would be ample time to either replace it with another trusted repository or we could even continue without.

B2FIND is another EOSC service that publishes metadata on data and some of the ICOS data is also published through this B2FIND channel, but that is additional to their own data publishing through the Carbon Portal, that is indexed not only by B2FIND, but also by for example Google Data Search, GEO, GoFAIR and potentially any other open data service that wants to give access to our open and rich metadata on ICOS data.

In order to further improve the data services ICOS uses several feedback mechanisms to collect user requirements and experiences (see chapter 4. USER STRATEGY & ACCESS POLICY).

All in all we regard highly the way in which ICOS deals with its e-infrastructure needs. We have no specific recommendations.

PART C – IMPLEMENTATION PART

6. STAKEHOLDER COMMITMENT

Sustainable budget, including the budget for national nodes

Summary of implementation state:

ICOS-RI is on the right course and is moving towards sustainability. It has already a stakeholder commitment from 16 members and has provided five years of detailed financial statements. The 3-tiered structure (National Nodes, Central Facilities, and ERIC/HO) appears to be functioning well, particularly in terms of the member countries' commitment to the Central Facilities, the Head Office, and the Carbon Portal.

ICOS-RI has identified a major risk associated with the continued financing of national nodes, which will have a direct impact on all data services the RI provides on a global scale. A convincing financial/sustainability plan for moving forward is of high priority.

Items that are not sufficiently elaborated on and may be further considered for ICOS-financial RI's sustainability include three facets: current and prospective members, key stakeholders and operations and services. More specifically, ICOS-RI may formulate a more effective strategy to highlight benefits that the current members enjoy, improving also the RI branding at national level (e.g. web pages of national nodes), with the aim also to recruit new members. Development of a more effective strategy and action plan for increasing industry relations may also be quite helpful. A potential venue would be emerging data spaces and how ICOS-RI can provide services (on top of data) to attract industry (e.g., Mobility Data Space). Increasing the visibility and policy relevance of ICOS-RI data at the national and European level would also be advantageous. The city observatories that actively support the development of the climate-smart cities initiative are excellent in terms of what people can relate to and may serve as opportunities to develop links with EU Green initiatives such as the EU's "100 Climate-Neutral and Smart Cities by 2030" Mission" that are not currently exploited. Value-added upstream services to existing ICOS Carbon Portal (CP) with a well-defined strategy and implementation plan will enable innovation. Identifying joint efforts with all National Nodes to bring value to their operations and potentially discover economies of scale will significantly contribute to the sustainability plans of the RI. For example, refining costs at the CP, central facilities, and National Nodes to reflect operations, maintenance, and upgrades distinguishing funding required for operations and maintenance (which may come from government funding programmes) from funding for new construction (which may come from competitive R&I funding). As with most RIs, ICOS seeks funds through the participation to EU calls and scientific excellence that an organization can bring to the consortium is the most crucial criterion as it was also explained during the hearing process; thus, participation only to those calls that fulfil specific strategic implementation actions (identified in the ICOS strategy plan) is also important.

7. CURRENT STATUS AND PLANNING

Core construction effectively completed or underway and any upgrade plans approved

Procedures for appropriate termination established

Summary of implementation state:

After more than five years of operation, ICOS-RI has a thorough understanding of processes and workflows. The materials used to demonstrate this are of superior quality. The ICOS Strategy is a well-developed document that provides a long-term vision, with two strategic goals i.e. to facilitate current and future science and international cooperation. However, the ICOS strategy seems to lacks the implementation plan details (action points, specific roadmaps) necessary to anticipate short- to medium-term system changes. Understandably, in the current stage of its lifetime, it emphasises more on the upstream (i.e. input process of National Nodes and Operations) rather than the downstream (i.e., how researchers, policy makers, industry, citizens may use the data products). ICOS-RI is invited to consider how they will shift this balance, potentially shifting to a service-oriented rather data-oriented provision.

Planning issues to consider include recording and breaking down costs for operations, maintenance, and upgrades across all RI divisions. This would provide a deeper understanding of the intervention points and how to implement anticipated changes. Additionally, creating and distributing more detailed implementation plans for new operations/functions across all tiers would be beneficial. This is notably important for the ICOS Carbon Portal's (CP) value-added services for which it is crucial to have detailed plans on how a new development will be scaled to either existing or new users and how concrete synergies may be built on different fields beyond data provision (e.g. technology, methodology, data treatment, storage, sharing etc.) around the worldwide, addressing global challenges. A more detailed stakeholder analysis for the downstream services to identify the perceived value of the data/services other than how they are currently being used in research would be helpful. This analysis shall include stakeholders' willingness to commit/engage with ICOS-RI as a trusted service provider. Steps to this direction have already been taken as explained during the hearing.

8. GOVERNANCE, MANAGEMENT & HUMAN RESOURCES POLICY

Mechanisms in place for annual planning and reporting

All human resources policies and instruments established, including training

Summary of implementation state:

The information provided by ICOS-RI indicates that the Head Office (HO) has established rigorous procedures for preparing annual planning and reporting. This is also evident from the annual progress reports that have been published. The human resources policies and instruments are operational as it becomes evident from the information provided. However, the HO organisational framework is not sufficiently described. For example, an organogram that would indicate the people who have been assigned to specific tasks would be useful. Similarly, in addition to a reference in the contract, there is not a sufficient amount of information pertaining to training for the staff.

The Governance structure with the different layers is rather complex for the size and objectives of ICOS-RI. This is evident in the ICOS 2020 Evaluation Report where members are calling for changes. The effectiveness and efficiency of the governance structure and bodies, their delivery and their interactions with the HO was elaborated during the hearing process because their scope and decisions were not described in the supporting documents (or on the website). Challenges emerging from the increased number of countries and the differences in regulations were underlined, for example in terms of employment regulations. The ICOS-RI committee, in which all central facilities are represented are working on addressing these challenges and establishing a functional governing body.

9. FINANCES

Long-term financial plan and budget (including an estimation of decommissioning costs if relevant)

Auditing of accounting and budget systems in place

Summary of implementation state:

The representation of short-term financial planning is adequate. It is imperative though for ICOS-RI to focus more on developing mid- and long-term financial planning in relation to novel uses of its data, workflows, and services for all tiers. In this process, it is essential to consider the cost breakdown for operations, maintenance, and upgrades.

With data homogenisation and access becoming increasingly important in the EU data strategy and global climate change initiatives, the ICOS Carbon Portal (CP) should become a top priority and the ICOS-RI should increase its investment. This is not evident in current financial budget.

The ICOS Internal Financial Rules stipulate auditing procedures, but from the Landmark report it is unclear if and how external audits have been conducted.

10. RISKS MANAGEMENT

Appropriate operational risk management and mitigation policies established

Summary of implementation state:

ICOS-RI has identified financial (sustainability of national nodes), operational (data quality and gaps) and managerial risks (policies and organizational procedures).

Financial risks: Not clear mitigation processes yet.

Operational risks: Mitigations rely predominantly on monitoring (ex-post), but it is unclear how these are implemented at specific nodes.

Managerial risks: The mitigation processes include a rigorous RI management plan, but the specifics of how this plan is implemented and influences the processes are unclear.

Some ideas to enhance risk management in a pro-active fashion include the initiation or strengthening processes such as a mutual learning environment for nodes to learn from one another on a variety of topics. For example, how to pursue financial stability, technical issues, legal concerns, internal organisational concerns, and innovative ideas. In addition, improvement of annual reporting of operations (quality, gaps, successes) per node, centers and CP would be beneficial. On the same lines, routine internal evaluations of the HO's operations and its interactions with nodes and centers may be helpful.

Overall, a stand-alone document on risk management and foreseen mitigation actions is expected to be included in the ICOS-RI management portfolio.

11. ENVIRONMENTAL / ENERGY POLICY

Green Deal

Summary of implementation state:

ICOS-RI has taken steps (internal policy) to limit emissions from business travel and the daily commute of HO employees. This measure, might be promoted to member organisations.

ICOS-RI is invited to further actively investigate environmental policies in its operations: do the nodes, centers, and CP adhere to an environmental policy regarding energy utilisation, for instance, to use eco-friendly cloud computing. Use of renewable sources as much as possible for the actual operation of the ICOS stations is an action that may contribute the ICOS-RI policy and serve as a paradigm for other RIs. Extra funding opportunities may be available for this purpose.

Furthermore, ICOS-RI would be excellent to disseminate information to cities and citizens about how to reduce carbon emissions. There are already a great number of apps that attempt to do this (with some degree of success), and ICOS-RI can be involved in order to offer credit.

PART D: KPI

KEY PERFORMANCE INDICATORS (KPI)

Summary:

The list of 20 KPIs reflects the analysis of the KPI suggestion by the ESFRI working group on Monitoring (2019), experience from the ICOS statuary evaluation that was conducted during the year 2020, and the dialogue with the Monitoring Panel in preparation for the monitoring process. Finally, a list of 20 KPIs was created covering all relevant aspects for ICOS RI monitoring, including management, data use, scientific excellence level, public outreach, and facilitation of international and transnational collaboration.

When considering KPIs, it is worth considering the balance between the workload required to calculate the indicators and the relevance of the information obtained. From this point of view, the presented set is appropriate, although some modifications and additions may be appropriate.

Most KPIs met the RACER criteria; however, the criteria “Easy to monitor” and “Robust” are the most difficult to reach. Broader use of open science and open sources for establishing KPIs may contribute to strengthening compliance with the RACER criteria.

The presentation of KPIs would gain clarity if individual KPIs were shown as a reflection of essential elements of the ICOS long-term strategic lines.

It is worth considering breakdowns of relevant KPIs according to National station Networks and/or Monitoring station Assemblies and/or Thematic Centers & Laboratories.

Concerning KPIs, it is very positive to consider trends over time for individual KPIs, which allows tracking the development of a RI and recognising challenges early. The Monitoring Panel invites ICOS RI to extend this approach as relevant data becomes available. For this reason, a stable set of KPIs should be maintained. New indicators should be of complementary importance. Possible list extensions may concern, for example, the distinction between different groups of users (researchers, industry, policymakers, citizens) and purposes of data usage

One of the most important KPIs is documenting in scientific publications the use of research infrastructure and the data it generates. As the Monitoring Panel, we agree with the suggestion of ICOS ERIC to elaborate within ESFRI general harmonizing rules for attribution of publications to research infrastructures.

In conclusion, the presented set of KPIs documents ICOS RI's operation and growth very well.

PART E: ADDITIONAL INFORMATION

ADDITIONAL QUESTIONS, DOCUMENTS, HEARINGS, ON-SITE VISITS

Summary:

ICOS has succeeded in being well identified in the European and international scientific community and also in the community of operational services and decision-making bodies for the essential role of CO_2 and CH_4 in the climate change (from long-term monitoring to verification of emissions). The integration of the communities and their observing systems clearly focused on the Carbon Cycle in the different “spheres” of the Earth has undoubtedly allowed this.

A second step towards other successes allowing the next generations of scientists a further integration of the full (biophysicochemical) Earth climate system would including co-emitted species (e.g. the short lived climate forcers) and their feedback processes. This is indeed monitored and organized by other RIs in the individual environmental domains, Atmosphere, Ocean, and Terrestrial. Such an integration challenge will not only require scientific arguments but probably also a significant change in the governance practices of the different RIs to maximize the chances of success regardless of difficult interpersonal relationships.

So elevated ICOS's position can support creating a Pan-European network of monitoring GHG flows based on this infrastructure, particularly emphasizing the anthropogenic component.

The Monitoring Panel arranged the hearing with the leading team of the ICOS ERIC. Before the meeting, the Monitoring Panel formulated questions to which ICOS RI prepared written answers. Thanks to this, we could focus on explanations and in-deep discussion of individual issues during the hearing.

Considering that ICOS RI is a distributed infrastructure, as well as very good preparation of materials for monitoring the process, the Monitoring Panel decided that there is no need to organize an on-site visit to one of the facilities belonging to this infrastructure.

We add the file: *Initial answers of ICOS ERIC for the hearing*