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Study to evaluate the **ERA policy framework and ERA monitoring mechanism**

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European Commission
Directorate-General for Research and Innovation
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STUDY TO EVALUATE THE **ERA POLICY FRAMEWORK AND ERA MONITORING MECHANISM**

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LIST OF ACRONYMS AND GLOSSARY

List of acronyms and glossary	Full name/ and or description
AI	Artificial Intelligence
Bologna Declaration	A key intergovernmental commitment to reform in higher education. Drafted in 1999.
The Charter	The European Charter for Researchers and Code of Conduct for their Recruitment
EGTC	European Grouping for Territorial Cooperation
EIS	European Innovation Scoreboard
EMM	The ERA Monitoring Mechanism
EOSC	European Open Science Cloud
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERAC SWG	European Research Area and Innovation Committee Standing Working Group
ERA Pact for R&I	The Pact for R&I is meant to include 1) common values & principles for R&I in Europe; 2) jointly agreed priority areas for ERA action (horizontal as well as thematic), and 3) common approaches for the "mechanics" of implementation at European/national level (e.g. in the context of the "European Semester").
ERA Forum for Transition	The Forum was set up in February 2021 aims to design and advance the agenda for the new European Research Area and its initiatives and actions.
ERA Partnership	Partnership comprised of Member States, countries participating in the DG RTD Framework Programmes, the European Commission and stakeholder organisations.
ERA Stakeholder Platform	The ERA Stakeholder Platform was part of ERA governance mechanisms in the 2015-2020 period. Organisations such as CESAER, EARTO, EUA, LERU and Science Europe were participants.
ERC	European Research Council
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum for Research Infrastructures
ESIFs	European Structural and Investment Funds
EUI	European Universities Initiative (funded under Erasmus+)
FAIR data	Findable, Accessible, Interoperable and Reusable data
FPs	Framework Programmes
GPC	High Level Group on Joint Programming
H2020	Horizon 2020 Programme
HEIs	Higher Education Institutions
IP	Intellectual property
IPR	Intellectual property rights
MSCA	Marie Skłodowska-Curie Actions: Research fellowships within the ERA.
MORE Studies	A series of studies on researcher mobility commissioned by DG RTD. Three have been published to date, with a further MORE IV study underway.

OPs	Operational Programmes (a planning tool used to set out an overall strategy and priorities in European Structural and Investment Funds)
Open Science	The scientific creation of transparent knowledge developed and proliferated through collaborative networks.
R&D	Research and Development
R&D&I	Research and Development and Innovation
R&I	Research and Innovation
RFOs	Research Funding Organisations
RIs	Research Infrastructures
RPOs	Research Performing Organisations
SCs	Societal Challenges
SDGs	The United Nations' Sustainable Development Goals
STEM	Science, Technology, Engineering and Mathematics academic subjects
SWG GRI	Standing Working Group on Gender in Research and Innovation under European Research Area and Innovation Committee
TFEU	Treaty on the Functioning of the European Union
TEU	Treaty on European Union
WoS	Women in Science survey - survey informing assessment of progress towards gender equality.

EXECUTIVE SUMMARY

The European Research Area (ERA) aims to harmonise the framework conditions for R&I in Europe, and builds on both national and EU level measures on a voluntary basis. To achieve these goals, the ERA Roadmap 2015-2020 set out a framework for implementing the ERA in a more structured way that aimed to strengthen the contribution of national measures to ERA implementation (recognising the crucial role already played by EU measures). Within the ERA Roadmap, the National Action Plans (NAPs) played an important role in setting out the contribution of the Member States and other ERA-participant countries to the ERA. Additionally, the European Research Area and Innovation Committee (ERAC) provided technical inputs to facilitate ERA implementation across the 6 thematic ERA priorities defined in 2012 and incorporated into the ERA Roadmap. The study reviewed ERA governance arrangements in 2015-2020 as well as the monitoring and indicator system.

In the context of the revitalised ERA Communication of September 2020, and subsequent Council Conclusions to further elaborate the approach to the new ERA, an assessment was carried out of the new proposed approach to governance arrangements and a new proposed monitoring and indicator system in the form of an ERA Scoreboard and broader performance monitoring framework was developed. This aimed to incorporate the lessons learned to date and reflect the additional EU level priorities to ensure a renewed joint undertaking based on a multi-level governance and partnership-based model.

The study presents a set of recommendations for the future.

On the ERA Roadmap process, ERA governance and ERA policy framework:

Recommendation 1 – Ensure that high-level political buy-in and engagement with the ERA process is secured at Ministerial levels nationally, with a corresponding level of seniority from the European Commission.

There is a need to strengthen the linkages to high-level decision-making processes to build a stronger strategic programming process leading to the development of an overarching set of objectives for ERA. Mainly led by Ministries of Education in the 2015-2020 period, the study identified a gap in the engagement in the ERA of other Ministries that would be beneficial for higher uptake of ERA measures if addressed for the future. The ERA process needed closer alignment and engagement with high-level policy decision makers in many countries, especially Ministers responsible for R&I. The low level of political interest in some of the ERA topics, perhaps due to their technical nature in some cases and a lack of understanding about the strategic policy benefits in others, was problematic. This meant that there was a lack of an appropriate incentive to stimulate discussion and engagement at higher political levels, and a lack of interesting and challenging meeting agendas that could attract Ministerial attention.

Recommendation 2 – Put in place an effective strategic planning process to support the ERA to ensure that the process is more systemic and co-designed jointly between the Commission and Member States but including other R&I stakeholders in consultation processes.

The partnership model relies on voluntary processes inspired by the Open Method of Coordination (OMC), in which there is reporting on progress made towards the common ERA objectives. This is seen by most stakeholders as an essential element of the ERA governance process. The debates in

ERAC and the ERA-related Standing Working Groups (SWG) constituted the main platform for joint agenda-setting in relation to the ERA priorities and the ERA Roadmap. However, the productivity and value add of the ERA-related ERAC Working Groups varied, with some working well and playing an active role in the EMM process while others were considered to have commenced well, but lost their momentum.

Stronger coordination is needed at national level both at a Ministry level and in the context of multi-level governance. In addition, there is a need to re-engage stakeholders from applied research and industry-oriented research and innovation. The new ERA should strengthen stakeholder involvement to become more inclusive by involving a broader spectrum of R&I stakeholders including regional and local actors. The coordination between all Ministries and agencies involved in the national and regional R&I eco-system needs to be strengthened at MS/AC level, with a view to broadening ERA actions beyond policies on public and academic research institutions and careers.

Recommendation 3 – Consideration should be given to assigning a longer duration to the new ERA, such as a 10-year implementation period. This would allow sufficient time for a more strategic approach to be pursued, and allow sufficient time for wider consultations with national and regional R&I stakeholders not only Ministries.

There was limited adjustment made to the NAPs and ERA actions at national level following the ERA progress reports, possibly due to the limited ownership of the national level in these reports and limited room to react to these. A longer time horizon would allow for strategic planning for ERA advancement while also allowing for periodic reviews of the extent of progress towards the ERA objectives at national and EU levels. In addition, the ERA process should be sufficiently flexible to be able to react and respond to upcoming new themes.

Recommendation 4 – A wider set of stakeholders should be involved in the new ERA governance arrangements, supported by regular stakeholder consultations. This would serve several aims, including strengthening the ERA's visibility at national and regional level, harnessing the collective knowledge and expertise of EU, national and regional R&I stakeholders, and ensuring that all relevant types of stakeholders covering academic and applied research, and innovation (including its industrial dimension) are represented.

The study identified the need for embedding a multi-level governance approach including the regional dimension in the new ERA. This was arguably a major deficiency in the previous ERA Roadmap process at the NAP development level, as regional stakeholders were rarely involved. In addition, as the majority of ERA-related governance structures were found to be led by representatives from the Ministries of Education and Science, representatives of Ministries and agencies responsible for applied and industrial research and innovation were less informed about and involved in the ERA policies. Therefore, a multi-level governance approach would be crucial also in ERA implementation and, as part of this, stakeholder engagement in smart specialisation strategies could be seen as a good practice model that could be adapted in the future ERA. A more central role could be given to the ERA Stakeholder Platform in consultations related to the design of the ERA policy agenda and reviews of its effectiveness. The Platform could also be involved in identifying conclusions and lessons learned from the different processes used to monitor and evaluate progress of the ERA policy agenda implementation.

Recommendation 5 - Establish closer links between the development and implementation of NAPs or their successors and other national strategies and priorities, such as the Smart Specialisation strategies.

The ERA Roadmap 2015-2020 was agreed voluntarily between the European Commission, the Member States and the ERA Partnership, so that ERA participant countries could implement the Roadmap and develop NAPs appropriate to their national R&I situation. This flexibility was appreciated as reflecting the heterogeneity of R&I systems across the ERA's diverse landscape, yet led to a wide variation in the NAPs in terms of their ambition and level of detail. As a result, there was a lack of synchronisation in the timing of the development of national R&I strategies and the NAPs did not achieve their full value add potential.

Recommendation 6 - Develop more targeted guidance for the development of national ERA Action Plans (NAPs) in the form of improved ERA Roadmap guidance, supported by good practice examples.

The ERA Roadmap set out useful high-level objectives, however limited guidance was provided on operational implementation at national level, including the translation into specific objectives, actions and targets. On the one hand, this posed challenges especially for countries needing structural, institutional and / or administrative reforms, and / or that needed to catch up with better-performing R&I countries across ERA participant MS and ACs. On the other hand, however, the roadmap provided a basic framework for actions to be developed at the national level while allowing for sufficient room for flexibility to translate this into the specific national context. This voluntary aspect was considered as being key to building the ERA around a partnership-based model and providing a genuine platform for reform based on common objectives.

Clearer guidance on translating concrete ERA actions into a national agenda of reforms and measures is needed, which even though non-binding would help to review the extent of progress in ERA implementation, identify policy priorities and opportunities to identify synergies with other EU policies and EU programmes.

Recommendation 7 – Monitoring data generated through both the new ERA Scoreboard and the revised and upgraded EMM should be used to influence EU and national R&I policy making. The interlinkage between monitoring and policy-making in R&I needs to be strengthened, and lead to follow-up actions, such as revising and improving the NAPs.

Dilemmas revealed by the study refer to the involvement of national stakeholders. Although national Ministries would value more direct involvement in monitoring and reporting activities to allow for greater engagement and accuracy in the data, some MS also reported a lack of human and financial resources to be sufficiently actively involved in monitoring activities across so many thematic areas. This could be addressed in a two-fold manner. Firstly, if greater political attention were to be paid at national level to the ERA, Ministries could be encouraged to increase their resource allocation to ERA implementation including monitoring aspects. Secondly, investment at EU level in the new ERA Scoreboard and in a performance dashboard in which data could be provided both from the EU level and national levels via official statistical sources (e.g. Eurostat) and via an ERA policy platform portal could strengthen the efficiency of monitoring and reporting activities.

On the Indicator and monitoring system:

Recommendation 8 – A new ERA Scoreboard should be developed consisting of 15-20 quantitative indicators to assess strategic progress in ERA implementation. The indicator system should be streamlined to distinguish between the ERA Scoreboard and a broader monitoring framework consisting of a performance dashboard.

The revitalised ERA priorities, the Council Conclusions and feedback from stakeholders suggest the ERA Monitoring Mechanism (EMM) needs to be updated to incorporate developments in the R&I landscape in order to better capture progress towards achievement of individual ERA priorities. The restructuring of the indicator system will need to take into account aspects such as a balance between continuity of indicators and new ones, data availability through centralised EU/ international sources and the otherwise resulting data collection efforts. The ERA priorities in the revitalised ERA Communication and in the ERA Pact are very broad, hence it will need to be considered whether all priorities, sub-priorities and objectives are equally important, or whether prioritisation is necessary.

With the introduction of the new ERA Scoreboard, consideration should be given to how this affects the broader monitoring mechanism and what the process should be in future. If the ERA Scoreboard is to focus on strategic high-level indicators, these could be integrated into a broader set of indicators monitoring other dimensions through more operational and activity-based indicators. Potential additional monitoring indicators could be included within a new monitoring and reporting system through the creation of a Performance Dashboard to replace the EMM, and/ or a centralized Policy Online Platform where ERA participant countries can upload information about ERA-relevant activities, strategies and general actions. Data collection responsibility and accountability would also be needed for these proposed new initiatives.

A combination of EU and national monitoring would be complementary and representative of the actions taken. With EU level monitoring linked to the indicators selected, and national monitoring linked to the development and implementation of the successor to the ERA Roadmap, synergies and coordination efforts will be needed to bring together findings from both the EU level top-down monitoring and bottom-up national monitoring to provide a comprehensive overview of progress towards the new ERA's objectives, as defined in the ERA Pact.

Whereas annual reporting frequency was accepted for the ERA Scoreboard, stakeholders' preferred monitoring and reporting approach to the broader monitoring system was biennial. The present system whereby there is a biennial ERA Progress Report providing an overview of progress towards ERA implementation at the EU level overall, with supporting country fiches to assess national performance data and to track the evolution in performance was considered proportionate.

Recommendation 9. The Commission should debate with ERA participant countries whether to continue the biennial ERA Progress Reports or to replace these with an alternative.

Coordination of reporting and monitoring at EU and national level is key to strengthening the link to policy-making and to ensure that R&I decision-making to be data and evidence-based. Long-term ERA objectives are monitored by the EU and in the 2015-2020 period, this was achieved through the biennial ERA Progress report. Should such a report be continued, national stakeholders could be involved by having a role as observers, or be consulted on the progress made at national level to increase their ownership and strengthen the incentive to revise and adjust ERA measures based on the resulting conclusions. However, there is limited capacity at national level in terms of available human and financial resources. This suggests that it would be best to strike a balance regarding

the involvement of EU and national level stakeholders in monitoring, so as to maximise accountability and ownership without creating too much burden that countries would risk being unable to meet.

Recommendation 10 – The knowledge and experience of the ERA Forum, ERAC members and Stakeholder Platform members should be leveraged as they could help to play a crucial role in the monitoring system, given links between monitoring and evaluation.

Monitoring at national level in 2015-2020 was organised through the ERAC SWGs i.e. at the ERA Priority level. There was a focus on monitoring progress towards implementation of the NAPs at a thematic level, which was considered to be very useful for national stakeholders.

A similar effort could be replicated in the future to complement EU level monitoring. National Ministries and other national and regional R&I stakeholders should add value by helping the Commission and consultants preparing EU level progress reports in ERA/ biennial progress reports (if continued). They could provide interpretation of the factors underlying country-specific changes in performance over time. Otherwise, there is a risk that national context-specific factors are overlooked and lead to data being misinterpreted. In addition, the ERA Forum, ERAC members and Stakeholder Platform members could help to analyse and interpret monitoring data, provide contextualisation, commentary on what has been achieved in terms of progress towards the 4 strategic objectives and 15 thematic priorities.

Recommendation 11 - The ERA Scoreboard should adopt a good practice approach to data visualisation and design.

The commitment to the creation of an ERA Scoreboard is an opportunity to present findings in a more user-friendly and visual way, including through strengthened data visualisation and use of infographics. This will be a major change to the reporting so far through the ERA progress report and will need to be accompanied by consideration of data collection responsibilities. Clear benefits including higher visibility of the ERA efforts could encourage greater action and political commitment.

On the need for follow up to the study:

Recommendation 12 – There is a need to follow up this study to determine the optimal way forward.

Additional debate is needed in regards of ensuring that the new governance arrangements to underpin implementation of the ERA Pact work efficiently and effectively. Besides, further efforts are needed for determining which indicators should be selected for the new ERA Scoreboard and Performance Dashboard and for finalising monitoring arrangements and related activities e.g. responsibility for updating monitoring data, data collection, data sources and reporting activities linked to the new ERA Pact. Also agreeing the role of the EU and ERA participant countries respectively in relation to monitoring.

RÉSUMÉ EXÉCUTIF

L'Espace européen de la recherche (EER) vise à harmoniser les conditions structurelles de la recherche et de l'innovation (R&I) en Europe en s'appuyant sur des mesures nationales et européennes adoptées sur une base volontaire. Pour atteindre ces objectifs, la feuille de route 2015-2020 de l'EER a défini un cadre structuré pour la mise en œuvre de l'EER qui visait à renforcer la contribution des mesures nationales à la mise en œuvre de l'EER tout en en reconnaissant le rôle crucial déjà joué par les mesures par l'Union Européenne (UE). Dans le cadre de la feuille de route de l'EER, les plans d'action nationaux (PAN) ont eu un rôle important définissant la contribution des États membres et des autres pays participant à l'EER. En outre, le comité de l'espace européen de la recherche et de l'innovation (ERAC) a joué un rôle technique facilitant la mise en œuvre de l'EER au travers des 6 priorités thématiques de l'EER définies en 2012 et intégrées à la feuille de route de l'EER. Cette étude examine les modalités de gouvernance de l'EER pour la période 2015-2020 ainsi que le système de suivi et d'indicateurs.

Dans le contexte de la nouvelle communication sur l'EER de septembre 2020, et des conclusions du Conseil qui ont suivi précisant l'approche du nouvel EER, cette évaluation porte sur les nouvelles propositions concernant la gouvernance et le système de suivi et d'indicateurs prenant la forme d'un tableau de bord de l'EER et d'un cadre plus large de suivi des performances. L'objectif était de synthétiser les enseignements tirés à ce jour tout en prenant en compte les priorités supplémentaires au niveau de l'UE afin de garantir une approche commune basée sur une gouvernance à plusieurs niveaux et un modèle fondé sur le partenariat.

L'étude présente une série de recommandations pour l'avenir. À savoir :

Sur le processus de la feuille de route de l'EER, la gouvernance de l'EER et le cadre politique de l'EER

Recommandation 1 - Veiller à ce que l'adhésion et l'engagement politiques de haut niveau dans le processus de l'EER soient garantis au niveau ministériel dans les États membres, avec un niveau de responsabilité correspondant au niveau de la Commission européenne.

Il est nécessaire de renforcer les liens avec les processus décisionnels de haut niveau afin de construire un processus de programmation stratégique plus solide menant à l'élaboration d'un ensemble d'objectifs primordiaux pour l'EER. Alors que l'action était principalement menée par les ministères de l'éducation au cours de la période 2015-2020, l'étude a identifié un manque d'engagement des autres ministères qui aurait permis une meilleure adoption des mesures de l'EER. Le processus de l'EER a besoin d'un alignement et d'un engagement plus étroit avec les décideurs politiques de haut niveau dans de nombreux pays, en particulier les ministres responsables de la R&I. Le faible niveau d'intérêt politique pour certains des thèmes de l'EER est peut-être dû à leur nature technique dans certains cas et à un manque de compréhension des avantages politiques stratégiques dans d'autres. Cela signifie qu'il n'y a pas eu d'incitation appropriée pour stimuler la discussion et l'engagement à des niveaux politiques plus élevés, par exemple au moyen de réunions sur des arguments stimulants qui auraient pu attirer l'attention des ministres.

Recommandation 2 - Mettre en place un processus de planification stratégique efficace pour soutenir l'EER afin de garantir que le processus soit plus systémique et conçu

conjointement par la Commission et les États membres, mais en incluant d'autres parties prenantes de la R&I dans les processus de consultation.

Le modèle partenarial repose sur un engagement volontaire inspiré par la méthode ouverte de coordination (MOC), dans le cadre de laquelle sont rendu compte les progrès réalisés vers les objectifs communs de l'EER. La plupart des parties prenantes considèrent qu'il s'agit d'un élément essentiel du processus de gouvernance de l'EER. Les débats au sein de l'ERAC et des groupes de travail permanents (GTP) liés à l'EER ont constitué la principale plateforme pour la définition conjointe de l'agenda en relation avec les priorités de l'EER et de la feuille de route de l'EER. Toutefois, la productivité et la valeur ajoutée des groupes de travail du CCRE liés à l'EER étaient variables, certains fonctionnant bien et jouant un rôle actif dans le processus de l'EMM, tandis que d'autres malgré avoir bien commencer, ont perdu de leur élan.

Une coordination plus forte est nécessaire au niveau national, tant au niveau des ministères que dans le contexte de la gouvernance à plusieurs niveaux. En outre, il est nécessaire de réengager les parties prenantes de la recherche appliquée et de la recherche et de l'innovation orientées vers l'industrie. Le nouvel EER devrait renforcer la participation des parties prenantes pour devenir plus inclusif en impliquant un plus large éventail de parties prenantes de la R&I, y compris les acteurs régionaux et locaux. La coordination entre tous les ministères et agences impliqués dans l'écosystème national et régional de la R&I doit être renforcée au niveau des EM/AC, en vue d'élargir les actions de l'EER au-delà des politiques relatives aux institutions de recherche publiques et universitaires et aux carrières.

Recommandation 3 - Il faudrait envisager une période de mise en œuvre du nouvel EER plus longue, par exemple dix ans. Cela permettrait de disposer de suffisamment de temps pour adopter une approche plus stratégique et de mener des consultations plus larges avec les parties prenantes aux niveaux nationales et régionales de la R&I, et pas seulement avec les ministères.

Les ajustements apportés aux PAN et aux actions de l'EER au niveau national à la suite des rapports d'avancement de l'EER ont été modestes, peut-être en raison de l'engagement limitée du niveau national dans la rédaction de ces rapports et de la marge de manœuvre restreinte pour y réagir. Un horizon temporel plus long permettrait une planification stratégique de l'avancement de l'EER tout en permettant des examens périodiques de l'étendue des progrès vers les objectifs de l'EER aux niveaux national et européen. En outre, le processus de l'EER devrait être suffisamment flexible pour pouvoir réagir et répondre aux nouveaux thèmes qui émergent.

Recommandation 4 - Un ensemble plus large de parties prenantes devrait être impliqué dans les nouvelles instances de gouvernance de l'EER, et consulté régulièrement. Cela permettrait d'atteindre plusieurs objectifs, notamment de renforcer la visibilité de l'EER au niveau national et régional, d'exploiter les connaissances et l'expertise collectives des parties prenantes de la R&I aux niveaux de l'UE, national et régional, et de garantir que soient représentés toutes les catégories pertinentes de parties prenantes couvrant la recherche universitaire et appliquée et l'innovation (y compris sa dimension industrielle).

L'étude a identifié la nécessité d'intégrer une approche de gouvernance à plusieurs niveaux, incluant la dimension régionale dans le nouvel EER. Il s'agissait sans doute d'une lacune majeure de la précédente feuille de route de l'EER concernant l'élaboration des PAN, car les parties prenantes régionales étaient rarement impliquées. En outre, étant donné que la majorité des structures de gouvernance liées à l'EER étaient dirigées par des représentants des ministères de l'éducation et de la science, les représentants des ministères et agences responsables de la recherche appliquée et

industrielle et de l'innovation étaient moins informés et moins impliqués dans les politiques de l'EER. L'approche de gouvernance à plusieurs niveaux serait également cruciale dans la mise en œuvre de l'EER et, dans ce cadre, l'engagement des parties prenantes dans les stratégies de spécialisation intelligente pourrait être considéré comme un modèle de bonne pratique qui pourrait être adapté dans le futur EER. La plateforme des parties prenantes de l'EER pourrait jouer un rôle central dans les consultations liées à la conception de l'agenda politique de l'EER et à l'évaluation de son efficacité. La plateforme pourrait également être impliquée dans l'identification des conclusions et des leçons tirées des différents processus utilisés pour suivre et évaluer les progrès de la mise en œuvre de l'agenda politique de l'EER.

Recommandation 5 – Établir des liens plus étroits entre l'élaboration et la mise en œuvre des PAN ou de leurs successeurs et d'autres stratégies et priorités nationales, telles que les stratégies de spécialisation intelligente.

La feuille de route 2015-2020 de l'EER a fait l'objet d'un accord volontaire entre la Commission européenne, les États membres et le partenariat de l'EER, afin que les pays participant à l'EER puissent mettre en œuvre la feuille de route et élaborer des PAN adaptés à leur situation nationale en matière de RDI. Cette flexibilité a été appréciée en ce qu'elle reflète l'hétérogénéité des systèmes de R&I dans le paysage varié de l'EER, mais a conduit à une grande variation dans les PAN en termes d'ambition et de niveau de détail. En conséquence, il y a eu un manque de synchronisation dans le calendrier de développement des stratégies nationales de R&I et les PAN n'ont pas atteint leur potentiel de valeur ajoutée.

Recommandation 6 – Élaborer des orientations plus ciblées pour le développement des plans d'action nationaux pour l'EER (PAN) sous la forme d'orientations améliorées de la feuille de route pour l'EER, étayées par des exemples de bonnes pratiques.

La feuille de route de l'EER a défini des objectifs de haut niveau qui ont été utiles, mais peu d'indications ont été fournies sur la mise en œuvre opérationnelle au niveau national, notamment la traduction en objectifs, actions et cibles spécifiques. D'une part, cela a posé des problèmes, en particulier pour les pays qui ont besoin de réformes structurelles, institutionnelles et/ou administratives, et/ou qui doivent rattraper les pays plus performants en matière de R&I dans les EM et les PA participant à l'EER. D'autre part, la feuille de route fournit un cadre de base pour les actions à développer au niveau national tout en laissant une marge de manœuvre suffisante pour les traduire dans le contexte national spécifique. Cet aspect volontaire a été considéré comme essentiel pour construire l'EER autour d'un modèle fondé sur le partenariat et fournir une véritable plateforme de réformes poursuivant des objectifs communs.

Des orientations plus claires sont nécessaires pour traduire en actions concrètes l'EER et établir un agenda national de réformes et de mesures, qui, même s'il n'est pas contraignant, aiderait à examiner 'les progrès de la mise en œuvre de l'EER, ainsi qu'à identifier les priorités politiques et les opportunités de synergies avec d'autres politiques et programmes de l'UE.

Recommandation 7 – Les données de suivi générées par le nouveau tableau de bord de l'EER et par l'EMM révisé et amélioré devraient être utilisées pour influencer l'élaboration des politiques de R&I de l'UE et des États membres. Le lien entre le suivi et l'élaboration des politiques de R&I doit être renforcé et déboucher sur des actions de suivi, telles que la révision et l'amélioration des PAN.

Les dilemmes révélés par l'étude concernent l'implication des parties prenantes nationales. Bien que les ministères nationaux apprécieraient une implication plus directe dans les activités de suivi et de rapport pour permettre un plus grand engagement et une plus grande précision des données, certains États membres ont également signalé un manque de ressources humaines et financières pour s'impliquer suffisamment dans les activités de suivi d'un si grand nombre de domaines thématiques. Ce problème pourrait être résolu de deux manières. Premièrement, si une plus grande attention politique était accordée à l'EER au niveau national, les ministères pourraient être encouragés à augmenter l'allocation de leurs ressources à la mise en œuvre de l'EER, y compris les aspects de suivi. Deuxièmement, un investissement au niveau de l'UE dans le nouveau tableau de bord de l'EER et dans un tableau de suivi des performances regroupant des données fournies à la fois par l'UE et les États membres via des sources statistiques officielles (par exemple Eurostat) et via un portail spécifique 'qui pourrait renforcer l'efficacité des activités de suivi et de rapport.

Sur le système d'indicateurs et de suivi :

Recommandation 8 – Un nouveau tableau de bord de l'EER devrait être élaboré, composé de 15 à 20 indicateurs quantitatifs permettant d'évaluer les progrès stratégiques dans la mise en œuvre de l'EER. Le système d'indicateurs devrait être rationalisé pour faire la distinction entre le tableau de bord de l'EER et un cadre de suivi plus large consistant en un tableau de suivi des performances.

Les nouvelles priorités de l'EER, les conclusions du Conseil et les retours des parties prenantes suggèrent que le mécanisme de suivi de l'EER (MSE) doit être mis à jour pour intégrer les nouveaux développements dans le paysage de la R&I et mieux saisir les progrès vers la réalisation des priorités individuelles de l'EER. La restructuration du système d'indicateurs devra prendre en compte des aspects tels que l'équilibre entre la continuité et l'introduction de nouveaux indicateurs, la disponibilité des données par le biais de sources centralisées européennes/ internationales et les efforts de collecte de données qui en découlent. Les priorités de l'EER dans la nouvelle communication de l'EER et dans le Pacte de l'EER sont très larges, et il faudra donc examiner si toutes les priorités, sous-priorités et objectifs sont d'importance égale, ou si une hiérarchisation est nécessaire.

Avec l'introduction du nouveau tableau de bord de l'EER, il convient d'examiner comment cela affectera le mécanisme de suivi plus large et quel devrait être le processus à l'avenir. Si le tableau de bord de l'EER devait se concentrer sur des indicateurs stratégiques de haut niveau, ceux-ci pourraient être intégrés dans un ensemble plus large d'indicateurs couvrant d'autres dimensions par le biais d'indicateurs plus opérationnels et basés sur les activités. D'éventuels indicateurs de suivi supplémentaires pourraient être inclus dans un nouveau système de suivi et de rapport par la création d'un tableau de suivi des performances en remplacement de l'EMM, et/ou d'une plateforme centralisée en ligne (portail) où les pays participant à l'EER pourraient télécharger des informations sur les activités, les stratégies et les actions générales relatives à l'EER. La responsabilité de la collecte des données et l'obligation de rendre compte des progrès seraient également nécessaires pour ces nouvelles initiatives proposées.

Une combinaison de suivi aux niveaux européen et national serait complémentaire et représentative des actions entreprises. Le suivi au niveau de l'UE serait lié aux indicateurs sélectionnés, alors que le suivi national serait lié à l'élaboration et à la mise en œuvre du successeur de la feuille de route de l'EER. Des synergies et des efforts de coordination seraient alors nécessaires pour rassembler les résultats du suivi « descendant » au niveau de l'UE et des

suivis nationaux « ascendants » afin de fournir une vue d'ensemble des progrès accomplis vers les objectifs du nouvel EER, tels que définis dans le pacte de l'EER.

Alors que la fréquence annuelle des rapports a été bien acceptée pour le tableau de bord de l'EER, l'approche de suivi et de rapport que les parties prenantes préfèrent pour le système de suivi plus large est bisannuelle. Le système actuel, qui prévoit un rapport d'avancement bisannuel sur l'EER donnant une vue d'ensemble des progrès accomplis dans la mise en œuvre de l'EER au niveau de l'UE, ainsi que des fiches par pays pour évaluer les données de performance nationales et suivre l'évolution des performances, a été jugé proportionné.

Recommandation 9. La Commission devrait débattre avec les pays participant à l'EER afin de savoir s'il convient de maintenir les rapports d'avancement bisannuels de l'EER ou s'il faut les remplacer par une autre solution.

La coordination des rapports et du suivi au niveau de l'UE et au niveau national est essentielle pour renforcer le lien avec l'élaboration des politiques et pour faire en sorte que la prise de décision en matière de R&I soit fondée sur des données objectives. Les objectifs à long terme de l'EER font l'objet d'un suivi par l'UE et, pour la période 2015-2020, ce suivi a été assuré par le rapport d'avancement bisannuel de l'EER. Si un tel rapport devait être maintenu, les parties prenantes nationales pourraient être impliquées en ayant un rôle d'observateur, ou être consultées sur les progrès réalisés au niveau national afin d'accroître leur implication et de renforcer l'incitation à réviser et à ajuster les mesures de l'EER sur la base des conclusions qui en découlent. Cependant, les capacités au niveau national sont limitées en termes de ressources humaines et financières disponibles. Cela suggère qu'il serait préférable de trouver un équilibre concernant l'implication des parties prenantes au niveau de l'UE et au niveau national dans le suivi, afin de maximiser la responsabilité et le niveau d'implication sans créer une charge trop lourde que les pays risqueraient de ne pas pouvoir assumer.

Recommandation 10 – Il convient de tirer parti des connaissances et de l'expérience du Forum ERA, des membres de l'ERAC et des membres de la plateforme des parties prenantes, car ils pourraient contribuer à jouer un rôle crucial dans le système de suivi, compte tenu des liens entre suivi et évaluation.

Le suivi au niveau national en 2015-2020 a été organisé par les GTS du CCRE, c'est-à-dire au niveau des priorités de l'EER. L'accent a été mis sur le suivi des progrès de la mise en œuvre des PAN au niveau thématique, ce qui a été considéré comme très utile pour les parties prenantes nationales.

Un effort similaire pourrait être reproduit à l'avenir pour compléter le suivi au niveau de l'UE. Les ministères nationaux et les autres acteurs nationaux et régionaux de la R&I devraient apporter une valeur ajoutée en aidant la Commission et les consultants à préparer les rapports d'avancement au niveau de l'UE dans le cadre de l'EER/des rapports d'avancement bisannuels (s'ils sont maintenus). Ils pourraient fournir une interprétation des facteurs qui sous-tendent les changements de performance spécifiques à chaque pays au fil du temps. Dans le cas contraire, il existe un risque que les facteurs spécifiques au contexte national soient négligés et conduisent à une mauvaise interprétation des données. En outre, le Forum de l'EER, les membres de l'ERAC et les membres de la plateforme des parties prenantes pourraient contribuer à l'analyse et à l'interprétation des données de suivi, et fournir une contextualisation ainsi que des commentaires sur les progrès vers les 4 objectifs stratégiques et les 15 priorités thématiques.

Recommandation 11 – Le tableau de bord de l'EER devrait s'inspirer des bonnes pratiques en matière de visualisation et de conception des données.

L'engagement en faveur de la création d'un tableau de bord de l'EER est l'occasion de présenter les résultats d'une manière plus conviviale et visuelle, notamment en renforçant la visualisation des données et l'utilisation d'infographies. Il s'agira d'un changement majeur par rapport aux rapports établis jusqu'à présent dans le cadre du rapport d'avancement de l'EER, qui devra s'accompagner d'une réflexion sur les responsabilités en matière de collecte de données. Des avantages clairs, notamment une plus grande visibilité des efforts de l'EER, pourraient encourager une action et un engagement politique plus importants.

Sur la nécessité d'un suivi de l'étude :

Recommandation 12 – Il est nécessaire d'assurer le suivi de cette étude afin de déterminer la meilleure façon de procéder.

Un débat supplémentaire est nécessaire pour garantir que les nouvelles dispositions de gouvernance destinées à soutenir la mise en œuvre du Pacte de l'EER fonctionnent de manière efficace et effective. En outre, des efforts supplémentaires seront nécessaires pour déterminer quels indicateurs devraient être sélectionnés pour le nouveau tableau de bord de l'EER et le tableau de suivi des performances et pour finaliser les dispositions de suivi et les activités connexes, par exemple la responsabilité de la mise à jour des données de suivi, la collecte des données, les sources des données et les activités de rapport liées au nouveau pacte de l'EER. Il convient également de définir le rôle de l'UE et des pays participant à l'EER en matière de suivi.

1 INTRODUCTION

This document sets out the Final Report for the study, *Data gathering and analysis of the policy developments and reforms: Study to evaluate the ERA policy framework/ERA monitoring mechanism (EMM).*

1.1 STUDY OBJECTIVES

The study's **overall objectives** are to evaluate the effectiveness of the previous ERA policy framework (the implementation architecture, governance arrangements, etc.) in the 2015-2020 period and to assess the ERA monitoring and indicator system (EMM).

The **specific objectives** are to:

1. Evaluate how far the ERA Roadmap process and development of National Action Plans (NAPs) have stimulated the development and implementation of ERA-relevant national R&I policy measures, initiatives and reforms at national level, and whether the NAPs were adequate in light of the overall ERA objectives across the six ERA priorities in 2015-2020;
2. Evaluate the role of the ERA Monitoring Mechanism (EMM), including the indicator system and role played by the biennial ERA Progress Reports and associated reporting processes at national and EU levels. Assess the extent to which ERA monitoring data and reporting processes have contributed to bringing about national R&I policy changes and reforms;
3. Contribute to the political process of co-designing elements of the future ERA policy framework through the study findings and objectives of the revitalised ERA Communication and in the ERA Pact; and
4. Develop recommendations for a new monitoring system and set of indicators to monitor progress towards the new ERA objectives.

The evaluation required a retrospective assessment of the *effectiveness, efficiency, relevance, coherence* and *added value* of the ERA Roadmap process in the 2015-2020 period covering both the ERA policy framework and the EMM. The study analysed how far the ERA Roadmap provided an appropriate policy framework at EU level for the 27 EU Member States (MS) and 16 Associated Countries (ACs) taking part in the ERA. The extent to which the ERA policy framework was an appropriate mechanism to bring about national R&I reforms (e.g. either policy-oriented, structural/ institutional, administrative or a combination) at the level of EU-27 MS and ACs has been assessed. In addition, the study has assessed how far the ERA Roadmap provided a suitable strategic framework and relevant narrative to support ERA implementation and to monitor progress towards the achievement of the ERA objectives at EU and national levels.

1.2 STUDY SCOPE

The study scope covers the ERA Roadmap process agreed between the Member States and the Commission in 2015. The **time scope** covers the implementation of the ERA policy framework and the EMM in the 2015-2020 period, although it should be recalled that the six ERA priorities were already agreed in 2012.

The study's **geographic scope** covers all countries participating in the ERA. This includes the EU-27 Member States, along with the 16 Associated Countries (ACs) taking part in the EU RTD Framework Programmes[1]. Whilst the ACs are part of the ERA, particular countries have been involved to a greater or lesser extent. The focus was on those countries that were more active in the ERA Roadmap implementation process, and which prepared ERA National Action Plans (NAPs). Non-EU ERA participant countries include the EEA / EFTA countries and a number of other third countries, including EU candidate countries.

Regarding **country coverage**, it was agreed with the Commission and the Steering Committee during Phase 1 that the following 15 Member States and 3 ACs would be selected:

Table 1-1 - Country selection and allocation among study team members

Country selection	Population	Explanation/ description
EU Member States		
Czech Republic	10.69 million	Medium-sized MS, Moderate Innovator
Denmark	5.81 million	Small MS, Innovation Leader
France	66.99 million	Large MS, Strong Innovator
Germany	83.02 million	Large MS, Strong Innovator
Greece	10.72 million	Medium-sized MS, Moderate Innovator
Ireland	4.90 million	Strong Innovator
Italy	60.36 million	Large MS, Moderate Innovator
Lithuania	2.79 million	Small MS, Moderate Innovator. Question mark over measurability of measures identified in NAP.
Netherlands	17.28 million	Medium-sized MS, Innovation Leader
Poland	37.97 million	Large MS, Moderate Innovator
Portugal	10.28 million	Small-medium MS, Moderate Innovator.
Romania	19.41 million	Medium-sized MS, relatively new EU MS (since 2007), Modest Innovator
Slovenia	2.08 million	Small MS, Moderate Innovator
Spain	46.94 million	Large MS, Moderate Innovator
Sweden	10.23 million	Medium-sized MS, Innovation Leader
Associated Countries		
Montenegro	0.62m	EU candidate country and modest innovator. Only recently included in EIS [2]
Switzerland	8.57 million	Small-medium-sized AC, Strong Innovator, high level of participation in the FPs.
Norway	5.33 million (2019)	Strong Innovator, high level of participation in the FPs.

sources: Population statistics from Eurostat, 2015-2020, depending on when census last carried out, type of innovator data from the EIS, 2020.

1 The associated countries are: Iceland, Norway, Albania, Bosnia and Herzegovina, the Faroe Islands, North Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova and Switzerland.
https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf

2 https://www.gov.me/en/News/227996/Montenegro-is-for-the-first-time-on-European-Innovation-Scoreboard.html

1.3 STUDY TASKS

The study required four main Tasks, as summarised in the following table:

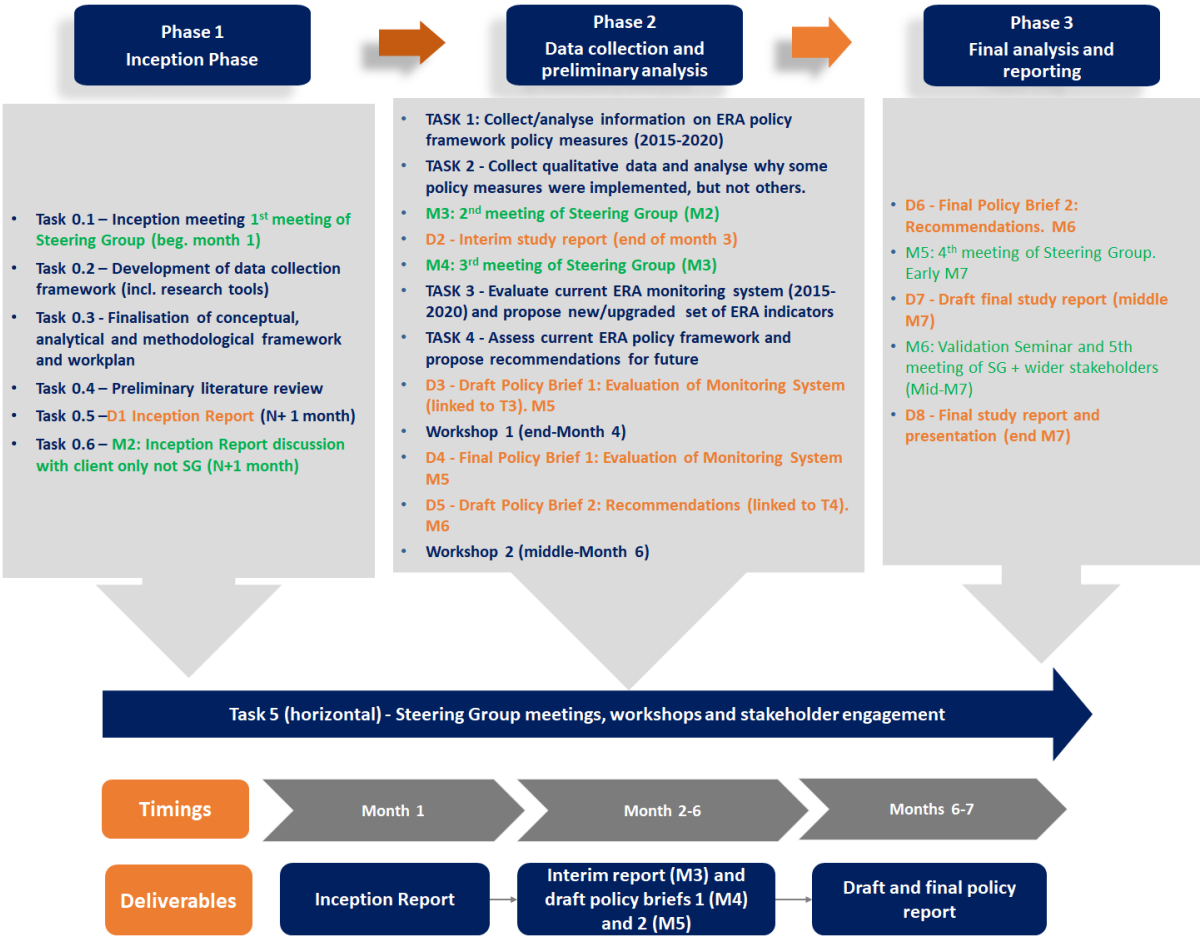
Table 1-2 - Overview of the Tasks

Task	Explanation/ description
Task 1: Analyse which national policy measures and actions were proposed and went ahead under the ERA policy framework in 2015-2020.	• Review of the development and implementation of National Action Plans (NAPs) in a representative sample of 18 countries. • Assessment of measures and actions in NAPs. • Assessment as to how useful the ERA Roadmap process was in preparing NAPs. • Assessment of the degree of influence of the ERA on national R&I policy developments and the impacts of NAP implementation.
Task 2 - Analyse why some proposed ERA policy measures were implemented, and some were not.	• Examination of which policy measures were proposed under the current ERA policy framework (2015-2020), which were actually implemented • Assessment of theory of change elements to explain causal relationships e.g. how far did the ERA Roadmap process and the six ERA priorities influence national ERA implementation and R&I policies, systems and structures?
Task 3 - Provide an assessment of the current ERA policy framework, its efficiency, effectiveness and impact on the successful implementation of ERA priorities and propose recommendations for a future ERA policy framework.	• Review of the former ERA policy framework in 2015-2020 • Assessment of the new proposed ERA policy framework, to reflect both the September 2020 ERA Communication and ERA Pact of June 2021. • Review how best to align the six former ERA priorities with the new ERA objectives and priorities. • Review of governance arrangements under the new ERA at EU and national level, and consideration of multi-level governance issues.
Task 4 - Evaluate the current ERA monitoring and indicator system (2015-2020) and propose a new set of indicators for the ERA Scoreboard	• Assess the effectiveness of the ERA monitoring mechanism in 2015-2020 (and the common set of 24 indicators). • Review the ongoing relevance and / or obsolescence of monitoring indicators. • Analyse how the monitoring and indicator system could be updated to reflect the objectives and priorities in the new ERA policy framework. • Develop recommendations for a new and upgraded monitoring and indicator system for the evolution of the EMM (in the context of the new ERA); • Validate the new monitoring and indicator system with the Commission, national Ministries and wider EU, national and regional R&I stakeholders.

1.4 METHODOLOGY

An overview of the methodology is provided in Figure 1.1 below.

FIGURE 1-1 – METHODOLOGY AND WORKPLAN



The study was carried out over three-phases, as per the above Figure. This was comprised of an inception phase, a data collection and preliminary data analysis phase and a final analysis and reporting phase, during which the stakeholder feedback from interviews, the online survey and workshops was triangulated.

The research and analytical framework was based on a robust methodology consisting of a set of key study issues, and the development of data collection tools. The research tools consisted of a common template for the country fiches to review the development and implementation of National Action Plans in 18 countries, a set of interview guides customised by stakeholder type, and an online questionnaire. These tools were used throughout Phase 2 (see below) and the emerging findings analysed for the production of an interim report, Policy Brief 1 on the Evaluation of the Monitoring System and Policy Brief 2 on the ERA governance and framework. The two Policy Briefs were followed by stakeholder workshops, described later below. The present final report brings together the final findings from all previous phases.

A **desk research-based literature review** was carried out. This focused on analysing the ERA NAPs in the representative sample of 18 countries. The development and implementation of these NAPs was analysed to ascertain which measures went ahead and which did not, and an assessment of wider literature, such as the national R&I strategies and actions plans that laid the basis for developing the NAPs. In addition, wider literature was consulted, e.g. reviewing the new

ERA Communication, the Council Conclusions and stakeholder position papers on the new ERA, the proposed new governance arrangements and the previous monitoring and indicator system. Further desk research was carried out to identify potential new indicators and new data sources for the new ERA Scoreboard and wider update to the EMM.

Turning to the collection of primary data, stakeholder consultations played a major role during the study assignment. These consisted of an **interview programme, online survey, Steering Committee meetings and two workshops.** The **interview programme** consisted of 73 interviews completed in total. An overview is provided in Table 1-1.

Table 1-1 Interview programme overview

Planned interviews	Completed interviews	Interviews by types of stakeholders
• Circa 71-73 interviews	• 73 interviews	• 6 interviews with EU policy makers • 6 interviews with EU R&I associations • 13 interviews with ERA governance stakeholders • 31 interviews with national Ministries • 5 interviews with national/ regional R&I funding agencies • 6 interviews with national/ regional R&I associations • 3 with international stakeholders • 3 interviews with consultants/ researchers and academics

The interviewees encompassed a broad range of stakeholders from the EU and national levels. At an EU level, this included EU policy makers and R&I associations, as well as members of ERA governance groups such as ERAC and the Chairs (and where possible Vice Chairs) of the ERAC Standing Working Groups. At national level, interviewees were the relevant national Ministries, national R&I funding agencies, as well as national R&I associations. In several cases, interviews haven been undertaken in form of focus groups, which consisted of several representatives from the relevant national authorities, such as in Sweden, Lithuania and Switzerland. International input from relevant entities such as the Organisation for Economic Cooperation and Development (OECD) and Eurostat have provided further insights into certain aspects of the study, including indicator selection, data availability and cross-country comparisons.

The **targeted online survey** was launched on 26th March and kept open for 8 weeks until 24th May 2021. Reminders were sent to non-respondents to maximise responses. Slightly over 100 responses answered all the questions across different types of stakeholders. Additional partially completed responses were also considered to the extent possible, which accounted for a further 100 responses.

Throughout the different phases, four **Steering Committee (SC) meetings** have taken place, with the final validation seminar (and fifth Steering Committee meeting) taking place in September, 2021. The aim of these SC meetings has been to obtain feedback on the overall approach and emerging findings as part of a validation process. The Steering Committee was comprised of officials from the Commission services (relevant policy Units in DG RTD, including members of the lead Unit responsible for the study, Unit A2, "ERA Governance and Implementation"), three representatives from ERAC as a link to the Member States and contractor study team, including the project manager, several researchers and senior experts involved in the project.

In addition, stakeholder feedback has been gathered through the study through **two Workshops organised** on June 10th and June 18th 2021. Each workshop was attended by about 30 to 40

stakeholders each (including R&I associations, industry representatives, national stakeholders and EU policy makers) linked to Policy Brief 1 (monitoring and indicators) and Policy Brief 2 (the ERA policy framework) respectively. The final study report was validated through a final validation seminar with the Steering Committee and wider stakeholders.

1.5 REPORT STRUCTURE

Section 1: provides an introduction and outlines the study objectives and scope.

Section 2: sets out the ERA Roadmap process in 2015-2020, and reviews the development and implementation of the NAPs and assesses the ERA Monitoring Mechanism and indicators.

Section 3: sets out key issues in respect of the new ERA Policy Framework and the monitoring and indicator system, including the ERA Scoreboard. Also integrates the revised versions of Policy Briefs 1 and 2, which were updated following the two workshops.

Section 4: sets out the conclusions and recommendations.

Given the study complexity, it is necessary to provide supporting materials in annexes for different aspects of the study. A summary of the annexes is now provided:

Annex 1: Supporting material on indicators

Annex 2: Review of ERA Roadmap guidance by priority

Annex 3: Best practices identified at national level

Annex 4: Thematic case studies

Annex 5: Monitoring system to keep track of ERA priorities

Annex 6: Lessons learned from comparable governance, monitoring and reporting processes

Annex 7: Benchmarking case studies on scoreboards

Annex 8 : Bibliography

Annex 9 : Online Survey Questionnaire

Annex 10: Online Survey Responses

2 ERA ROADMAP IMPLEMENTATION IN 2015-2020

In this section, the efficiency and effectiveness of the ERA Roadmap process in 2015-2020 are assessed. As part of this assessment, a review is also provided of the development and implementation of the ERA National Action Plans (NAPs).

Section 2.1 sets out an overview of the ERA Roadmap process at EU level and considers its effectiveness and value added as an implementation tool in facilitating the development of NAPs. Section 2.2 examines different national approaches to NAP development, and compares and contrasts these. Section 2.3 reviews the implementation of the NAPs, and considers drivers and obstacles as to why some measures went ahead, whilst others did not. Section 2.4 reviews the ERA monitoring and indicator system, the EMM.

2.1 ERA ROADMAP (2015-2020)

2.1.1 Introduction to the ERA

At a **European level,** the EU has played an important role in contributing towards ERA implementation since its launch in 2000. The ERA's priorities are to improve and harmonise the framework conditions for R&I in Europe. The ERA is based around the concept of fostering a European research environment. The EU policy framework provided through the ERA and programming framework provided through the EU's RTD Framework Programmes (RTD FPs) have contributed towards the objective of completing the ERA.

The focus has been on strengthening R&I activities at EU level, and on supporting joint, transnational R&I activities through cooperation between the EU and MS, for instance, through the Joint Undertakings (Horizon 2020) and future European Partnerships in Horizon Europe.

2.1.2 Introductory overview to the ERA Roadmap

The **ERA Roadmap 2015-2020** was developed in close consultation with the European Research Area and Innovation Committee (ERAC), the ERA Related Groups and many of the organisations which made up the ERA Stakeholder Platform. The Roadmap stressed the importance of a partnership-based approach between the Commission and the Member States, but also with the involvement of the EU R&I organisations that signed up to the ERA Partnership[3].

The Roadmap aimed to reinforce efforts towards achieving the ERA objectives by providing a common framework for implementing the ERA at national level. It should be stressed that the ERA Roadmap was purposely designed to be flexible, given that it is a voluntary process. Furthermore, recognising the wide diversity of different national research and innovation (R&I) systems, it was recognised when the Roadmap was drawn up that this heterogeneity should be seen as a source of strength.

The ERA Roadmap sought to reinforce the efforts being undertaken in ERA participant countries to strengthen their contribution to the ERA. In previous Council Conclusions, progress made at EU level towards the ERA was considered to have been greater than progress at national level. In 2014, two years after the adoption of a **Communication on a Reinforced European Research Area (ERA) Partnership,** the Commission reported that EU MS and ACs taking part in the ERA (and stakeholders involved in ERA governance) had made progress towards the realisation of the objectives linked to the six ERA priorities, but that further efforts were needed. In 2015, the European Council reaffirmed its commitment to a fully operational ERA and endorsed the ERA Roadmap 2015-2020. [4]

3 The organisations that signed up to the ERA Partnership were: the European Association of Research and Technological Organisations (EARTO), the European University Association (EUA), the League of European Research Universities (LERU), NordForsk, Science Europe and the Conference of European Schools for Advanced Engineering Education and Research (CESAER).

[4] Council of the European Union. (2015). *Draft Council Conclusions on the European Research Area Roadmap 2015-2020.* Brussels. Available at: **http://data.consilium.europa.eu/doc/document/ST-8975-2015-INIT/en/pdf**

Further efforts were called for in the Council Conclusion with regards to maximising the quality, effectiveness and impact of national expenditure on R&I; the need to further strengthen the Joint Programming Process, the improved use of coordination instruments and improved synergies with funding programmes at EU, national and regional levels. The Council Conclusions also called on the Member States to step up the efforts in the area of the Research Infrastructures, including the infrastructures, in particular by making use of Structural Funds for these purposes.

Member States are also encouraged to strengthen comprehensive human resources strategies including mobility of researchers, also from outside the EU as well as from and to the private sector, and the empowerment of young researchers. Further action on the digital dimension of the ERA was also called for.

The ERA Roadmap 2015-2020 therefore put a strong emphasis on the importance of national measures to strengthen the ERA's role at national level, and on promoting national policy reforms to achieve better alignment with the ERA priorities. Accordingly, the ERAC Opinion on the ERA Roadmap notes that "The ERA Roadmap 2015 included fewer initiatives and actions at EU level, including those based on the essential role of the EU framework programmes for research and innovation in delivering a fully-functioning ERA".[5]

The ERA Roadmap process was therefore intended to support and influence Member States' national policies and actions across the six ERA priority areas agreed in 2012. The ERA Roadmap has some in-built flexibility in that it was meant to serve as a living document to guide the EU MS in structuring the **ERA National Action Plans (NAPs)** and in the implementation of ERA priorities at national level. The Roadmap called on Member States to implement measures through their ERA NAPs, but with flexibility to reflect evolving priorities over time. Most EU Member States (MS) therefore produced NAPs in 2016 covering the 2016-2020 period. [6]

2.1.3 Feedback on the effectiveness and added value of the ERA Roadmap process and guidance

The effectiveness and added value of the ERA Roadmap process was examined, drawing on feedback through the interviews.

Overall, the putting in place of the ERA Roadmap at EU level was viewed as having been helpful in providing an overarching framework for national ERA implementation. The Roadmap process was recognised at least by some national stakeholders as having helped to provide the ERA with a renewed impetus, which was necessary as at the time, the contribution being made at national level towards the implementation of the ERA was viewed as having lost momentum.

- As the ERA Roadmap process was agreed voluntarily between the Commission and Member States, there was considerable flexibility for ERA participant countries to implement the ERA Roadmap, and to develop National Action Plans (NAPs) in a way that was deemed most appropriate to their national R&I situation.
- However, a disadvantage of not having a more common approach to the development of NAPs was that NAPs could vary considerably in their level of ambition, the amount of detail and in the extent to which promised measures were genuinely new, or rather were centred on existing national R&I action plans, strategies and funding programmes that had already

[5] ERAC Opinion on the ERA Roadmap 2015-2020, Brussels, 20 April 2015, ERAC 1208/15
[6] https://era.gv.at/era/era-roadmap/other-national-era-roadmaps/

been planned prior to the NAPs. A consequence was that there was considerable divergence in the nature and length of the content in the NAPs, and to a lesser extent, in their structure. This issue is explored in greater detail in Section 2.2 (development of NAPs).

- An arguable weakness in the ERA Roadmap is that whereas guidance is provided, this is priority-specific rather than focusing on what the ERA is seeking to achieve overall and how best the ERA participant countries at national level can contribute to its realisation.
- Examples of priority-specific actions and measures that ERA participant countries could adopt mentioned in the guidance document appear to be appropriate and relevant to identified needs. These were selected on the basis of a consultation with ERAC stakeholders and the ERA Partnership signatories.
- However, there was a lack of supporting good practice examples and/ or national level case studies in the guidance document for the ERA Roadmap process to provide inspiration as to the types of measures that could have been implemented.
- The Roadmap process was viewed as having been beneficial at national level in that it stimulated the development of NAPs and to align national R&I strategies and actions plans with the overall Roadmap and the six ERA priorities agreed in 2012. Nonetheless, the considerable divergence in approaches may make it difficult to compare NAPs easily (see Section 2.2 and Section 2.3). However, this was anticipated in the Roadmap itself.
- "The Roadmap has been drawn up in full recognition that national R&I systems across Europe have different characteristics and that this variety is an asset which Europe needs to exploit to the full". It does not "prescribe actions which must be implemented by every Member State, and in one particular way. The intention is rather to draw attention to key areas where action is likely to pay most dividends for the majority of national research and innovation systems by spreading excellence and strengthening their ability to operate at a high level of effectiveness".
- Regarding **added value**, the Roadmap was viewed as having been helpful in providing a common framework through which the six ERA priorities could be prioritised, and supported through the identification, planning and implementation of national measures and activities.
- However, both a strength and weakness was that the common framework was flexible. Whilst many Member States appreciated this, other Member States were unclear as to how they should go about developing a National Action Plan (NAP), and the common elements that should be contained therein. It was suggested it would have been useful to incorporate a skeletal structure of the content of a NAP.
- The guidance in the Roadmap for national authorities was nonetheless useful in some areas. For instance, it highlighted a number of potential actions at national level under each Priority, which were seen as being likely *"to have a particularly profound impact and to provide particular benefits if implemented across Europe".* These were considered to be generally useful, however, case study examples of good practices could have been added to provide clearer illustrations as to how particular actions or measures might be implemented in practice.
- A **review of priority-specific guidance** contained in the ERA Roadmap document is provided in Annex 2, including any national actions suggested that MS and ACs could potentially pursue. Commentary from the study team regarding how useful the guidance and suggested actions might be is then outlined. Consideration is also given as to how the guidance might be improved.

- The inter-linkages between many of the six priorities and sub-priorities and cross-cutting was also highlighted in the ERA Roadmap guidance. This was positive in terms of encouraging national authorities to reflect on embedding these linkages in their national R&I strategies and action plans. The Guidance document points out that "there are particularly strong linkages between some Priorities (e.g. Priorities 1 and 2(a)), whilst others (Priority 4 on gender and Priority 6 on international cooperation), have clear transversal links to all other priorities. These need to be taken into account, as should other cross-cutting issues such as the role of social sciences and humanities research and closing the R&I divide".
- However, interviewees from EU-level R&I associations not representing academia mentioned that whilst the Roadmap process was helpful for Member State Ministries, for other stakeholders especially, the fact that the ERA Stakeholder Platform met less frequently after the 2015-2017 period meant that there was **discontinuity in terms of engagement in ERA governance**. The strong priority given to ERA governance in the new ERA from 2021 through the ERA Forum for Transition, was therefore welcomed. The lesson stressed was that continued buy-in is needed from the EU, not only national stakeholders for the roadmap process to be effective.
- A further challenge was that stakeholders representing the industrial researcher community, including the RTOs and applied research, expressed frustration that industry has not been more closely involved in ERA governance and in actual ERA implementation. The perception was that industry was less well represented and less directly involved compared with academic organisations. It was suggested that looking ahead to the new ERA, the effectiveness of the ERA Roadmap process could be strengthened if an ecosystem-wide approach were to be adopted, which involved representative associations from academia, industry and other sectors. In general, there could be more emphasis on co-ordination at a national level, to ensure that all parties contribute as much as possible to the evolution of the national components of the ERA.

2.2 THE DEVELOPMENT OF NATIONAL ACTION PLANS (2016)

The following subsections provide an overview of the NAPs in terms of how they were developed, what impact they had, how they compare and the emerging findings. This will provide context to the actual implementation of the NAPs, which will be covered in Section 2.3. The review of National Action Plans (NAPs) covers 15 Member States (MS) and 3 Associated Countries (ACs). An overview of countries selected for country coverage scope is provided in Section 1.3 (study scope).

Member States and Associated Countries developed their NAPs based on the ERA Roadmap guidance document at EU-level. This helped to structure NAPs according to the six ERA priorities in 2015-2020, but there was divergence between countries in their interpretation of these priorities. This helps to explain the findings presented below. In general, the following factors can impact how the NAPs are developed: how advanced particular national R&I systems are; the level of dedicated funding allocated to national ERA measures and actions; the timing of the NAP in relation to major national and regional R&I strategies, the degree of political commitment; and the baseline situation in respect of the economy and economic structures. These factors are taken into account in this section.

2.2.1 The development and coordination of National Action Plans (NAPs)

As part of the ERA Roadmap process agreed in 2015, Member States and Associated Countries taking part in the ERA were required to develop a National Action Plan (NAP). This sub-section sets out the process at national level of developing a NAP. In subsequent sub-sections, examples of the different approaches that different countries have adopted to preparing a NAP, and the degree of priority given to particular priorities is considered.

The measures, actions and initiatives contained in the NAPs set out priority actions in line with the common approach set out in the ERA Roadmap. They also contained other actions that are country and context-specific. Member States have full autonomy in identifying those actions and measures considered to be most appropriate and best suited to their national R&I systems.

These actions were predominantly designed top-down, i.e. this process was driven by the respective Ministries and the input from regional and sectoral stakeholders varies considerably. In most cases, consultation with R&I stakeholders is very limited, also if the NAPs include some measures already under development. A reason therefore might have been the lack of clearer guidance at EU level in regard to consultation or existing previous agreements among stakeholders on individual measures included in the NAP, which limited the strategic discussions and aspects to be considered in the NAP as a whole.

In some countries, e.g. **Slovenia,** the Roadmap and NAP development was a positive process, but also a learning process for the Ministries, meaning that the design of measures was restricted to key national actors and there was limited time for wider consultation among RTDI actors. In the case of **Denmark,** the roadmap was conceived as a discussion document that should form the basis for debate in national R&I communities about the future shape of R&I and about how national priorities could be aligned with the ERA. This was seen as having ensured buy-in and contributed to shaping the political agenda in new areas like Open Innovation and Open to the World. This also meant that there was a good balance between a top-down and a bottom-up approach in the implementation process.

In the **Netherlands**, quite a number of actions were developed through cooperation between research community stakeholders as they aligned with ongoing reforms, such as improving research careers at universities. In **Greece**, the national R&I Smart Specialisation Strategy (RIS3) had a pronounced positive influence on the design of the NAP. In this way, the ERA roadmap had a strong overlap with national priorities, while most proposed measures have been already discussed / included in the policy cycle. In **Norway**, the Ministry of Education and Research engaged with other ministries with an interest in ERA which helped to formulate different priorities in the NAP and has worked closely with the Research Council of Norway. In addition, Norway has been actively involved in ERAC meetings through ministry officials and agencies reporting to the ministries, which has helped to ensure effective coordination and cooperation.

Table 2.1 provides an overview of the Ministry responsible for developing the NAP in the 18 selected countries.

Table 2-1 – Overview of Ministries in charge of developing the NAPs

Country	Ministry in charge of developing the National Action Plan
Czechia	• Section for Science, Research and Innovation, Government of the Czech Republic
Denmark	• Ministry of Higher Education and Science • Danish Agency for Science Technology and Innovation (DASTI)
France	• Ministry for Higher Education, Research and Innovation
Germany	• Development: Ministry of Education and Research • DLR project management agency
Greece	• General Secretariat of Research and Technology (GSRT)[7]
Ireland	• Department of Enterprise, Trade and Employment
Italy	• Ministry of Education, University and Research
Lithuania	• Ministry of Education, Science and Sport
Netherlands	• Ministry of Education, Culture and Science
Poland	*No NAP was developed*
Portugal	• Department for International Relations (DRI) and Studies and Strategy Office (GEE) • Fundação para a Ciência e a Tecnologia (FCT), leading public funder of research
Romania	• Ministry of National Education and Science • Change in ownership with change in government, now: Ministry of Research
Slovenia	• Ministry of Education, Science and Sport
Spain	• Ministry of Economic Affairs and Digital Transformation
Sweden	• Ministry of Education and Research. Note that no NAP was developed initially in 2016 when it was needed until 2019, when one was developed based on existing strategies.
Montenegro	• Ministry of Science
Switzerland	• State Secretariat for Education, Research and Innovation (SERI), within the Federal Department of Economic Affairs, Education and Research (EAER)
Norway	• Ministry of Education and Research

Although almost all countries developed a NAP in 2016, the different approaches create some difficulties in terms of the measurability of the implementation of some NAPs. This is a challenge faced by the ERAC and the ERA related groups. In the Draft Report on Monitoring ERA Priorities with ERA Roadmap National Action Plans, the ERAC concluded that "In general, it is somewhat difficult to determine whether measures were on track or delayed because most are on-going type of

[7] The GSRT was attached to the Ministry of Education since 2019, when it was transferred to the Ministry of Development and Investments

initiatives or timelines were not included in the design of the action or measure. Future monitoring exercises would be recommended of including a more systemic monitoring with clear identification of concrete actions with timelines. The monitoring tool would need to be refined in this respect."[8]

The study team's review of the NAP process indeed found that, particularly in the countries with strong R&I systems such as **France, Germany,** the **Netherlands** and **Switzerland**, the actions listed in the NAP strongly align with preceding national R&I strategies, such as the France-Europe 2020 Strategy in France, High Tech Strategy and Excellence Initiative in Germany, and the 2015 Federal Act on Funding and Coordination of the Swiss Higher Education Sector. The case of **Greece** mentioned above shows that other EU policies, such as the RIS3 aspect in Cohesion Policy, may have a positive effect in aligning NAPs with national R&I strategies. The review found that even in countries that did not produce a NAP in 2016 the ERA Roadmap had an influence on national policy making.

In **Sweden,** the decision not to produce a NAP 2016 was due to the publication of the Swedish Research Bill in 2016, which already outlined a national R&I strategy. As such, developing a separate NAP was perceived as being duplicative. Nevertheless, the Research Bill 2016 was treated as a de facto ERA NAP, until Sweden published its first NAP in 2019. **Poland** is another country that did not produce an ERA NAP and interviews suggested that there is an absence of leadership to drive the ERA process. Nevertheless, the 2018 Act on Higher Education and Science in Poland has clear overlaps with ERA priorities according to stakeholders and pushed changes towards better performance on ERA priorities.

These findings raise the typical evaluation challenge of the attribution of changes to the subject of evaluation, in this case the ERA and more specifically the ERA Roadmap.

The ERAC and ERA-related Standing Working Groups (SWGs) were responsible in 2015-2020 for monitoring progress towards ERA Roadmap implementation, and for monitoring progress towards the six ERA priorities (the latter assigned to the ERAC SWGs). The monitoring process of the priorities differs significantly since the ERAC and the related groups did not follow a common work plan for all priorities. For some priorities such as Priority 1 or 3, the monitoring provides general information regarding the policies elaborated by the Member States (e.g. if the NAPs are finished/ongoing/cancelled). Whereas for others, such as Priority 4, the related group (SWG GRI) developed a deeper analysis of the NAPs and classified them according to their comprehensiveness and also used other evaluation methods, such as surveys. More detailed information regarding monitoring arrangements in 2015-2020 is provided in section 2.4.2 (Monitoring system to keep track of ERA implementation).

Some interviewees suggested that the activities and results of the WGs depended on the commitment of its participants and Chairs with the topic and the ability of the WG to define clear common objectives.

2.2.2 Overview of key findings from review of NAPs within scope

An overview of the key findings relating to the review of NAPs within study scope is provided below.

[8] ERAC (2019) Draft Report on Monitoring ERA Priorities with ERA Roadmap National Action Plans, ERAC 1212/19

Table 2-2 - Findings from national NAPs

Country	Key findings	Country	Key findings
Czechia	• The priorities in the NAP stress the need to put in place the necessary funding to support NAP implementation. • There is a focus on developing adequate methodologies to strengthen the effectiveness of R&I. • Czechia has put a strong emphasis on a holistic approach to their NAP, in which positive framework conditions for an efficiently-functioning R&D and innovation ecosystem are supported. • The NAP recognises the role played by both fundamental and applied research in developing knowledge and in its transfer to the economy.	**Netherlands**	• The 2016 NAP covered all ERA priorities and closely aligned the ERA Roadmap. The objectives and measures listed in the NAP were in line with national strategy papers for Enterprise Policy and Science that preceded the ERA roadmap. • The NAP includes its own indicators alongside headline EMM indicators. • Measures were mostly implemented effectively. The ERA process particularly made a difference on the priority where NL performed below EU average: gender equality.
Denmark	• The NAP covered all ERA priorities and was generally very closely aligned with the ERA Roadmap. • Implementation of planned measures has been effective across the board and-well balanced between priorities. • The vast majority of measures were already completed by early 2019, or they involved continuous monitoring actions. • The NAP was conceived as a discussion document forming the basis for debate in R&I communities of how to shape the future of research. This ensured buy-in and a good balance in the implementation process between a top-down and a bottom-up approach.	**Norway**	• The 2016 NAP covered all ERA priorities and closely aligned with the ERA Roadmap. • The NAP included its own indicators in addition to the EMM indicators. • Internationalisation is a priority in Norwegian research policy, and is deemed a prerequisite for ensuring high research quality. • In relation to research excellence, Norway has set a target of achieving a participation rate of a minimum of 2 per cent average of grants announced in H2020.
France	• The French NAP is a serious effort to reflect on how strategic objectives and initiatives taken at national (to some extent regional) level in the field of R&I align with the ERA priorities. • Reference to ERA doesn't seem to guide implementation and no direct attribution between ERA and progress along priorities can be made. No ERA-specific monitoring system is in place. Measures were often in place before the ERA process started. • Generally, France made progress across the six ERA priorities. The country continues to be deeply involved in the development of European R&I projects and policies.	**Poland**	• There is no NAP. However, the feedback received indicated that the 2018 Act on Higher Education and Science reflects the ERA priorities. • Implementation did not follow the process envisioned at EU-level, while awareness of the ERA is lacking among the R&I community. However, the priorities have, to an extent, been pursued through the 2018 Act on Higher Education and Science.
Germany	• The German NAP is well-developed, covers all priorities and is aligned with the ERA Roadmap. The NAP acknowledges Germany's position as a driver of an internationally-renowned ERA. • High political significance has been given to R&I in Germany. As such, Germany was already well placed to develop the ERA. • The NAP particularly highlighted the integration of national, bilateral and European R&I policy. • Implementation was generally successful,	**Portugal**	• The Portuguese NAP covers all priorities in bullet points format and lists measures to be developed indicating instruments and policies at a rather high level with no specific actions, targets nor timelines, although it includes several indicators per priority. • Despite structural challenges in the economy, making R&I a less immediate strategic priority area for Portugal, there

Country	Key findings	Country	Key findings
	though more effective in some areas than others, e.g. Germany performed better on priority 6 than priority 4.		has been an effort to strengthen international cooperation, given concerns that the country was peripheral in R&I terms compared with other EU MS. • Implementation of the measures varies across priorities and points to the need to launch targeted measures as well as a long-term vision.
Greece	• The NAP covered all ERA priorities, stating national and EU policy objectives and how to attain them. There are detailed action plans but no related timetable or clearly defined indicators. • R&I stakeholders were closely involved in developing the NAP. • The NAP is fully aligned with the National RIS3. Its implementation and follow-up is affected by the limited resources available. • It is difficult to assess the direct contribution of the ERA Roadmap to NAP implementation.	**Romania**	• The Romanian NAP contains concrete measures to develop the ERA accompanied by indicators. • There is a mix of ambitious quantitative and qualitative indicators to help measure progress. • Some progress was made on several ERA priorities, while limited or no progress were made in others. Romania performed best on Priority 4, gender equality. However, this priority contained no measures. Investment in R&I has been severely impacted by the financial crisis.
Ireland	• The NAP for Ireland sets out engagement with the ERA will be deepened. • Strong focus put on innovation and on implementing the NAP in parallel with a new strategy for research and development, science and technology "Innovation 2020" launched in 2015. • Ambitious aim of Ireland transitioning to becoming a Global Innovation Leader (using the EIS classifications). • NAP sets out commitments to progressing the ERA Priorities in terms of actions, actors, timelines, targets and indicators.	**Slovenia**	• The NAP covered all ERA priorities with indicators developed per measure. Indicators were focused on those deemed most obtainable in terms of data needs. • Implementation was more effective in some areas than others. Some barriers were due to the legislative framework (slow progress in reforms) and the fact that the implementation of Priorities were dependent on dedicated individuals driven by ERA issues. • A delay in legislative reform (Priority 1) also had a negative knock-on effect on other measures.
Italy	• The Italian NAP is ambitious and precise in its objectives and specifies assessment tools and targets for all priorities. • The implementation seems to have achieved only partial progress, with structural weaknesses and budget cuts impinging on the possibility of achieving real progress. • The involvement of national stakeholders was limited and there is little awareness of the ERA.	**Spain**	• Spain did not produce a standalone NAP and treated its State Plan of Scientific and Technical Research and Innovation 2017-2020 as such. The main objectives of the strategy are in line with ERA priorities, centred around recognising and promoting R&D&I talent and employability, support business leadership in R&I and to foster R&I activities targeting society's overarching challenges. • Spain recognises the need to further improve and promote a shared R&I vision and common objectives across stakeholders, enabling them to compete in a globalised and dynamic environment and securing access to the European Research Area.
Lithuania	• The NAP was unusual in that it consisted of a table mapping out the objectives and envisaged measures across the six priorities, with no actual action plan. • There were no specific measures or actions	**Sweden**	• No NAP was produced. ERA priorities were instead covered through the Research Bill (2016) and later through an ERA Roadmap (2019). • National measures are overall well - aligned to the ERA priorities but cross-

Country	Key findings	Country	Key findings
	included under P6 (international cooperation). • The NAP had to be developed too late to be able to influence national R&I strategy as this had already been developed (also problem that ERA NAP development was not part of national strategic R&I planning system at time. • However, looking ahead to the new ERA, there is increased political buy-in with a change in government having taken place. The aim is to align a new national R&I strategy under development with the new ERA in 2021.		reference between the two is rather weak although stakeholders confirm the importance of ERA policies in the Swedish system. This makes it more difficult to establish clear attribution. • There is generally however a lack of indicators in the ERA Roadmap, which makes it difficult to assess progress.
Montenegro	• The NAP places strong importance on innovation and has established a new institutional framework in support of innovation, and strengthened innovation support programmes. It has put in place a regulatory and policy framework to support innovation too. • Montenegro has defined three strategic goals in science and research: (1) Development of the research community, (2) Strengthening multilateral, regional and bilateral cooperation, and (3) Cooperation between academic research and the economy. • Some of the information is unavailable. As such, making a full assessment of the country's progress is challenging. However, the country performed well on Priority 2a and 4.	**Switzerland**	• The NAP covered all ERA priorities with the objective to primarily expand on already existing measures, given the well-advanced Swiss R&I system, in line with European priorities. • Implementation was successful mainly due to the wide consultation of stakeholders when developing the NAP and the high level of consensus across measures.

Source: Own elaboration

2.2.3 Cross-comparative assessment of NAPs

This section provides a cross-comparative assessment of the NAPs in the sample of 18 countries within study scope. The purpose of the review was to:

- Check which countries participating in the ERA prepared a NAP in 2016 (covering the 2016-2020 period);
- Review the content, scope and depth of the NAPs;
- Assess the extent to which there are similarities and differences between the NAPs;
- Assess the level of ambition of the NAPs;
- Ascertain the approach adopted across different countries to the NAPs, for instance, whether countries included an overview of their national R&I system, and a review of the prevailing framework conditions;
- Examine the degree of influence of, and alignment between the ERA on national / regional level policy developments and reforms, and on systems and structures (including coordination arrangements) and on funding approaches; and
- Find out which among the set of 24 indicators in the EMM were utilised at national level, and review the extent to which different ERA countries used additional indicators too.

There is a need during the study to develop a deep understanding as to what has been achieved since 2015 in respect of:

- The baseline situation in terms of the level of development of national R&I systems and structures, policies, funding etc.;
- The level of ambition of the NAPs both overall, and in respect of specific ERA priorities; and
- The extent to which the level of ambition of the NAPs correlates with the baseline situation in terms of the relative strengths and weaknesses across different countries.
- Activities supported through the ERA focus on spreading excellence and strengthening their ability to operate at a high level of effectiveness. The ERA also proposes specific actions to implement these priorities, but acknowledges that not all priorities identified will have equal relevance in all Member States.

The key findings are set out below:

Overall approach, structuring and format of the NAPs:

- Most NAPs set out extensive, concrete actions to be undertaken and implemented across all six of the ERA priorities.
- There was generally a common format to presenting the actions across the ERA priorities, which were simply enumerated sequentially, although Lithuania's NAP was in tabular form.[9]
- Indicators were only included in some NAPs. For example, **Norway** and **Slovenia's** NAPs included indicators and their recent performance; others did not include this content (e.g. France). The **Netherlands** and **Portugal** included specific targets for some of the priorities that went beyond the EMM and listed the actors responsible for the monitoring of these targets. In the case of **Slovenia,** stakeholders explained that the selection of indicators was challenging due to data constraints. Hence, the NAP contains indicators where it was feasible to obtain data, however the 'usefulness' of the indicators to measure progress was not always deemed sufficient. The **Romania** NAP includes a mixture of qualitative and, mainly, quantitative indicators while in the case of **Italy**, quantitative indicators are provided.
- Some of the most developed NAPs included clear timelines for the implementation of proposed measures, such as in **Italy, Norway, Denmark** and **Switzerland.** In the case of **Greece**, targets are set for 2020 or 2025 depending on the measures.

Supporting evidence to illustrate the above-mentioned points is now provided.

The NAPs were generally structured according to the six priorities and the broad guidance set out in the ERA Roadmap. However, while some NAPs are well-written with clear action points, others provide only a general description of their system, and lack clear measures that relate to the ERA priorities. Many of the NAPs were also quite detailed. For example, across the six priority areas in the NAPs:

- The Swedish Roadmap from 2019 lists over 40 operational measures. The measures are aligned with ERA priorities and stakeholders confirm the importance of ERA in Sweden.

9 A selection of NAPs can be found on ERA Portal Austria: **https://era.gv.at/era/era-roadmap/other-national-era-roadmaps/**

- The Danish NAP is equally detailed, containing 44 operational action points. It was developed with different R&I stakeholders, ensuring buy-in.
- The Belgian NAP is an 82-page report that includes major reforms in the R&I system and some specific measures. It also includes roadmaps for the different entities in line with the country's federal structure.
- The Italian NAP contains 16 actions, each with its indicator and target. The ERA Roadmap reflects the research priorities of Italy and receives strong political support.
- The NAP for Germany contains 42 measures, demonstrating how well-advanced its R&I system is. Germany also has a separate internationalisation strategy to support priority 6.
- The NAP for France is extensive, containing 43 measures, reflecting the ambitious approach taken to aligning national R&I policy with the ERA.
- The NAP for Romania sets out objectives, indicators and measures across all priorities, except for priority 4. It focuses on a limited number of priority actions which will have the most relevant impact on the national R&I system and provide benefits to different stakeholders.
- The NAP for Norway contains 64 actions at the national and EU level. Active participation in the ERA is a clear priority for the Norwegian government's R&I cooperation with the EU. Norway has taken part in ERA from the start.

Other NAPs lacked enough detail to ascertain which ERA measures and actions were going to be supported. The NAP for **Lithuania**, for instance, consists of a 4-page table. Some of the measures included are very broad and difficult to translate into operational objectives and activities. The **Bulgarian NAP** was also found to be lacking detail.

The degree of value added varies across the ERA priorities. Different countries accorded different levels of importance to the six ERA priorities. Only France highlighted a different order of priority given to the six ERA priorities, while other NAPs were not explicit about the different weighting of the priorities. Interviews showed that some priorities were more relevant than others. The more developed countries tended to prioritise international cooperation. **Germany**, which plays a leading role in ERA implementation, developed a separate strategy on international cooperation, and stresses the importance of Europe competing with its international counterparts.

Norway also prioritised international cooperation in R&I, and developed a roadmap, which included separate bilateral roadmaps for R&I cooperation with eight other countries. **Denmark** sees international cooperation in research as an important priority allowing it to attract and maintain the necessary knowledge and capacity from abroad. The country had already signed bilateral agreements with research-strong countries like Japan, South Korea, the USA, China, India and Brazil well before drafting the ERA roadmap and had set up Danish Innovation Centres in seven overseas locations[10] to facilitate access for business and research institutions. **Portugal's** NAP is oriented towards European and international cooperation.

The **Swedish Roadmap** also stressed international cooperation with third countries. The Netherlands is the exception as Priority 6 was the weakest part in the NAP, with no objectives

[10] The Innovation Centres are based in Silicon Valley, Shanghai, Munich, São Paulo, New Delhi/Bangalore, Seoul and Tel Aviv.

mentioned, while internationalisation is a key priority in R&I policy. Moreover, the more established EU member states concentrated on strengthening coordination between R&I stakeholders and improving monitoring of R&I. Countries with less advanced R&I systems tended to prioritise reforming their national R&I structures, such as **Romania. Montenegro** is keen to increase its participation in EU programmes.

All ERA countries linked their NAPs to existing national R&I strategies and action plans. While the NAPs strengthened alignment of national R&I priorities with the ERA priorities, the fact that the NAPs were often so heavily drafted on existing national R&I strategies and action plans undermined their overall effectiveness. Conversely, in countries where the NAP was very closely based on what already existed, this made it easier to achieve the implementation of measures mentioned in the NAPs as there were already foreseen to be implemented in national R&I strategies/ action plans.

Interpretation of ERA priorities:

- The NAPs tended to be ambitious, but the levels of achievement set for the measures varied. The **Lithuanian** and **Greek** NAPs contain very general objectives, for example, while the **Italian** and **Norwegian** NAPs are more extensive.
- Differences in how ERA countries interpreted the ERA priorities and objectives and translated them into country-relevant actions were observed between countries with advanced, well-developed R&I sectors, such as **Germany**, **Norway** and **France** and non-EU countries/EU Member States with less developed systems, such as **Romania and Montenegro.** The latter focused more on developing new and reforming existing R&I structures, whereas the former concentrated on strengthening coordination between R&I actors and on improving monitoring activities relating to R&I at the regional level.
- The classification system used in the European Innovation Scoreboard (EIS) influenced how some countries prioritised particular Priorities, measures and actions within their NAPs. For instance, moderate innovators such as **Czech Republic** and **Slovenia**, tended to focus on transitioning to the status of Strong innovators. Other moderate innovators, such as **Italy**, tried to tackle some of the most important structural bottlenecks of their R&I systems, with a view of aligning their performance with European R&I leaders. Given the EU ERA Roadmap's objective to accommodate for the heterogeneity of national R&I systems, the diversity in interpretation is to be expected.
- Moderate innovators tended to prioritise the necessary funding for specific measures. Examples are the **Czech** roadmap which included public funding of EURAXESS activities (Priority 3) or targeted co-funding for transnational public research in Slovenia (Priority 2a). In some cases, however, the financial crisis impacted severely public funding for R&I, such as **Greece** and **Romania**. **Portugal** also experienced weak investment in R&I.
- While the NAPs certainly contributed to strengthening national alignment with the ERA, they were often drafted based on existing national R&I strategies. In **Spain**, for example, the NAP was not the main policy framework for implementing the ERA Roadmap.
- Several of the NAPs, such as Greece's, stress the importance of developing the ERA to boost Europe's R&I capacity.

Differences in measures by priority:

- **Priority 1:** Countries such as **Romania and Montenegro** with less developed systems have chosen to prioritise upgrading the R&I governance structure to become more effective and efficient, whereas **Germany, Denmark, Switzerland** and **Norway** aim to advance and expand their R&I systems. An exception is **Sweden**, where the Research Bill (in lieu of a NAP) and the ERA Roadmap both describe reforms of the RTDI system, mainly impacting universities. The **French** NAP also uses this priority to improve coordination between R&I actors. In **Switzerland** the improved collaboration between funding agencies headlined the reform agenda. Another example is **Italy** which used this Priority to tackle its well-known and persistent structural issues, related to its limited pool of researchers in the public and private sectors. In **Portugal**, the aim was to increase evidence-based public policies.

- **Priority 2:** The **Belgian** NAP highlighted the importance of the country's participation in space research by establishing a national space agency. **Montenegro** intended to increase its participation in H2020 and develop new legislation in line with the EU. **Swedish**, **French** and the **Netherlands'** measures are focused on ESFRI (Priority 2b) but also on investments in digital infrastructure. In countries of moderate and modest innovators such as **Slovenia**, the use of Structural Funds for the investments in research infrastructures is a recurring topic. In **Czechia**, the development of large infrastructures has been a long-term priority of the country's R&I policy. **Romania** intends to increase its participation in JPIs and boost public investment in research infrastructures. The **Norwegian** NAP highlights the importance of increasing cooperation between national and international research institutions, while **Germany** mentions that it is a financial contributor to 18 of the 48 projects on the ESFRI Roadmap. The **Portuguese** NAP stresses aligning the National Roadmap and ESFRI and increasing participation in European infrastructures.

- **Priority 3:** Differences remain between EU countries in terms of an open labour market and career development opportunities for researchers and this is reflected in the NAPs. The roadmap in **Germany** acknowledges that international mobility creates scientific added value and proposes measures accordingly. In the **Netherlands** this priority was taken up by stakeholders and the association of universities (VSNU). The **Czech** roadmap instead included one action centred around ensuring public funding of EURAXESS activities. In **Lithuania,** Ministry interviewees noted that national expenditure to support NAP implementation has been concentrated on P3 to support the career development of researchers. Brain drain has also been an issue for **Romania**. **Norway** encourages organisations to implement a comprehensive career policy, including the Charter and Code and the Human Resources Strategy for Researchers. **Portugal** stresses the need for open and transparent recruitment practices. **Montenegro** seeks to obtain EU assistance in policy planning, while **Denmark** has set an ambitious target of being among the European elite in using open, transparent and merit-based recruitment to be attractive to foreign researchers. **Sweden** focuses on contractual conditions for doctoral students and other HEI employees.

- **Priority 4**: Some countries described the whole gender equality policy mix, others described the current focus of gender equality policy or the process by which an existing policy mix is to be further developed; others formulated a commitment to gender equality or did not address gender equality in their NAPs at all (**Bulgaria** and **Romania,** mainly given the high share of

women in Grade A positions). In addition, **Gender was not integrated as a cross-cutting topic in most countries:** only 7 NAPs linked priority 4 to at least one other ERA priority. **Denmark** aims to translate national equality legislation into effective action to address gender imbalances in research. **Germany** set a target of at least 30% of women on scientific executive committees. **Montenegro** stresses the importance of the Action Plan for Achieving Gender Equality in Montenegro (2013-2017) in their NAP. **Spain** has several measures under this priority, including fostering women's participation in leading positions at research institutions and centres. **Greece** focuses on improving the institutional framework and exploiting scientific knowledge that has been produced on gender issues. **Italy** aims to have 30% of women in 'grade A' academic positions by 2020. **Norway** also wants better gender balance in these positions.

- **Priority 5**: In focusing on the circulation and transfer of scientific knowledge, this priority is a critical element in building the transnational dimension of the ERA. However, whilst some countries, such as **Denmark** and the **Netherlands** have taken steps to open up access to research results at national level, there have only been limited steps taken to encourage the wider circulation of scientific knowledge, for example, by strengthening systems for the management of intellectual property and licensing. The **French NAP** gives high priority to the enhancement of industry-science cooperation (with numerous measures including the development of "Poles of competitiveness"). The **Italian NAP** tries to tackle one of the weaknesses found in the EIS, namely the one related to Linkages. One of the two actions on Priority 5 explicitly relates to the promotion of National Technology Clusters as drivers for public-private collaborative research. The target for this action is to achieve a 1 percentage point increase yearly on the indicator on businesses cooperating with CTN-associated RPOs. The **German** Roadmap highlights the importance of effective knowledge transfer to create economic value. It focuses particularly on strengthening collaboration between science and industry and the role of public-sector research in 'open innovation'. **Norway** aims to strengthen collaborative research between public and private research performers and ensure that all published scientific articles based on publicly funded research are freely available. **Montenegro** seeks to improve cooperation between science, industry and society and increase the number of start-ups. **Romania** encourages the coordination of innovation and entrepreneurship policies, while **Portugal** seeks to develop a strategy supporting knowledge transfer and circulation.
- **Priority 6:** The more developed countries in R&I tended to prioritise international cooperation more, such as **Norway and Germany**. The roadmap from **Sweden** emphasises the need to bring together the international efforts of research funders, strengthen them and make them more efficient, i.e. it echoes the overarching rationale of ERA in pooling resources. One measure entails setting up a national coordination body (Intsam)[11] for the funding and coordination of international research and innovation collaborations outside the EU. Another measure links internationalisation of R&I to the Swedish export strategy (societal challenges and the future

[11] The agencies involved in Intsam are: the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning; the Swedish Research Council for Health, Working Life and Welfare; the Swedish Energy Agency; the Swedish Research Council and Vinnova (which is responsible for its secretariat).

export of solutions. **Italy** leveraged on science diplomacy to prioritise collaborations with partners in the Mediterranean region, strengthening research on important topics such as migrations and integration. **Slovenia** aims to encourage participation and success rates in European cooperation as well as bilateral co-operations, while **Poland** has not listed any objectives under this priority. **Montenegro** prioritises cooperation in medicine, ICT and agriculture/food safety. **Portugal** seeks to expand its international partnerships within the EU and beyond. **Romania** wishes to enhance cooperation with third countries on a bilateral and multilateral level. **Slovenia** focuses on funding and the preparation of strategies to increase cooperation. The **Netherlands** pointed out that it has been internationally-oriented for several decades, but did not define any specific targets for this priority.

Role of national R&I strategies and national entities in shaping NAPs:

- In **France**, the NAP is used to bring together and make sense of the existing measures in the light of the ERA priorities. The **French** NAP mentions that *la Stratégie Nationale de la recherche (SNR)* has been closely aligned with the Smart Specialisation Strategy, and that both these documents have in turn shaped the NAP.
- In **Czechia**, the National Research and Innovation Strategy for Smart Specialisation plays a role in the NAP. In **Greece**, the National Strategy for Research, Technological Development and Innovation for the period 2014 – 2020 and the RIS3 play an important role.
- **Belgium's** NAP is the only one to consider roadmaps for different entities in line with the country's federal structure;
- **Sweden** did not produce a NAP. Instead the national Research Bill was 'treated' like an action plan up until the publication of the ERA roadmap. The roadmap was published in 2019. The late publication of the roadmap (and the decision not to publish NAP) was to avoid the ERA strategy to detract from the direction set in the Research Bill; and
- In **Italy**, the national research strategy and smart specialisation strategies have helped to shape the NAP.
- In **Romania**, the NAP is in line with the National Strategy for RDI 2014-2020.
- The NAP for **Montenegro** is aligned with the Strategy of Scientific Research Activity 2017-2021.

Role of national strategies to utilise EU funding in shaping NAPs (e.g. Smart Specialisation strategies)

- All countries are implementing national and regional **Smart Specialisation strategies** to improve their R&I systems. This was strategically important, given the potential for synergies between EU funding for R&I available under ESIFs to support Smart Specialisation funded through the ERDF, excellence funding under the RTD Framework Programmes (FPs) and the potential contribution to the ERA priorities.
- The role of national Smart Specialisation Strategies for 2014-2020 (RIS3 document) in informing the development of national R&I strategies was mentioned in some NAPs. However, this was often only mentioned in passing and there were not so many direct links between the RIS3 strategies and the NAPs. For example:

- The **French** NAP mentions, for instance, that *la Stratégie Nationale de la recherche (SNR)* has been closely aligned with the Smart Specialisation Strategy, and that both these documents have shaped the NAP;
- In **Poland**, a list of 20 prioritised R&I areas was identified in the National Smart Specialisation strategy (KIS). However, as no NAP was developed, it was unclear how far this has benefited realisation of the ERA priorities; and
- In **Germany**, to facilitate its efforts in strengthening the national R&I system, all of the Länder have developed a smart specialisation strategy.
- As mentioned above, smart specialisation strategies have helped to shape NAPs in **Italy**, **Greece** and **Czechia**.

Language and public accessibility

- The NAPs assessed were drafted in English, except for the French, which was drafted in the national language. Whilst outside the country scope, **Latvia** and **Slovakia's** NAPs were not publicly-available in English;
- In terms of accessibility, there was an absence of a simple gateway portal to access all relevant NAPs and other documents regarding ERA implementation in 2015-2020. Moreover, most NAPs were not available on the Commission website, but rather via the **ERA portal Austria**. [12] Whilst this is an excellent resource, and relatively comprehensive, it is not the optimal means of improving access to interested R&I stakeholders to information about the ERA and its implementation. There is also the risk that information is spread across different websites e.g. the ERA Portal for Austria and the Commission's DG RTD website for the ERA Progress Report and country fiches.

2.2.4 Assessment of the impacts of NAP development

The ERA Roadmap and the development of NAPs has had different types of impacts at country level. There are differences in the maturity of R&I systems across countries, resulting in different national contexts and starting points for ERA Roadmap development by country. There are also varying degrees of strategic relevance of the R&I system, as well as diverging perceptions as to the value of the ERA Roadmap at national level.

The table below categorises countries into five different groups, based on the observed extent and type of impact of the ERA Roadmap and an assessment of the level of ambition of the NAP.

12 https://era.gv.at/ - The Austrian online platform for the European Research Area (ERA) is a knowledge-sharing platform and initiative aiming at providing comprehensive information on the ERA

Table 2-3 - Impact of the ERA Roadmap and NAP development by category

Category	Main impact of the ERA Roadmap	Type of R&I system (EIS categorisation)	Strategic relevance of R&I system	Impact	NAP characteristics	Country examples
1	**Encouraging strategic reflection with limited further impact of the ERA Roadmap**	• Generally innovation leaders and some strong innovators	• High strategic relevance of the well-established R&I system	• Moderate impact of the ERA process/ NAP given already advanced systems in line with EU priorities • High involvement and active participation in the ERA governance mechanisms e.g. ERAC is considered a channel for influencing EU policy from the national perspective	• NAP measures mainly expanding and strengthening mostly ongoing actions/ initiatives rather than new ambitious measures	CH, SE, FR, NL
2	**Encouraging strategic reflection to advance current system and strengthen the positioning of the R&I system globally.**	• Generally strong innovators	• Strategically relevant R&I system	• Well-established RTDI systems already in line with ERA priorities • ERA process brought new momentum and streamlined effort to further implement measures to continue advancing the R&I system	• Resources allow for high level of ambition of the NAP, extensive measures and initiatives in the R&I field at national level and ERA NAP	DE, DK, NOR
3	**Encouraging strategic reflections on R&I and alignment with the ERA priorities**	• Generally moderate innovators, widening countries	• R&I system of medium strategic relevance	• Impact of the ERA roadmap in terms of alignment of national R&I priorities with EU ones to prioritise initiatives in line with EU objectives • Beneficial process for MS to reflect and analyse their own system, context and priorities • Lack of human and financial resources as barrier for higher level of ambition yet political will for reform	• Mixed ambitions in NAP, some NAPs showed ambitious initiatives to strengthen the current R&I system to improve innovation performance	ES, CZ, PT, ME, GR, IT

4	**Strengthening national coordination of R&I actors**	• Moderate and modest innovators, widening countries	• Moderate to low strategic relevance of the R&I system	• Impact mainly around structuring and strengthening national R&I governance • Before Roadmap, there were either no or few meetings of ERA Group delegates at national level to discuss ERA priorities • ERA led to increasing relevance of R&I on the policy agenda	• NAP measures centred around improving governance and strengthening the R&I system.	SI, LT
5	**Limited impact and value add of the ERA roadmap process**	• Modest innovators, widening countries	• R&I not considered a priority sector for the economy	• Limited impact of the ERA roadmap process, due to lack of ownership and leadership at national level and little political commitment • General national R&I efforts and aspirations to some extent mirror the EU/ ERA priorities • Little visibility of the ERA roadmap at national level and no/ limited mention of it in high-level policy documents	• No NAP or high-level NAP with limited, often already existing measures.	PL, RO

Source: Own analysis

In general terms, the categorisation is based on the maturity and strategic relevance of the R&I sector, in most cases linked to political commitments, as well as to resources available to implement reforms. Priorities range from expanding existing measures in the case of mature, stronger R&I systems, with focused progress in certain areas being more common, to a focus on improving governance of the R&I system as a whole and on institutional and structural reforms in developing systems.

Furthermore, the type of R&I system e.g. using the classification system in the EIS (e.g. innovation leaders, strong innovators moderate and modest innovators), closely linked to the maturity level of R&I system, has been considered in the above typology of countries. In addition, there could be further variables and characteristics that could influence the degree to which NAP development has had positive, negative or neutral impacts. For example:

- The presence or absence of an appropriate Ministry or other national R&I organisation in national policy-making/ implementation bodies with an international focus to drive NAP development and raise awareness among other Ministry officials not working in an international capacity;
- Perceptions as to the extent of legitimacy of the NAP among national stakeholders; and
- Levels of awareness of the ERA overall and of the six priorities among national and regional policy makers and other R&I stakeholders.

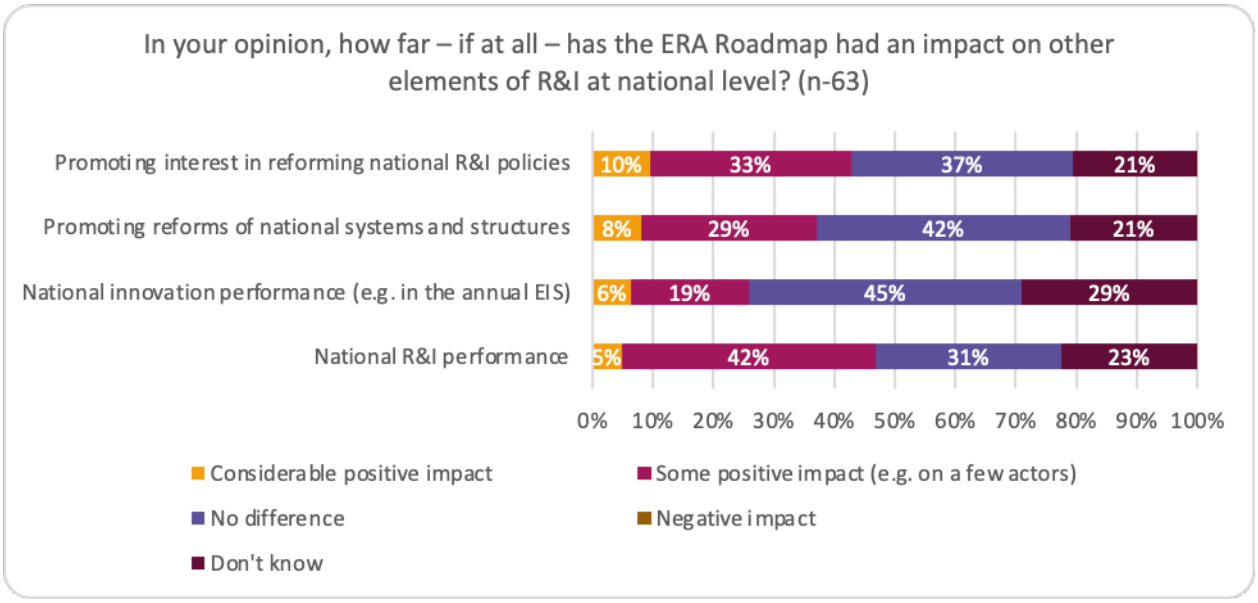
In some countries, the ERA Roadmap process has had a positive structuring effect. It has encouraged national authorities in the MS and ACs to review their national R&I strategies and to ensure closer alignment with the ERA priorities. This is an improvement compared with the situation before the Roadmap was adopted, when the ERA had less visibility in some countries.

However, **in other countries, interviewees suggested that the ERA has had a limited impact,** especially for countries in categories 1 and 2, mainly due to the fact that the national R&I systems were already quite advanced and many NAPs "repackaged" existing national R&I strategic and action plans.

Nevertheless, there might still be longer-term effects from setting ERA objectives and priorities through a common framework at EU level and ongoing processes of national alignment (to the extent that the six priorities were also shared priorities at national level).

Input from stakeholders through the online survey suggest that the ERA Roadmap, including development and implementation of the NAPs, indeed had an impact in shaping both the formulation and the implementation of R&I policies. Aligning the ERA priorities with national ones and integrating the former into national strategies and priorities is also considered to be an impact of the ERA Roadmap so far.

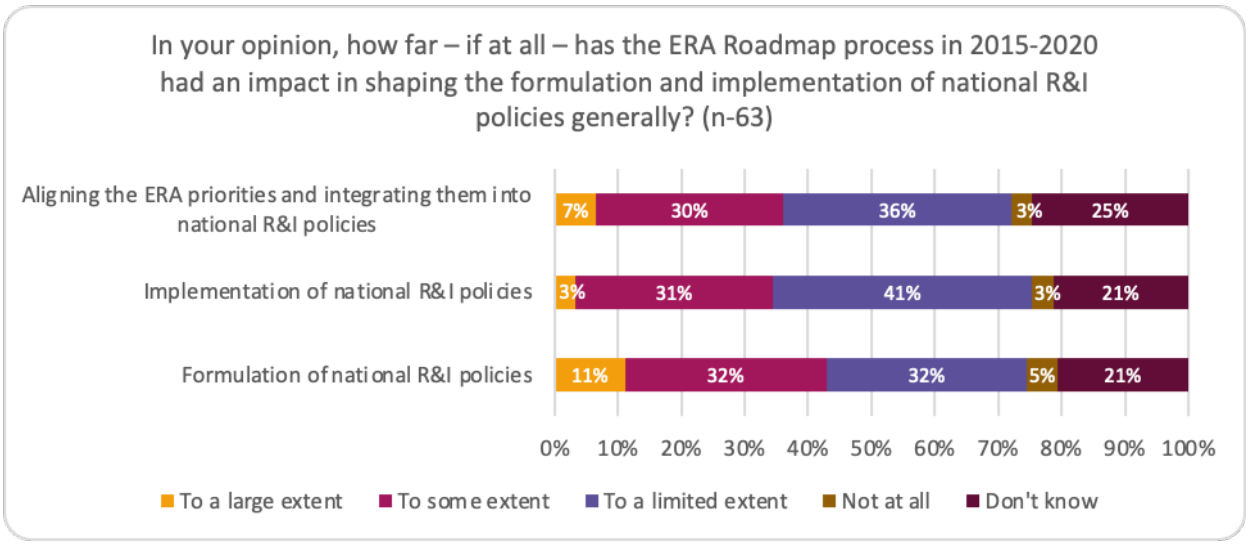
Figure 2-1 - Impact of the ERA Roadmap at national level (Q8)



Source: ERA Monitoring Online Survey

Similarly, when assessing the impact of the ERA Roadmap on further elements of the national R&I system, respondents shared diverging views, as shown in Figure 2-2 below and in similar fashion to the country categorisation outlined earlier in this section. The reason therefore is likely to be the differences in R&I systems and their respective baseline scenarios, the different priority given to R&I as a whole and the ERA Roadmap implementation in particular.

Figure 2-2 - Impact of the ERA Roadmap on other elements of national R&I system (Q9)



Source: ERA Monitoring Online Survey

A further challenge is the **difficulty in disentangling the impacts from the development of NAPs from the role that pre-existing national strategies played,** and how far these were influenced by the ERA policy framework earlier, given that the six ERA priorities were originally adopted in 2012. The ERA priorities could have influenced the development of national R&I strategies and policies already before the formulation of NAPs. In addition, influence might have also been apparent in a two-way dynamic through the participation of country representatives in ERAC, thereby aligning priorities and objectives with a long-term vision rather than through the NAP only. This would potentially paint a more positive picture than what comes across in the interviews, and from looking at the NAPs at first sight. This may however be hard to prove.

2.2.5 Overall findings from the assessment of the 2016 NAPs

Overall, the findings from the assessment of the NAPs can be grouped according to their i) process of development and extent of stakeholder consultation, ii) format and approach, iii) content, and iv) indicators and monitoring. Findings include the following:

Process of development of NAPs and extent of stakeholder consultation

- Member States have full autonomy in identifying those actions and measures considered to be most applicable to their R&I systems. The extent of the NAPs often depends on the strategic importance of R&I to the country.
- There was predominantly a top-down approach to developing the NAPs.
- In the majority of cases, consultation with national R&I stakeholders is very limited.
- However, in some cases, such as **Denmark** and **Norway**, the ministries engaged with other Ministries and the wider R&I stakeholder community to ascertain their views on research priorities. This led to greater buy-in and enhanced coordination and cooperation.

Format and approach

- The majority of EU MS and associated countries selected for this study produced NAPs in 2016. However, Poland did not produce a NAP and Sweden only produced one in 2019.
- Many of the NAPs were based on pre-existing national strategies on R&I. In some instances, this was because using existing R&I action plans and strategies was seen as a shortcut to developing a NAP, whilst in other cases, the NAP was required at a point in time when there was insufficient time to develop something new, so pre-existing strategies were necessarily used.
- There is a need in the next generation of NAP development to synchronise the timing of the development of ERA NAPs with national R&I strategies to strengthen alignment.
- The majority of NAPs were structured according to the six ERA priorities. Not all NAPs covered all Priorities.
- There is a lack of consistency and a common approach between NAPs in terms of their overall structure and in particular the level of detail presented. However, it should be recalled that whilst a guidance document was prepared to support NAP development, it intentionally allowed flexibility for MS in terms of structure.

Content

- The majority of NAPs included a description of the baseline situation, principally qualitatively. Some of the NAPs also included indicators and clear timeframes to aid implementation.

- The NAPs differed greatly with regards to the level of detail of the rationale and content of the various measures presented. This makes it somewhat challenging at times to assess to what extent the measures selected could be considered appropriate.
- Differences were observed between countries with well-developed and less developed R&I systems. The former typically focused on enhancing international cooperation while the latter tended to focus on developing effective national R&I systems.
- Some of the NAPs included actions at both the national and EU level and referred to the various actors responsible for certain measures.
- Some NAPs included tangible policy objectives that were possible to assess either qualitatively or quantitatively. However, in the case of others, there was a lack of sufficiently clear definition of the policy objectives, other than repeating the objectives set out in the ERA roadmap, but lacking detail for instance on national-specific interpretation of how the ERA priorities are relevant to national R&I policy priorities.
- The new ERA offers a good opportunity to guide countries on the content to be included in the NAPs, taking into consideration different R&I systems.

Indicators and monitoring

- There were varying degrees of effort put into developing monitoring systems and indicators.
- Not all NAPs included indicators. Many of the NAPs that presented indicators struggled to make them RACER (Relevant, Acceptable, Credible, Easy, Robust). Some of the indicators included were found to be too ambitious.
- Many NAPs integrated timelines to implement their objectives (e.g. **Italy, Norway** and **Switzerland**), but there was commonly a lack of supporting detail. NAPs usually indicated the year by which the objectives would be achieved, but did not include interim deadlines in terms of stepping stones towards full implementation. Other NAPs however did not include any timeframes for implementation.
- In certain cases, information was unavailable to assess performance. It was therefore challenging to provide an overall assessment of the country's progress.
- Although monitoring data was provided back to the MS and ACs, this did not lead to revisions to the NAPs, which was seen as being a missed opportunity in terms of strengthening the role of monitoring in enhancing policy learning and in improving the quality of NAPs over time.

2.3 IMPLEMENTATION OF NAPS - CROSS-COMPARATIVE ASSESSMENT

In this section, an analytical framework is provided outlining the NAP implementation and factors influencing this process, together with a cross-comparative assessment of the implementation of NAPs in the different countries.

2.3.1 NAP implementation in 2015-2020

Under **Priority 1 (effective national research systems),** the majority of NAPs demonstrated strong alignment between EU and national R&I objectives aimed at achieving the ERA and national objectives. This was positive, as strengthening alignment with the ERA was a key aim highlighted in the guidance in the ERA Roadmap.

For example, interviewees from Ministries in **Slovenia** and the **Netherlands** mentioned that there was close alignment between the NAPs and national R&I strategies. However, due to timing synchronicity reasons, it was not always possible for national policy makers to take into account the ERA priorities in their domestic national R&I strategies and action plans, and vice versa in their ERA NAPs. For instance, the NAP in **Slovenia** was based on the Slovenian research and innovation strategy for 2011-2020, which pre-dated the development of the NAP. In the case of **Italy**, the NAP is aligned with the national research programme and is connected to the national RIS3 strategy, as well as the regional RIS3 strategies. Additionally, the **Romanian** NAP is in line with the National Strategy for RD&I 2014-2020.

It should however be pointed out that there is a distinction between achieving alignment and synergies between the ERA priorities and national R&I strategies and the ERA NAPs. In some cases, it was mentioned that a real effort had been made to achieve alignment, whereas in the case of other NAPs, it was more a question of national strategies being largely replicated in the country ERA NAP, which added limited if any value. This appears to have been the case in countries such as **Sweden, Greece**, **France** and the **Netherlands**. However, Swedish stakeholders argue that the R&I Research Bill (national strategy) was an effective tool for i) highlighting to stakeholders, and ii) implementing ERA priorities since it is the main R&I document in the country, well-known among all stakeholders, and that measures listed in the Bill are also linked to quantitative budgets, thereby increasing visibility of the measures included.

However, the extent to which countries implemented the measures indicated in their NAPs varied between country and priority. In **Lithuania,** for instance, as the national R&I strategy had already been adopted, and was part of a separate strategic planning system, it was not possible to align the development of a NAP with the national strategy. More positively, it was noted that the follow-up to the NAP is being given much greater political attention due to a change in government. This will ensure that the next NAP better reflects the priorities in the new ERA and ensures alignment between national and EU R&I policy priorities. This was regarded as a major strategic priority, but this change has been driven not by the ERA itself, but rather national political changes. Similarly, measures included in the NAP for **Germany** were already in place. For example, under **Priority 1**, the amendment to the Basic Law, to improve cooperation between the Federal Government and Länder, took place in 2015 at the beginning of the ERA period. **Norway** had established the Long-Term Plan for Research and Higher Education 2015-24.

Progress on ERA implementation appeared to be quicker in the earlier stages of the 2016-2020 period than the later years, according to the ERA Progress Report 2018.[13] As such, the progress on headline indicators was stable for priorities 5 and 6, had slowed for priorities 1, 2 and 4 and had regressed on priority 3.

[13] ERA Progress Report 2018.

A further point under Priority 1 was that some countries reduced their spending on R&I, while others did not make any increase between 2014 and 2016. Moreover, many EU Member States have not been able to fulfil the political commitment of 3% of GDP expenditure on R&D&I. **Romania**, for example, had a total expenditure on R&D of 0.48% of GDP in 2016. **Germany's** expenditure was 2.98% of GDP. Only **Finland**, **Sweden** and **Denmark** spent higher proportions.

Nearly all countries reduced spending on EU-wide transnational public R&D. The MS also tend to prioritise participation in the EU RTD Framework Programmes (FPs). This makes financial sense from the MS perspective, given that the FPs are funded by the EU budgets hence a strong performance can be translated into better return on investments from the MS perspective. For example, the **Swedish** ERA roadmap recognises this fact. **Sweden** has been successful in collaborating with European counterparts over successive Framework Programmes. Although overall there has been a strong performance, there is a recognition among policymakers of the increased competition from other MS in securing EU funding, partly as a result of declining national funds, and there are strategic calls for improved strategies among Swedish research actors vis-à-vis their FP participation.

Denmark has also seen significant R&I spending cuts after the financial crisis, but is now seeking to stabilise public R&I investment by creating closer cooperation between universities and the private sector, thereby raising the universities' self-funding levels and increasing commercialisation.

Findings also show that there has been a heavier reliance on EU funds to supplement national R&I budgets in countries with less developed R&I systems. The challenge of combining European Structural and Investment Funds (ESIFs) with FP funding has been a prominent issue during the 2014-2020 period, which coincided with the 2015-2020 period of ERA Roadmap implementation. However some funding challenges stem from structural events. The financial and economic crisis of 2008 -2010 has been cited as the cause of public spending cuts on R&I.[14] This was observed, in particular, in the cases of **Romania**, **Greece** and **Portugal**. Similarly, there has been a decrease in private sector R&I investments in some countries, with most ERA countries using indirect measures to support private R&D. For example, **Spain** employs tax deductions for R&I, while Slovakia previously offered a 125% tax deduction for private companies investing in R&I, which was recently increased.[15] **Montenegro** relies heavily on external investment and in the case of **Romania**, foreign companies tend to keep R&D activities abroad.

Most countries have evaluation and monitoring systems in place, and several Member States are considering updating their national R&I documents and reforming their R&I bodies based on the results. **Germany's** High-Tech Strategy 2025 and **Ireland's** Strategy for research and development, science and technology, 2016-2020 are examples of national R&I documents designed during the period. The evaluation and rationalisation of R&I policies has also a key aim in Denmark, seeking complementarities between the EU and national levels. Since 2017, the **Swedish** government has tasked several of its agencies to develop new performance indicators for monitoring Swedish research based on the objectives expressed in the research policy. Sweden has also focused on improving quality assurance in HEIs with the aim of developing a QA system. More recently, **Italy** has developed a COVID-19 recovery plan which has synergies with the NAP.

[14] **ERA Progress Report 2018 – Technical Report**.
[15] **ERA Progress Report 2018 – Technical Report.**

Legislative reforms have also taken place, or are underway. **Slovenia** has prepared new RDI legislation to reform its RTDI system. This would – *inter alia* – improve the autonomy of public research actors. However, due to changes in government the legislation has been delayed, although stakeholders are positive about the legislation being passed in the near future. **Montenegro**, which aspires to join the EU, is also putting in place legislation and is seeking EU assistance in policy planning.

Under **Priority 2a**, most countries enhanced their **participation in public-public partnerships (P2Ps)**, though national policies and resources require improved coordination. At the EU-27 level, an average of EUR 558 per FTE researcher was invested in these partnerships in 2016, whereas the level in **Denmark** was more than twice that level at EUR 1,222/researcher. **Romania** invested roughly EUR 1 200 per researcher. However, this information was unavailable for **Montenegro**. The larger economies are usually less dependent on international partnerships due to the extent of domestic collaboration opportunities. This could explain the position of **Cyprus** and the lower position of the likes of **France and Germany**. **Denmark** pledges to secure 2.5% of total H2020 funds distributed, especially focusing on grand societal challenges, where its knowledge institutes and businesses are particularly strong (health, energy, climate, environment, food).

Progress has also been made under **Priority 2b (research infrastructures)**. Participation in ESFRI projects and landmarks has grown, with increasing pan-European inclusiveness. As of 2018, there were 16 countries that had roadmaps in place with both ESFRI projects and funding needs identified. **France** adopted a first roadmap for Research Infrastructure in 2008 and adapted it to ESFRI objective in 2012. **Italy** was also a pioneer in this area, with a national programme for Research Infrastructures in place since 2014. Its participation rates in ESFRI Projects and Landmarks is roughly double that of the EU27 benchmark. Hungary had produced its first roadmap containing funding needs, while the roadmaps of **Greece** and **Italy** had identified funding requirements for the first time. The countries that had projects and funding identified accounted for 55% of ERA's GDP, while the 18 countries which had no roadmap in place represented around 10% of ERA's GDP. **Czechia's** best performance was observed on this priority. Stakeholders consider research infrastructures to be the strongest aspect of the national R&D system. The development of large infrastructures has been a long-term priority of the country's R&D policy, and is related to Czech representation in the ESFRI Executive Board.

In 2018, **Bulgaria, Croatia, Luxembourg** and **Slovakia** at least doubled their ESFRI participation rates in projects and landmarks relative to 2016, while **Cyprus** had an increase of around 400%. Norway and Ireland increased their participation in landmarks but experienced a decrease in developing projects. There is a correlation between participation and economic strength – the five largest ERA economies ranked highest in ESFRI participation. Together, they account for around 70% of ERA GDP. Overall, the data showed that participation in both ESFRI projects and landmarks by countries just below the ERA average was increasing faster than for those just above the average. This indicates a convergence among ERA countries.

Some progress has also been made under **Priority 3 (researcher mobility and merit-based and transparent recruitment)**. For example, the number of doctoral students with citizenship of another Member State is growing. **Luxembourg** performed the best, with more than half of doctoral students holding citizenship from another EU country. **Switzerland, Iceland, Austria,**

Denmark and the **Netherlands** also performed well. **FYR Macedonia** was the only country to not have any PhD students from another EU country in 2016, although whether this was due to poor data is not known.

Italy is also a country with an unsatisfactory performance in this indicator. Limited attraction of international talents, coupled with persistent brain drain, contribute to a shortage of skills, especially in STEM. **Romania** also suffers from brain drain. It has one of the highest shares of researchers working abroad. There are skills shortages in the ICT, health, teaching and engineering sectors, among others. **Portugal** adopted the "Fostering Scientific Employment" law in 2016. Although initiated as a response to the high emigration rate of graduates and highly unstable research careers, Portugal still struggles with recruitment of researchers by the private sector and has among the lowest shares of researchers employed by business in the EU.

In 2016, **Croatia, Poland, Luxembourg, Cyprus, the Netherlands** and **Norway** all advertised more than 75 jobs through EURAXESS per 1 000 public sector researchers. **Croatia** was the top performer in terms of the number of postings advertised through the EURAXESS job portal. However, this as Croatia has a problem with brain drain, this illustrates the point that indicators are not neutral. **Priority 3** was **Spain's** most challenging area. Only 19 jobs per 1 000 public sector researchers were advertised through EURAXESS, well below the EU-28 benchmark of 42.

Several stakeholders interviewed mentioned that a positive score does not always mean that the situation in a particular country is going well strategically, nor does a negative score always mean that the situation is bad. For instance, in the field of international cooperation, an interviewee from ERAC mentioned that greater *quantity* of international cooperation does not always mean improved *quality* e.g. of bilateral cooperation between particular MS or ACs and third countries. Therefore, it is necessary to ensure some qualitative interpretation of quantitative data is built in to the monitoring system.

Researchers across the continent are more satisfied with the level of open, merit-based and transparent recruitment procedures in their home institutions (P3), but this was assessed only through the MORE survey of researchers. Some interviewees at EU level suggested that whilst the MORE Survey is useful in providing data from a large cohort of researchers (circa 10,000), it would be preferable if there could be new data collection in order to ascertain how far there are actually improved recruitment procedures.

However, there remain differences between countries in terms of career attractiveness and development opportunities for researchers, while the number of job vacancies on the EURAXESS platform has decreased overall.

Under **Priority 4 (gender equality)**, overall, the share of women in Grade A positions in higher education increased by 1% per year in 2014-2016 in the EU-27, rising to 24% in 2016, though progress is slow and uneven across the ERA. To improve gender equality, RFOs **in Austria, Germany, Spain, Finland, Ireland, Italy, Denmark, Norway and Sweden** have implemented measures regarding gender equality for scientists and/or the integration of the gender dimension in research content in their evaluation criteria. **Turkey** in particular has achieved major progress in including the gender dimension in research content. However, gender bias continues to cause less favourable assessment of women's academic capabilities in research, teaching and leadership. **Denmark** faces a conundrum in that the share of women completing long-cycle higher education is higher than that of men, the gender distribution among PhD students is equal, but only a third of

researchers and under 20% of professors are female. **Romania** did not include any measures in this priority as it has traditionally performed well.

It placed in Cluster 1 for both the headline indicator and the gender dimension in research content. In **Norway**, women are still underrepresented in academic posts across disciplines and are generally underrepresented in grade A positions, though scored above the ERA average with a score of 28%. The Equality and Anti-Discrimination Act of 2018 emphasises gender equality in research performing institutions. In **Italy**, interviewees recognise that this Priority can be considered an area where progress was relatively slower. Because of this, the government is planning improved initiatives related to gender equality in research.

Estonia is a good example of measures being proposed to address the pay gap, which stood at 28.1%. Consequently, the government introduced measures including promoting wage transparency and increased access to childcare. Additionally, the government included gender equality objectives in the Welfare Plan 2016-2023. Especially for those countries that did not have gender equality policies in place in the R&I area, the ERA roadmap and the NAPs constituted a catalyst for change, as the NAP was the first policy document on gender equality in R&I. Whilst outside the country scope, this has been included as an example of good practice in the GE field. **Montenegro** has demonstrated progress under Priority 4, and arguably had its best score for the share of female PhD graduates. Further, to address gender equality among researchers, a working group was established for drafting the Action Plan for Achieving Gender Equality in Montenegro 2017-2021.

Under **priority 5a (support knowledge circulation and open innovation),** more actions and regulatory frameworks are being introduced across the ERA. For example, **France, Ireland, Greece and Montenegro** are adopting regulatory frameworks for protecting intellectual property. **Spain** has designed a large number of support schemes to foster R&D activities. Universities in **Denmark** are now required, contractually, to focus on knowledge exchange with their local communities to contribute to regional development and growth.

In **Hungary** and **France**, business and academia have enhanced their cooperation which has resulted in a higher number of corporate research centres and R&D labs. However, the transfer of research results to the market and enhanced collaboration between industry and academia still need to be encouraged in several ERA countries. Under **priority 5b (open access)**, most ERA countries have adopted policies and even legal measures for open access to publications. The leading countries in the share of research available in total OA are the **UK, Georgia, the Faroe Islands, Croatia, Switzerland and the Netherlands. Portugal**, **Montenegro** and **Germany** adopted national open science strategies, while **Norway** launched the STIM-OA scheme to facilitate the transition to open access publications. The 2016 **Netherlands'** Presidency of the EU took up this theme as one of its priority topics. It led to the "Amsterdam Call for Action on Open Science" which was referred to in the Council Conclusions of May 2016. This gave an important impetus to European and national actions for the promotion of Open Science. The Netherlands is one of the leading countries on this topic at the moment.

Countries participating in ERA have utilised a number of tools under **Priority 6 (to promote international cooperation).** International cooperation between ERA countries and third countries appears to be on the increase, while the strength of ERA countries in knowledge-intensive services exports seems to have been comparatively spread across small, medium and large economies. **Germany** and **Denmark** have established innovation and research centres in third countries, while

Belgium has appointed representatives for R&I in their consulates and embassies. **Germany, France and Norway** have also adopted a separate international strategies. **Norway's** Panorama strategy involves cooperation between Norway and eight non-EU countries. Moreover, Switzerland has a set of bilateral agreement with 7 non-EU countries. In fact, countries with more-developed R&I systems have more attractive collaboration opportunities and are better equipped to sustain and initiate new partnerships. It appears that a lack of financial and human resources is hindering the development of international partnerships. **Montenegro** implemented 'Strengthening National Participation in Horizon 2020' and participates in regional initiatives to enhance the country's integration into the ERA. **Romania's** National Plan for Research, Development and Innovation 2015-2020 contains a dedicated programme for international cooperation. **Italy** focused on strengthening cooperation with the Mediterranean region. **Greece** has agreements in place with Russia, China and Israel and recently signed an agreement with the US.

2.3.2 Drivers and barriers to ERA measures going ahead

Based on an analysis of the particular contexts around implementation and non-implementation and based on discussions with national and EU stakeholders, findings with regards to drivers and barriers for implementation of ERA NAP measures have been identified below.

At the political level, the **degree to which ERA measures have been integrated into the national policy cycle** has played a role in implementation. For example, and although **Sweden's** implementation of the ERA has not followed the process envisaged at EU level (given Sweden never produced a NAP), the fact that ERA-relevant measures formed a key part of the 2016 Research Bill meant that these measures were politically very prominent since they were part of the politically most high profile RTDI document, and also attached to funding and finance. Indeed, one advantage of implementing the ERA process through the Research Bill is that the latter is arguably the most influential steering document in the Swedish RTDI system. This has meant that ERA-aligned measures are more likely to have been carried out, but – at the same time – the ERA process has become less visible, having been usurped into the overall strategic direction of RTDI in Sweden.

In **Italy**, EU initiatives are considered politically valid and of higher quality compared to national ones. In the case of **Greece**, the ERA Roadmap was aligned with national priorities, while most measures have already been discussed or included in the policy cycle. In **Lithuania**, ERA was not high on the policy agenda and the NAP itself was less important than other national R&I strategies and the smart specialisation strategy. In **Spain**, the NAP was not the main policy framework for the implementation of the ERA Roadmap as national strategies were used instead. In the case of **France**, interviewees said that the country already had a well-developed R&I system. As such, the ERA does not have a strong influence on the national R&I system.

The extent to which the **NAP was integrated into national R&I strategies** proved crucial for its success. Such integration often indicated robust coordination across the actors involved and reflected commitment towards implementation in line with related national priorities. At the same time, the **inclusion of already ongoing measures in the NAP** (e.g. **Greece**, **Sweden**, **France**) was a sign in some countries of a rather limited or non-existent commitment to any new measures. The level of ambition of the NAP was often limited to existing planned national R&I measures mentioned in other national policy and strategic documents.

In addition, the **depth and specificity of national initiatives** outlined in the NAP further influenced the extent of progress towards implementation. **Germany, Norway, Denmark** and **Slovenia** are good examples of detailed action plans. The level of detail considered already in the development phase points to a thorough **assessment of the potential impacts of NAP implementation**, a further aspect considered as being a driver of future success. Similarly, the **Netherlands** NAP contains a list of specific national targets which can be measured using various sources. In the case of **Romania**, the measures proposed are well-developed, however the indicators could be seen as too ambitious, given the status of the R&I system in 2015.

More generally, there was a tendency on the part of national authorities to focus on **components of the overall strategy that will strengthen their own national R&I potential and performance.** There was more limited commitment to those elements in the ERA Roadmap intended to **strengthen links and co-operation with other countries**. The strengthening of national R&I systems tends to have a greater presence in NAPs than elements concerned with co-operation with other countries. This was observed in the cases of **Montenegro** and **Romania**, for example. However, this varies, as some countries did prioritise international cooperation in R&I as a key priority (e.g. **Germany, the Netherlands**, **Denmark**). **Portugal's** NAP is oriented towards European and international cooperation.

- The extent of **political ownership** of the ERA roadmap and national R&I agenda more broadly played a key role in determining whether measures went ahead or not. The extent of involvement at national level between different Ministries was a factor that influenced the extent to which there was a sense of shared ownership, which in turn influenced progress towards national ERA implementation across different ERA priorities. For example:
- In **Slovenia,** the Ministry of Education, Science and Sport was the lead Ministry, but several other Ministries were involved, namely the Ministry of Economic Development, Ministry of the Environment and the Ministry of Agriculture. A good practice was that the development of the Slovenian NAP in 2016 required different government Ministries to work together more closely on ERA-related R&I issues than would have been the case in national R&I policies usually.
- In **Lithuania**, the Ministry of Education, Science and Sport was also responsible for the ERA NAP, and whilst the Ministry of Economy and Innovation was nominally involved, they do not appear to have been active participants in ERA implementation.
- In **Portugal,** the Ministry of Economy and Ministry for Science, Technology and Higher Education were both involved in ERA implementation. Although both Ministries are stated to have been involved, research suggests mainly the latter was involved and responsible for implementation of the NAP.
- In **Norway**, the Ministry of Education and Research engaged with other Ministries and the Research Council of Norway and invited them to attend ERAC meetings. This fostered enhanced cooperation and a sense of shared ownership of the NAP and its implementation.
- However, in the case of **Czechia**, interviewees stated that the division of competencies between the Ministry of Education, Youth and Sports and the Ministry of Industry and Trade complicated coordination at the national level as they prefer to keep certain elements of R&I policy under their control.

- The extent to which there were diverging priorities between Ministries and other R&I actors involved also influenced the degree of progress. Feedback was received that in some cases, particular Ministries may have prioritised particular aspects of the ERA priorities based on their own agenda but not given that much attention to the ERA overall.
- The relevance of **coordination platforms** bringing together national stakeholders on a regular basis was also emphasised. A good example is the bi-yearly Swiss ERA Roundtable, in which the relevant actors come together in a dynamic forum to coordinate efforts to be carried out in what is a highly decentralised system.
- Key to political ownership was the **perception of the value of the ERA agenda** at national level. This was closely linked to the degree of policy attention and political commitment accorded to the ERA, and often related to the strategic value placed by the country to the R&I sector as a whole. In the case of **Montenegro**, for example, there are other strategic priorities, as the country is newly independent, recently joined NATO, and is transitioning to a market economy. In **Romania**, the two largest sectors of the economy are services and industry. Agriculture remains a significant sector and has the highest share of employment in the EU. Interviewees from **Portugal** stressed the importance of multi-level coordination and engagement in NAP development, which involved the FCT, ANI, research units, universities and industry.
- However, a weakness of ERA implementation is that as the Roadmap process was voluntary, the extent of progress was often dependent on the level of personal commitment of ERAC national delegates responsible for specific priorities. This was mentioned in Slovenia for instance as a key determinant in respect of the overall degree of progress and the implementation of promised measures in the NAP by Priority.
- **Political and civil service discontinuity** constituted a major barrier to the implementation of, and awareness about the ERA Roadmap process. General elections and reorganisations of departments within certain Ministries are examples of the loss in continuity in political agendas and in the degree of political commitment towards the ERA e.g. in **Lithuania, Spain**. In **Lithuania,** there was recognised as being an absence of sufficient political commitment to the NAP in 2016. However, more positively, there has been a recent change in government and looking ahead, an affirmation of strengthened political commitment to ERA has been made. In this context, **Denmark** was fortunate in that it had already implemented the vast majority of its ERA Roadmap by the time a new government entered into power in mid-2019, reorganising the key responsible ministries and agencies. In **Romania**, successive governments have moved responsibility for research over the last few years, which has caused confusion among stakeholders. In less than two years five ministers held responsibility for R&I under four governments.
- Generally, the **availability of resources** and predominantly lack thereof resulted in limited uptake of national measures. Cuts to national R&I funding, in many cases attributed to the longer-term budgetary impacts of the economic and financial crisis were among the barriers to the advancement of national R&I agendas, including their ERA dimension. A further issue was the lack of identification of specific funding needs to implement ERA actions and measures. In some cases, it was left unexplained whether dedicated funding would be made available, and unclear if particular measures and actions were likely to go ahead. The financial crisis impacted funding for R&I in **Romania**, **Greece** and **Portugal**, while there is a lack of human resources in **Czechia**, meaning ESFRI was prioritised over

other priorities. In the case of **Montenegro**, the Ministry of Science is relatively small; in 2014, it counted around 25 employees. As such, there is a lack of resources for analysing policy areas and engaging with stakeholders.

- Some Member States highlighted that they have limited resources to conduct national monitoring of ERA implementation, such as in **Slovenia**.
- **Structural and systemic aspects falling under Priority 1** identified included the need for legal changes not only referring to legislation but also in terms of statutes setting out the functions of different organisations and remits, as well as the lack of collaboration between academia and industry hindered a smooth, effective implementation of measures planned. This is the case for example in **Portugal**, where barriers have their roots in cross-cutting systemic issues, rather than in R&I policy only. In the case of **France**, research organisations were not heavily involved, lowering their commitment to the process.
- A general trend was that the imperative of undertaking structural and institutional reforms of national R&I systems was more common in widening countries (e.g. in Central and Eastern, and in Southern Europe) than in former EU-14 countries and in stronger innovation performers. This was observed in **Montenegro** and **Romania**, for example.
- In **Lithuania**, a need was identified to rationalise overly-fragmented higher education provision at national level, and also to reform some research institutes by incorporating them within universities.

In **Poland,** reform measures were introduced to improve its performance in science and in R&I. For instance, the 2018 Act on Higher Education and Science directly reflected the ERA 2016-2020 priorities in several areas, but without any explicit mention or references to the ERA. This was interpreted as being for political reasons. The Act sets out new evaluation criteria for scientific organisations that recognise the importance of international cooperation and the internationalisation of science. New quality assurance institutions have been set up, such as the Council of Scientific Excellence and the Science Evaluation Committee. The first edition of the 'Excellence Initiative – Research University' programme was completed in October 2019, with the selection of 10 universities to be reinforced in their research activities. Doctoral training has been re-organised with the creation of a single doctoral school within higher education institutions. Other measures included the reform of the Polish Academy of Science, initiated by the Ministry of Science and Higher Education in 2019. It envisaged, among others, increased prerogatives for the President of the Academy on the supervision of the Academy's institutes, an external review of the Academy's Institutes, and the introduction of minimum wage levels for researchers.

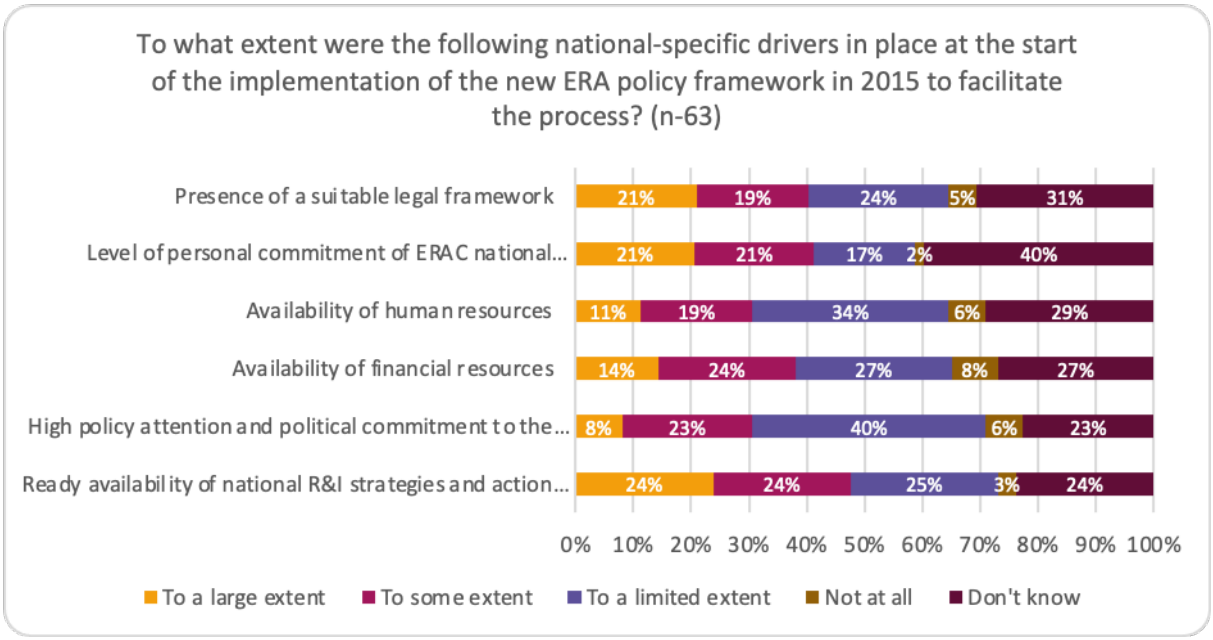
However, structural reforms were not confined to widening countries. For example, in **Sweden,** successive government reforms since the 1990s – continued through the NAP in the 2015-2020 period, have sought to foster closer collaboration between universities and other sectors, primarily business and public sector actors but also civil society with the aim of making universities more active partners in RTDI and knowledge ecosystems. It was also noted in the review of the development and implementation of National Action Plans that "despite continuous reforms, there remains rather weak interaction between academia and industry".

In **Switzerland,** reforms relating to HEI funding have been undertaken and were prioritised in the NAP. A commission of inquiry was appointed by the Government to conduct a general review of HEI governance, including the allocation of resources. Reforms relating to ethics were also undertaken,

such as the introduction of tighter regulations for the ethical review of human research, including tougher sanctions and the clarification of supervisory responsibilities.

Responses to the online survey rated drivers and barriers as they considered their influence on the ERA Roadmap process. Figure 2-3 and Figure 2-4 present the findings.

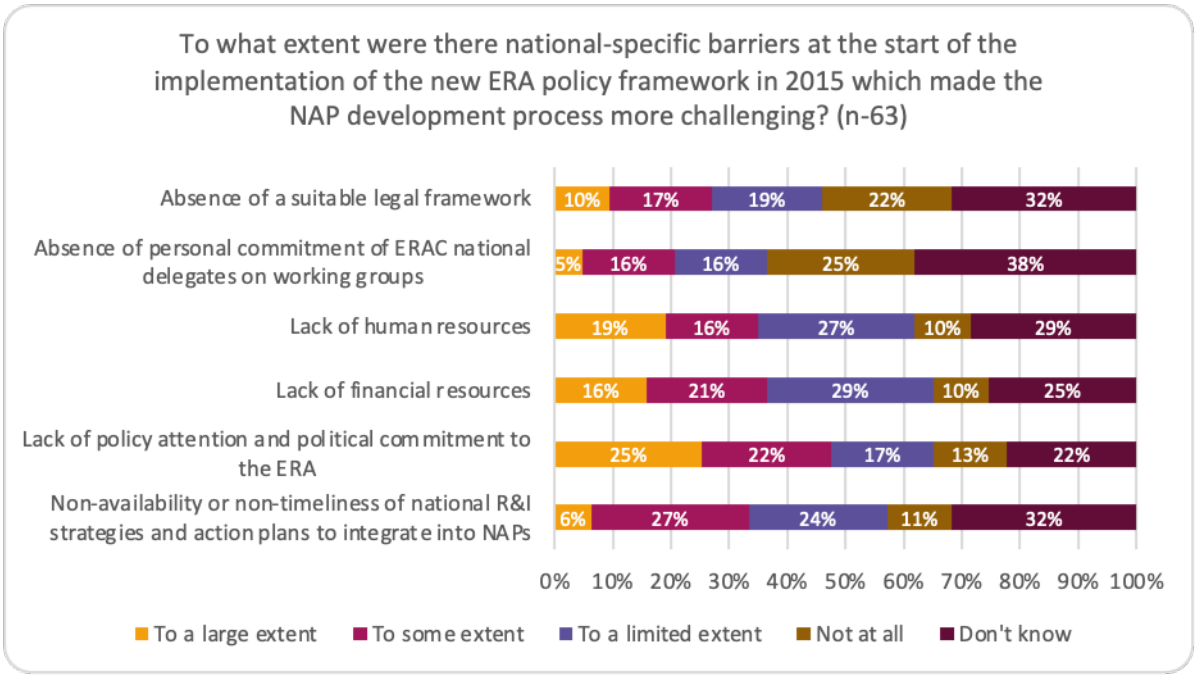
Figure 2-3 - Responses on relevance of drivers for NAP implementation



Source: ERA Monitoring Online Survey

As can be seen from the figure above, 40% of respondents considered the presence of a suitable legal framework to be to a large extent (21%) or to some extent (19%) a driver of the implementation of national measures. Nearly half (48%) believed the availability of national R&I strategies to be to some extent or a large extent a driver of implementation. This was confirmed in the interviews carried out during this study and emphasises the observation made that several NAPs were based on existing national strategies. Only 8% of respondents believed, to a large extent, that high policy attention and political commitment to the ERA was a driver. This is to be expected, given the varying strategic national priorities across the ERA.

Figure 2-4 - Responses on relevance of barriers for NAP implementation



Source: ERA Monitoring Online Survey

As highlighted above, given the varying strategic national priorities across the ERA, it is unsurprising that nearly half (47%) of respondents considered a lack of policy attention and political commitment to the ERA to be to some extent or a large extent a barrier to implementation. This was confirmed, for example, in the interview with representatives of the Lithuanian Ministry of Education, Science and Sport, who said the ERA was not high on the policy agenda. Several of the respondents believed to some extent or a large extent that a lack of human resources (35%) and a lack of financial resources (37%) were a barrier. While some of the larger countries, such as Germany, have dedicated resources for ERA implementation, others, such as Montenegro have relatively small ministries and budgets. As such, these figures are to be expected given the differences in human and financial resources across the ERA.

2.3.3 Findings – assessment of the effectiveness and impacts of NAP implementation

A synthesis was undertaken based on the review of NAPs and the findings emerging from the in-depth country research in 18 countries. A number of findings have been identified and some wider trends relevant to the assessment of NAP implementation and associated impacts.

These can be grouped into findings relating to i) governance ii) NAP implementation and impacts iii) follow-up and monitoring.

Governance

Some governance models appear to have been more effective than others. Clearly, countries that tend to have effective and collaborative RTDI governance in general are also more positive about the ERA governance set-up. In **Sweden**, one coordination group has been central to the implementation of the ERA. EU-Sam, which is also responsible for wider RTDI issues beyond the ERA, was set up in advance of the EU ERA negotiations and has worked with and advised the

Swedish government since the start. EU-Sam is chaired by Vinnova, the Swedish innovation agency, and is made up of all the main research agencies. It is the central coordination body but is supported by Priority working groups (and other ad hoc working groups).

The fact that the various RTDI relevant agencies are leading the implementation is in line with Swedish policymaking in general, where government Ministries issue the overall direction of policies and programmes, then to be implemented by numerous governmental agencies (often in cooperation with each other and also with the – more passive – involvement/observation of Ministries). Although the **Danes** did not establish a specific ERA coordination group, the governance situation was similar in that the Agency with responsibility for NAP implementation[16] already works in close cooperation with the various players in the Danish R&I system and actively involved them in the implementation process. In **Germany**, the DLR Project Management Agency supports the Ministry of Education and Research in implementing the NAP. In **Norway**, different ministries and the Research Council of Norway are involved in the NAP process, enhancing collaboration and allowing for progress under different priorities. In **France**, however, research organisations were not heavily involved, lowering their commitment to the process.

Although the governance model is similar in many other countries (perhaps with Ministries taking a more active role in MS/AC where this is the political culture), some stakeholders indicate that they experienced a fairly long learning curve in terms of establishing a good cooperation basis – Slovenia, for example. The Task 1 stakeholder consultations have also concluded that there is generally a need to better align various stakeholder's R&I strategies to improve cooperation.

- Effectiveness and impacts of NAP implementation

With regard to **the extent and degree of effectiveness of NAP implementation**, the following findings can be highlighted:

- In some countries, **substantial progress can be evidenced in terms of NAP implementation**: Austria, Belgium, Denmark, Finland, France, Ireland, the Netherlands, Norway and Switzerland progressed substantially with the implementation of their NAPs. This can be attributed to very tangible objectives which could be measured and followed up as well as to coordination efforts among national R&I stakeholders involved.
- However the **degree to which the ERA can be credited with the measures implemented varies**, and is in some cases uncertain. Some measures in most of the countries under review were already being implemented at the national level. For example:
    - In **Germany**, national R&I strategies such as the High-Tech Strategy, the Excellence Initiative and the Internationalisation Strategy for Education, Science and Research preceded the NAP.
    - In **Portugal,** several measures included in the NAP as "measures to be consolidated" were already being implemented prior to the NAP. This is the case of the monitoring and evaluation mechanism for R&I infrastructures or the support of open and transparent practices of recruitment for researchers.

[16] The Agency for Science and Higher Education, **https://ufm.dk/en/the-ministry/organisation/danish-agency-for-higher-education-and-science?set_language=en&cl=en**

- In **Sweden**, a large-scale and long-term research programme intended to tackle key societal challenges is included in the ERA Roadmap. However, the impetus of the funding scheme pre-dates 2016.
- In **Switzerland**, the well-developed R&I system meant that measures for those areas under development were in many cases underway already and the NAP aimed to strengthen or expand on them. For example, swissnex was already in place connecting Swiss researchers, entrepreneurs and thought leaders with inspiring peers abroad under P6, and for P2b the Swiss open government data strategy was already available online. In the **Netherlands**, a majority of the nearly 50 measures listed in the NAP was already part of the Enterprise Policy and the 2025 Vision for Science preceding the NAP.
- In **France**, many measures had already been implemented or were on the agenda before the ERA Roadmap process had started. For example, France has traditionally been very active in promoting international cooperation with third countries through the SFIC.
- In **Greece**, the NAP was developed soon after the adoption of the National RIS3. As such, many of the measures were already included in the policy pipeline.

- In a number of instances, measures in the NAPs have not gone ahead yet, and were either subject to delay, postponed or cancelled.
  - In **Italy,** the setting up an Inter- Ministerial Executive Board (Gruppo Operativo Interministeriale – GOI: see Fig. 5) to coordinate Italy's participation in JP activities (especially JPIs) was indicated to be "on-going with delay", just as the launching of a joint ministerial consultation in order to set up a steering board to coordinate national and EU research programmes on Grand Societal Challenges (Tavolo di ricerca sulle Grandi Sfide della Società Contemporanea – TASSC).
  - In **Ireland**, regular meetings of the national JP Oversight Group that were planned to be convened with the aim of bringing together representatives from the network of JPI steering groups to ensure effective oversight under P2a was postponed to a later stage. No particular reason is given for this in the evaluation by the GPC SWG of ERAC.
  - In **Slovenia,** for example, reforms of the legal statutes of particular organisations and bodies in the field of R&I that were meant to contribute to the ERA have been delayed due to changes in government. These could have resolved institutional uncertainties regarding which institution was responsible for particular ERA priorities. The non-implementation (to date) of these reforms has also had a negative spill-over effect on other ERA measures.
  - In **Romania**, there were no measures under Priority 4 and no major policy developments were observed during the period.
  - The NAP for **Montenegro** highlighted the establishment of a multi-actor workgroup, EU assistance in policy planning and monitoring and evaluation of the labour market conditions for researchers under Priority 3. However, information is unavailable.
  - In the **Netherlands** NAP, priority 6 is the only area that has not defined specific targets. A possible explanation is that from a policy perspective, the attention for non-European countries is mostly driven by commercial trade goals.

Regarding the **extent of impacts** of NAP implementation:

- The ERA Roadmap has helped to raise the visibility of some ERA priorities at national level that would not otherwise have been the case.
- **Priority 2b, Research Infrastructures** - the ESFRI roadmap has been an important impetus for the development of national research infrastructure roadmaps. The hugely improved access to RIs for researchers from across Europe has helped to improve the visibility of the role of European collaboration on this front.
- **Priority 4, Gender Equality** - several stakeholders highlighted P4 to be a main area that the ERA had highlighted as needing further development across the ERA countries. As a result, many NAPs included this as key aspect with specific measures, and countries grew in awareness of best practices also through their participation through the ERAC (see Annex 4: Case study on the thematic Gender assessment across NAPs).
- **Priority 5, Open Access** – the fact that Open Access was prioritised back in 2015 has put it on the agenda and not only the ERA but also other developments, such as the significant expenditure and momentum generated by the EOSC has helped to raise Open Science, Open Data and Open Access as major issues for national not only European R&I policies.

An example of the **interplay between national and European research agendas linked to the ERA reinforcing one another in the field of open access** can be found in the Netherlands where in 2016 the debate between the universities and the Ministry for Education, Culture and Science on improving the position and 'valuation' of researchers (Priority 3 and 5a) led to a different approach to bibliometric impacts and high impact journals. This helped in the negotiations with the publishers to push for more open access articles (Priority 5b), in line with what was happening across the rest of Europe. A similar interplay could be seen regarding gender equality, where national stakeholders that had pushed for this for years, received more political support and concrete targets set by the Ministry after the launch of the ERA roadmap in 2016.

- **Priority 6, International Cooperation** – arguably, international cooperation with third countries was prioritised quite strongly in a number of ERA participant countries (e.g. Germany and Switzerland), but not in all. Encouraged by the work of the SFIC a large share of EU countries has a national R&I internationalisation strategy. A survey conducted for the Mutual Learning Exercise on International Cooperation showed that Development of ERA Objectives was rated as the third most important objective for participating EU countries for international cooperation, after achieving science excellence and science diplomacy.[17]
- The ERA Roadmap and the ERA priorities seem to have taken a **relevant place in national debates on R&I to a varying extent**, often however not directly linked or labelled as being related to the ERA, making it hard to establish the direct level of impact.

[17] https://rio.jrc.ec.europa.eu/library/mle-national-strategies-and-roadmaps-international-cooperation-research-and-innovation-5

- In **Spain**, the objectives within the State Plan of Scientific and Technical Research and Innovation 2017-2020, de-facto NAP are in line with ERA priorities, centred around recognising and promoting R&D&I talent and employability, support business leadership in R&I and to foster R&I activities targeting society's overarching challenges without mentioning the ERA Roadmap explicitly more than twice in the entire document.
- In **Sweden,** stakeholders believe that the ERA Priorities are widely discussed, but not necessarily 'labelled as being ERA'.
- In **France**, the ERA lacks a concrete and tangible existence and a political dimension. In the absence of political ownership, it essentially remains a technocratic endeavour.
- **Poland** did not produce a NAP. However, the feedback received indicated that the 2018 Act on Higher Education and Science reflects the ERA priorities.

- **In other countries, the implementation of national ERA Roadmaps did not achieve much impact at the level of the ERA overall,** but did achieve progress in one or two ERA priorities (e.g. Germany, Netherlands) due to increased policy attention from Ministries stimulated by the work of the ERAC Working Groups. An interviewee from **Norway** asserted that the engine of the ERA was ERAC and the ERAC SWGs.
- However, it is **often difficult to establish causal attribution regarding impacts.** This was due to the challenges in disentangling what was already there at national in national strategies, what was driven by national participation in EU-level initiatives, whether those were already ongoing when the NAPs were drawn etc.
- Although the ERA is not necessarily clearly attributable as the main change driver, it has encouraged policy debates at national / regional levels, and contributed towards change. Overall, the development of NAPs has raised awareness about, and the visibility of the ERA policy framework and the six ERA priorities. For example:
  - In **Austria,** the ERA NAP led to a stronger coordination of ERA-related policies across different ministries and agencies. They meet regularly to discuss progress in implementation.
  - In **Slovenia,** the implementation of the NAP required closer coordination between Ministries than had been the case previously.
  - In **Portugal**, actors stressed the importance of the involvement of the FCT, ANI, research units, universities and industry in developing the NAP. The same approach was taken in developing the fifteen thematic agendas for R&I.
  - However, in the case of the **Netherlands**, it appears that policy makers were less focused on achieving the ERA NAP and more focused on achieving national policy goals. Additionally, the NAP was not updated in 2018, which indicates that the ERA framework was not very visible in the policy debate.
- It is perhaps not surprising that some NAPs seem to more or less copy existing national strategies, measures and actions in their NAP. For countries that show strong alignment between national R&I strategies and ERA priorities and in addition, already have a strong performance as innovation leaders or strong innovators such as **Germany, the Netherlands, Sweden and Switzerland**, the overall ERA Roadmap has less value added.
- Nevertheless, for one or two specific priorities the ERA governance process (including policy discussions among ERAC SWG members) might have had a strong impact, such as gender

equality (see above and Annex 2) and the implementation of Plan S by the funders of a growing number of countries.

- The ERA process (and indirectly the monitoring of the NAPs) has also had an impact on building trust and information exchange between policy makers across European countries. This type of impact cannot easily be measured, but was frequently mentioned in interviews an impact.
- This building of trust has taken place through the ERAC WGs, the GPC and other joint programming initiatives and activities supported by the Policy Support Facility. The effect of improving the social capital in R&I policy making can be found in better policy-making, faster dissemination of good practices and a greater ease of implementing transnational collaboration programmes and initiatives.
- Whilst evidence was found that the ERA has had positive effects in some countries, there were others where it was difficult to identify any tangible impacts of the ERA NAP. For example, in **Poland**, given that interviewees were unaware of any ERA measures being implemented, they had difficulties in assessing the ways in which the ERA could be implemented in the future, or what impacts this implementation / non-implementation would have.

The findings presented above as to the extent to which positive, neutral or negative impacts resulted from NAP implementation broadly correspond to the categorisation presented earlier in relation to the assessment of the impacts of NAP development (see Section 2.2.5). Some countries were more open than others to investing time and resources in NAP development and implementation. Others were more reluctant, or relied on existing national R&I strategies and commitments developed before it was required to develop an ERA NAP. The extent to which countries took the NAP development process seriously in turn influenced the scope for impacts to materialise due to NAP implementation.

Progress monitoring

- With regard to progress monitoring, there are challenges in comparing country performance under some of the six ERA priorities, such as strengthening the effectiveness of national R&I policies. Given the heterogeneity of national R&I systems, this demands a qualitative evaluative assessment based on a combination of quantitative data and qualitative feedback.
- There is scope for monitoring and evaluation of national R&I policies to be better aligned with EU policies and with the ERA policy framework. Stakeholders also admit to the challenges of monitoring and evaluation of the ERA. The work that ERA-Learn[18] has led in terms of developing indicators for RTDI was raised by some interviewees as having been helpful in this regard.

2.3.4 Analytical framework of NAP and measure implementation

This section provides a synthetic overview of the different findings from NAP development (section 2.2) and implementation (section 2.3). The objective is to map the different barriers and drivers,

[18] https://www.era-learn.eu/documents/tk_examples_of_indicators_project_level.pdf/view

which affect NAP development and implementation identified above, within the broader ERA roadmap process.

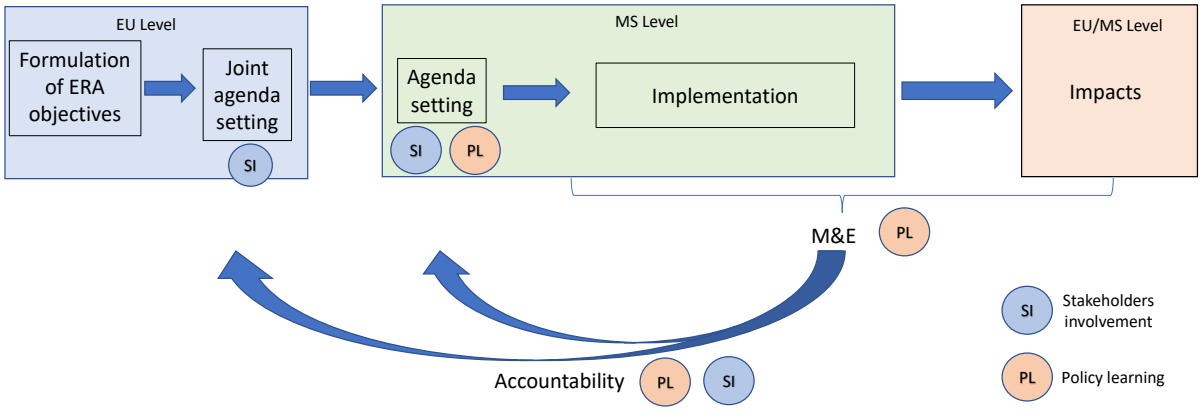
To do so, an archetype diagram reconstructs the intervention logic of the ERA Policy cycle (Figure 2-5). It provides an analytical framework accounting for the process through which ERA objectives are expected to translate into real effects (impacts). This analytical framework shows the relevant steps and levels of action, governance structures and processes through which the ERA is expected to impact national and EU RI systems. This framework draws on the policy cycle approach further detailed below (Section 3.2.1). Incidentally, it will also be helpful to assess the proposal for the new ERA and check whether it builds on lessons learnt from the 2015-2020 experience (see Section 3.2.2).

According to this framework, the policy cycle of the ERA starts with the formulation of the ERA objectives and the joint agenda setting which is an activity performed in partnership between the EC and the Member States. This agenda, defined at the EU-level, is then absorbed by the various MS, which translate it into their own agendas and implementation plans (NAP) in full autonomy.

Throughout the policy cycle, various instances of policy learning are identified: from the MS-level agenda setting process, to the critical phase of monitoring and evaluation of how the initiative has been implemented. Ensuring instances for stakeholder involvement and policy learning is a desirable feature of the ERA policy cycle.

Monitoring and evaluation of the implementation degree and impacts of the ERA gives way to a phase of accountability in which MS report on the progress made towards their NAPs and the ERA objectives benefits from policy learning across MS and an appropriate degree of stakeholders involvement. In turn, the accountability phase contributes to shape national and EU-level policy agendas.

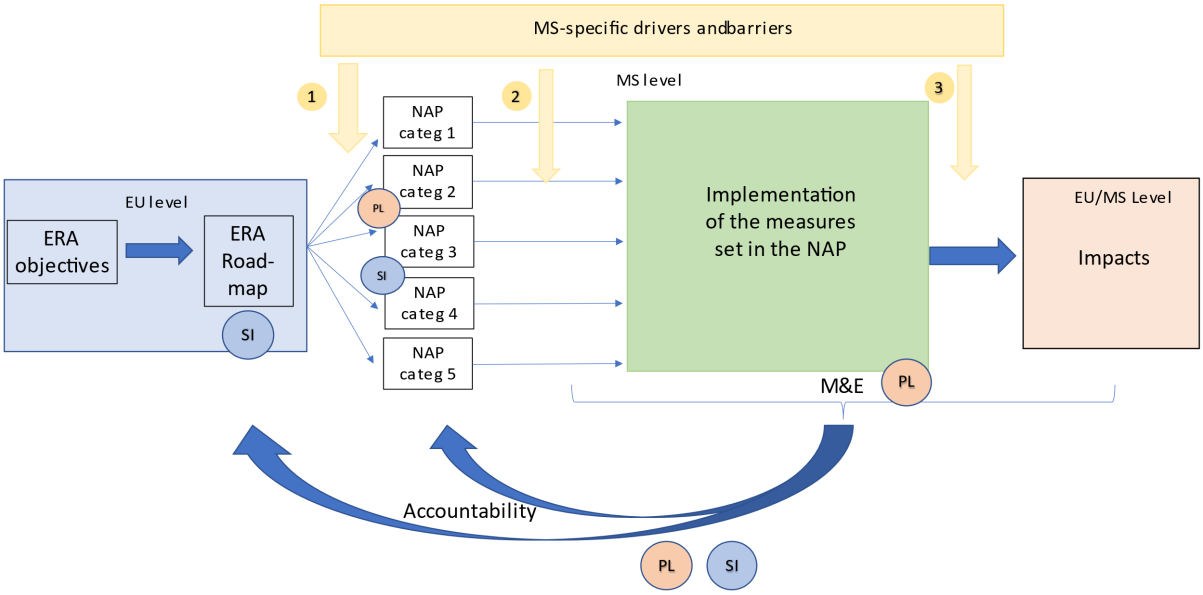
Figure 2-5 - ERA Policy cycle & intervention logic: an analytical framework



Source: own elaboration

This generic intervention logic is expected to underlie the ERA roadmap process. Comparing it with the actual developments described in sections 2.2 and 2.3 helps locate national drivers and barriers or put in other terms, strength and weaknesses of the ERA Roadmap process at the national level (see Figure 2-6).

Figure 2-6 - ERA Policy cycle / intervention logic: the case of the Roadmap process 2015-2020



Source: own elaboration

How the Joint Agenda (ERA Roadmap) translates into national agendas (NAPs) depends upon a series of country-specific drivers and barriers which can impact the policy cycle, determining the course of ERA-related actions in the Member State. These drivers and barriers have also an impact on how the agenda is then implemented and therefore, ultimately affect the impacts achieved by ERA through the whole policy cycle. Such drivers and barriers can be very idiosyncratic and as such difficult to generalise. Comparing the implementation degree and impacts of the ERA is a complex effort, given the high degree of heterogeneity across MS in terms of NAPs, measures, capacities, and R&I systems.

As illustrated in the figure above, the barriers and drivers identified through a cross comparative assessment of NAP (see sections 2.2.4, 2.2.5 and 2.3.2 in particular) materialise at different moments in the ERA roadmap policy cycle (1, 2 and 3 in the figure above).

The process led from the formulation of the ERA objectives and the drafting of the ERA Roadmap at the EU-level to the conversion of its principles into NAPs at the MS-level. This step of translation of the ERA Roadmap into NAPs was inevitably mediated by MS-specific drivers and barriers, which went beyond the foreseen necessity of giving full autonomy to Member States. This first set of MS-specific drivers and barriers were decisive and determined five broad categories of MS responses. They relate primarily to the maturity level of the R&I system, which is the main factor behind the classification of MS in five categories. Governance-related factors were also relevant, such as the limited involvement of stakeholders other than the concerned Ministry, the overall political engagement and institutional capacities. The incentives activated by the ERA process (the impetus that the adoption of the Roadmap represented as well as multi-level governance policy learning mechanisms), the limited extent of EU level guidance and support and the degree of stakeholders' involvement (and the lack of it, as observed in the 2015-2020 process) also played a role in shaping the NAPs. While in some cases stakeholders' involvement also influenced the formulation of the NAPs, this had an overall minor influence. The overall degree of accountability was

eventually rather limited, in the sense that no action was triggered as a result of the findings from M&E.

In most of the MS categories, NAPs contained a number of measures to be implemented over the period 2015-2020. The degree of implementation of these measures was again affected by a number of country-specific factors. In first place, were the degree of integration of the NAP in the national policy cycle and the R&I strategy in particular. The other factors have been materialising more downstream the policy cycle. Overall, this second set of drivers and barriers was more related to the administrative and financial resources available to MS, regulatory barriers, as well as institutional and behavioural factors. As noted for the previous phase, greater stakeholder involvement and more instances of policy learning might have benefited implementation at MS level.

Finally, the possibility of realising impact through the ERA is also intermediated by country-specific drivers and barriers, related to both the sets of factors identified above. In some cases, exogenous factors also contributed to determine the eventual impact of the ERA at MS and EU levels.

2.3.5 Lessons learned from the ERA Roadmap process

Overall, the development and implementation of the NAPs reflected a high level of ambition from participating countries to progress the ERA. It has helped countries to reflect on their own national R&I priorities, strategies and policies and to consider how well these are aligned with the ERA. This has served as a framework guiding progress towards a more integrated ERA and promoted broader alignment between national and EU R&D&I priorities.

Addressing some of the challenges identified in the process would allow for further efforts to be made at country and EU level and ensure a joint, coordinated effort in the future. In particular:

- The development and implementation of NAPs constituted a **helpful reflection effort** for most ERA countries, enabling them to assess their current performance in relation to EU objectives. The ERA Roadmap provided a relevant framework for countries, helping them to steer their efforts in line with the EU priorities. This can be considered as a success in terms of the realisation of the overall objective of the ERA.
- Finding the right **balance between greater guidance around priorities and allowing room for countries to implement measures relevant to their own context** and to their existing strategies, e.g. smart specialisation strategies, will be key for the future ERA. Asymmetric involvement across priorities is to be expected given the different context of individual countries. Respecting these differences is essential.
- A **standardised approach to developing NAPs** with additional guidance around priorities, sub-priorities and broader objectives could help ensure similar interpretation across countries, and result in a more coherent approach that would also aid comparison of measures and progress across countries. The introduction of minimum standards in the NAPs, such as a standard structure including a brief description of the actions within each priority, targets to measure progress and reference to other existing national strategies and ongoing measures would ensure a more structured approach.
- The existence of national R&I strategies and plans in place already before or at the same time as the NAP emphasizes the crucial aspect around **timing of the NAPs**. With national strategies taking long to be developed, flexibility is needed around NAPs integrating already

ongoing measures to allow for consistency across national efforts. Indeed, NAPs are most impactful when bringing together existing measures and newly planned ones.

- Development of the ERA requires **both strengthening national R&I capabilities and performance and building links and co-operation with other national systems** and the ERA Roadmap reflects this duality in its priorities. There are certainly examples of countries building transnational and international links, but there is an inevitable tendency in developing NAPS to focus on the first element. Countries could be encouraged to specifically identify the transnational elements in their NAPs, as a way of highlighting and strengthening the second element.
- When there is a strong **consensus in the NAP development**, established through wide consultations with different stakeholders, there is a greater buy-in of national actors and a greater degree of implementation of the proposed measures. Countries could be encouraged to take a more inclusive approach to their NAP development, which might lead to slower progress yet also result in increased coordination of efforts. For example, Switzerland's wide consultation ensured continuity and stability and for the Netherlands improved career paths of researchers and gender equality in the universities resulted.
- **Jointly striving towards progress on common ERA** objectives is enhanced when the objectives and targets can be clearly described and more difficult when the achievements are strongly context specific, such as in Priority 1. In such cases, the lack of a baseline study and customised national targets hamper the monitoring of progress.
- There is a need to **increase awareness and visibility of the NAP and the ERA more broadly at country level.** The greater awareness among civil servants working in international divisions of Ministries about the ERA than in other departments points at the fact that visibility of the ERA has been enhanced by the roadmap process, yet could be further improved.
- As the **ERAC WGs are an important vehicle for exchanging experiences**, policy learning and providing incentives for countries to demonstrate progress, these types of platforms are considered important to enhance in the future ERA.

2.4 REVIEW OF ERA MONITORING AND INDICATOR SYSTEM

2.4.1 The ERA Monitoring Mechanism (EMM) in 2015-2020

The **ERA Monitoring Mechanism (EMM)** was part of the ERA Roadmap process in 2015-2020. The purpose was to ensure that ERA implementation at national level could be monitored and transparency strengthened. [19]

The EMM indicator system was developed in 2014 based on inputs from the European Research Area and Innovation Committee (ERAC), specifically the Ad hoc Working Group on Monitoring. 24 indicators were selected, organised by Priority, and were broken down by **input, output** and **outcome/impact**. Eight of the indicators were classified as headline indicators, whilst the rest

[19] European Research Area, Cost of Non-Europe Report, 2016, European Parliament, EPRS https://www.europarl.europa.eu/RegData/etudes/STUD/2016/581382/EPRS_STU(2016)581382_EN.pdf

were designated as “supporting indicators”. The current set of EMM indicators (see Annex 2) has been reviewed to assess their *relevance, efficiency* and *effectiveness*. The EMM was agreed with the Member States in 2015.

The EMM as agreed was meant as a starting point for the monitoring of the ERA Roadmap process. The Ad hoc Working Group guided the discussions about the selection of indicators based on specific terms of reference which stated that the monitoring mechanism should be simple, easy to understand by all stakeholders, consistent of quantitative, not qualitative data, and rely on official data sources. This meant that the Ad hoc Working Group was restricted in their work and were well aware of the limitations of the resulting monitoring system, yet aimed to design the best possible monitoring mechanism within the stipulated terms of reference. In addition, although the EMM was developed after the six ERA priorities and associated objectives had been set, ERAC interviewees suggested that not all of these priorities were understood in the same way by all Working Group members. This meant that it was difficult to achieve a consensus on how progress towards particular priorities should be monitored and measured.

Data to underpin the indicators relied upon a variety of different EU data sources, especially Eurostat, but also data taken from the European Innovation Scoreboard (EIS), which is generated through the Community Innovation Survey (CIS) and from the JRC. In addition, data was obtained through regular surveys and studies funded by the Commission, such as EU-wide surveys of researchers (e.g. the MORE Surveys on the mobility and career development of researchers carried out three-yearly). A list of data sources for the current indicator set is provided in Annex 2.

An assessment of existing EMM data sources was undertaken.

Only EU data sources were used to carry out the monitoring of national ERA implementation, which reflected the constraints that the ERAC ad hoc group on monitoring were working under. National Ministries in ERA participant countries were reluctant to collect any new data at national level, which meant that there was no new data available to monitor the actions being implemented through the NAPs.

This had the advantage that the data was reliable and comparable. Although the different sources used vary in terms of their frequency of updating, most are updated annually, e.g. Eurostat and EIS data. However, a disadvantage was that there was a dependence on context indicators as a proxy, rather than direct assessment of the progress being made. The indicators selected were therefore often only indirectly relevant to the ERA priorities.

2.4.2 Monitoring system to keep track of ERA priorities

Monitoring of the ERA Roadmap process was carried out at EU level by the European Commission through the ERA Progress Report and the development of country fiches in 2018) and progress in monitoring overall progress towards NAP implementation at the priority level was led by the ERAC Working Groups. These two levels of monitoring are considered in Annex 4.

2.4.3 General feedback on the EMM

A key consideration is the extent to which the indicator system adopted in 2015 was appropriate and effective. 24 indicators were selected across 8 (sub-)priorities consisting of one headline, input, output and result/ outcome indicator were included across six priorities. An exception was Priority 2 and 5, which were split into two different sub-priorities. A further key issue is the extent to which the EMM indicators used in the 2015-2020 period have ongoing relevance, and/ or whether some

indicators have now become obsolete. The findings in respect of the monitoring and indicator system are that:

- The advantage of selecting a set of 24 indicators grouped around the six ERA priorities (and sub-priorities 2a/ 2b and 5a/ 5b) was that the indicators were considered manageable and proportionate by most Ministries. This is also the view in the online consultation, where >60% respondents considered the number of indicators to be appropriate.
- Civil servants were able to perform an analysis of ERA monitoring data themselves, without requiring any external support from consultants. However, performing the ERA monitoring function at national level was still considered to be challenging in some countries, due to a lack of dedicated resources for ERA monitoring.
- There were disadvantages in selecting only one indicator per Priority by type (e.g. one headline, input, output and result/ outcome indicator). As most priorities are complex, and involved different sub-priorities, only some elements of a particular priority could be monitored and not the full complexity.
- Moreover, sometimes a particular priority has more than one objective, such as Priority 3, where the objectives include fostering the mobility of researchers, but also support the enhancement of their career development.
- The 24 indicators were seen as being broadly relevant by national Ministries back in 2015 when they were selected, as there was a logical rationale for the choice behind each specific indicator. However, a drawback was that the indicators were often indirect, which undermined their relevance, in the views of some stakeholders.
- However, it should be stressed the strong reliance on indirect, context indicators was the result of the ad hoc Working Group on ERA Monitoring being given Terms of Reference that envisaged keeping the indicators as simple as possible, using existing indicator sources and data sources rather than collecting any new data. Therefore, the indicator set was developed working within these limitations. There was stakeholder buy-in to the EMM to some extent, as ERAC experts themselves from the Working Group selected the indicators. However, when the final set of indicators was presented, there were mixed views on the indicators' appropriateness. Whilst the indicators were broadly accepted, some stakeholders questioned their efficacy. This is also reflected in the diverse views in the survey regarding the EMM's overall effectiveness, with the following results observed - very effective (0%), somewhat effective (32%), neutral (20%) and not effective (32%). Some other respondents did not comment (16%). See Annex 8 for all survey responses.
- The selection of indicators was necessarily driven by data availability at EU-level, as Member States were reluctant to collect any new data, so existing data sources had to be relied upon.
- In common with any indicator system, stakeholders observed that certain indicators are more relevant in some countries than in others. Contextual factors influence the relevance of certain indicators at country level, with differences in R&I systems and their maturity adding further levels of complexity.
- Many indicators were contextual and indirect and there was little direct relationship to the types of activities being supported, or to the activities and Work Programmes of the ERAC SWGs (e.g. Priority 1 – strengthening the effectiveness of national R&I systems). Despite this, the context indicators nonetheless often remain relevant to the priorities concerned.

- Very few indicators directly measured progress at a Priority level, given the constraint of relying on existing EU data sources, and also the need to have access to reliable data frequently updated. Stakeholders pointed out that a structural challenge in developing effective indicator systems is that the priorities are often agreed on first at a political level, with the selection of indicators only happening as part of a second step. The identification of an optimal set of indicators is often then constrained by data availability issues which means that it is not possible to directly measure progress towards the policy objectives defined.
- For example, context indicators were used under P3 (the Open Labour Market for Researchers) at the input and output levels. The number of research positions advertised on EURAXESS was not directly linked to more operational objectives e.g. pursuing open, transparent and merit-based recruitment of researchers. However, this perception-based indicator with data available once every three years through the MORE Survey of circa 10,000 researchers is not without merit.
- Even for priorities in which there has been a considerable evolution in the policy orientation and focus of activities being supported, such as Priority 2b (e.g. ESFRI research infrastructures), the indicators agreed in 2015 relating to national roadmapping and the level of participation of particular countries in landmark ESFRI projects remain relevant. However, they could be complemented by new indicators to reflect improvements in data availability (e.g. national investments in landmark ESFRI projects in million EUR is available on a comparable basis, which was not the case in 2015). Moreover, there are new priorities in the area of research infrastructures that need to be monitored, such as optimising the usage of such RIs, by opening up access to different types of researchers, SMEs, etc.
- Although some composites were included in the EMM, most were subsequently discontinued. An exception was the Adjusted Research Excellence Index (AREI) indicator, developed by the JRC. Stakeholders were not in favour of the use of composite indicators generally either in the EMM 2015-2020 or in future.
- A small number of indicators have become obsolete over time. For instance, under P2a, the indicator MS' participation in public-to-public partnerships per researcher in the public sector uses ERA-LEARN data. However, ERA-LEARN will be discontinued after Horizon 2020, although in Horizon Europe, a partnership-based approach will be continued.
- No targets were set in the 2015-2020 period, as the Ad hoc Working Group on ERA monitoring did not consider this appropriate, given differing baseline situations and the difficulty in comparing performance across very different countries from an R&I system and performance perspective. A one size fits all approach was not seen as possible in monitoring progress in R&I across the ERA. Nonetheless, some degree of comparison has been possible based on the data presented in the ERA Progress Reports and NAPs.
- The ad hoc Group's set of 24 indicators did not contain any new indicators, but only focused on existing ones. This was due to the specific Terms of Reference that the Commission gave to the Working Group to develop the EMM. It was stipulated that the monitoring system should rely on official EU level data sources (e.g. Eurostat, the JRC, MORE surveys) only. This reflected a reluctance among national stakeholders to collect any new data for ERA monitoring
- The reliance on existing indicators meant that ERA monitoring data did not provide especially new insights. However, it was perceived by some stakeholders as having added value, as the data was presented from the perspective of monitoring progress towards the ERA goals across the six ERA priorities. This meant that the data confirmed through a different lens what was

already indicated through other R&I-related reports from Eurostat, the OECD and in the European Innovation Scoreboard. There was an added value in bringing together this particular set of indicators in an integrated form, as these indicators related to the six ERA priorities. National stakeholders considered the EMM to have been valuable even if these indicators already existed, as there were no priority-level indicators available previously.

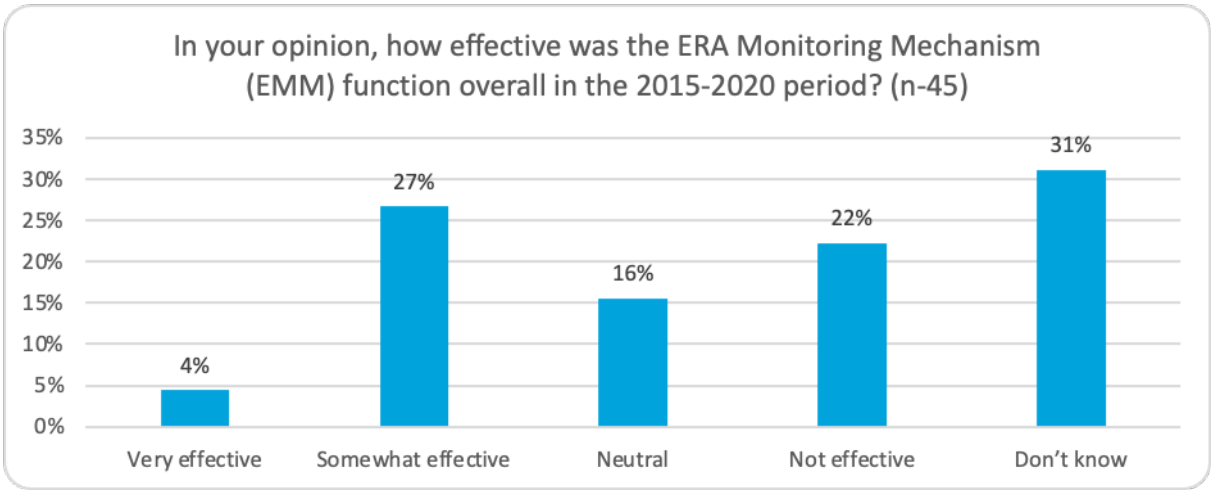
- Some areas of progress within the ERA required an analytical (qualitative) judgement to be made, as quantitative assessment alone could not shed sufficient light on progress. However, only two qualitative indicators were included in the EMM, firstly Priority 5b - a qualitative assessment of Open Access (OA) policies in NAPs and other information sources and secondly, Priority 4 (Gender equality and gender mainstreaming in research), the gender dimension in research content was assessed (output indicator). [20]
- To be effective, monitoring and reporting data needs to be backed up by qualitative interpretation of the data, and may require studies and evaluation to be commissioned.
- Regarding the timeliness of monitoring data availability, an issue raised was the time-lag in data for particular indicators. For instance, the MORE Surveys of researchers' mobility are only conducted once every 3 years, and measure progress over a period of 5 years, while the indicators rely on data which are 2 years old and need another year to be collected at EU-level. This is not unique to the EMM, as time lags in monitoring data to populate assessment of progress towards particular indicators is common to many indicator systems.
- Regarding qualitative indicators, stakeholders noted that some areas of progress cannot easily be measured quantitatively, if at all. For instance, strengthening the effectiveness of national research systems (former Priority 1) was seen as especially difficult to quantify or benchmark performance between countries, as this requires an analytical judgement, and depth knowledge of the national implementation context.
- Some interviewees moreover suggested that the inclusion of more qualitative indicators would have been useful in the EMM. The justification for more qualitative indicators was that:
    - Recognise that some kind of evaluative judgement is needed, especially for less easily measurable and comparable ERA priorities (e.g. former P1 and P6).
    - Allow for the interpretation of quantitative data on national ERA implementation, which is necessary due to the risk of misinterpreting data without context.

Whilst the EMM indicator set has a number of strengths, (e.g. simplicity, reliance on existing, reliable data sources, and avoidance of placing data collection / monitoring burdens on Ministries), its implementation also had weaknesses. The monitoring data generated through the EMM has been used for reporting purposes, as performance against these indicators was used to generate the ERA Progress Report and country fiches. However, monitoring has not been used as a tool at national level to review and revise NAPs, or to draw policy lessons as to how to increase the effectiveness of NAP implementation. Even when monitoring data pointed to the need to review the prioritisation and approach in the NAPs, NAPs were generally not revised at all following their publication in 2016 (for instance, following the 2018 ERA Progress Report and publication of country fiches).

[20] The data source was the Women in Science (WoS) survey. Whilst this had elements of a straight forward yes/ no has gender been considered in research content, qualitative issues were also considered.

Stakeholders responding to the online survey consider the EMM to have been somewhat effective but also point to some weaknesses and challenges in the mechanism (See Figure 2-7). As through the interviews, it is recognised that some challenges in monitoring and performance benchmarking are inherent as there is considerable divergence in national R&I systems, structures and actors across ERA participant countries. The high response rate of respondents not having an informed opinion regarding the effectiveness of the EMM – indicated as "Don't know"- points at the limited involvement and use national stakeholders made of the EMM to action on the findings to adjust national measures.

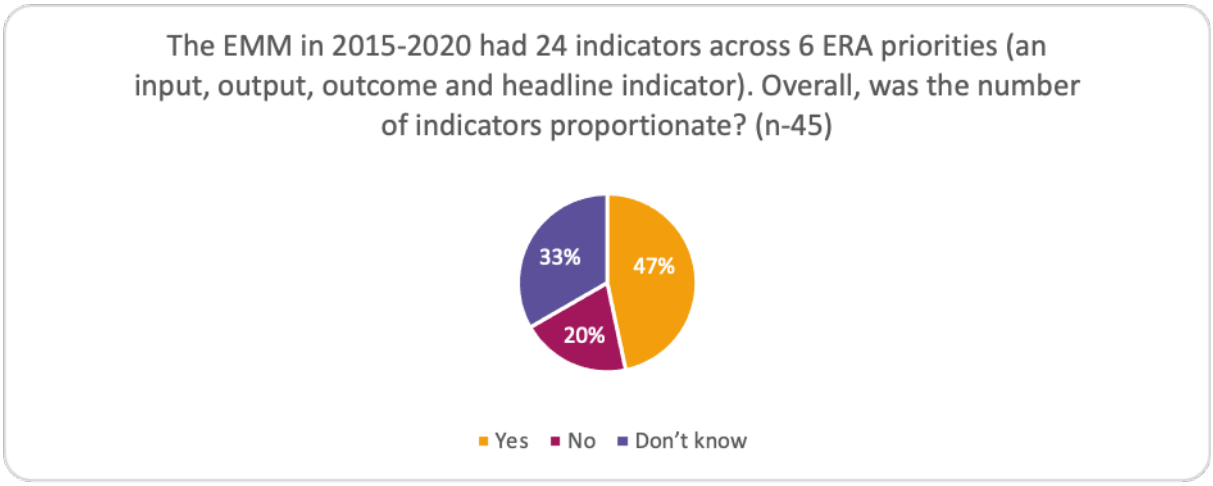
Figure 2-7 - Effectiveness of the EMM 2015-2020 (Q16)



Source: ERA monitoring Survey

In terms of the number of indicators in the EMM, survey responses confirmed the general perception in interviews that these were proportionate. It was agreed that national stakeholders' preferences when designing the EMM 2015-2020 was to limit the number of monitoring indicators to ensure manageability (see Figure 2-8). Again, the high neutral response suggests that some R&I stakeholder were either not very familiar or do not have a strong opinion about the EMM, pointing to the need to increase awareness, buy-in and some type of involvement in the monitoring effort of a wider range of stakeholders to strengthen accountability and action resulting from the monitoring effort.

Figure 2-8 - Proportionality of the number of indicators (Q18)



Source: ERA monitoring Survey

A key issue relating to the ongoing relevance and effectiveness of EMM indicators is that there has been a significant **evolution in priorities and sub-priorities**. Whereas the ERA is dynamic and constantly evolving, the **indicator system necessarily needs to demonstrate continuity and stability**. This influences the extent to which particular indicators can be considered to have relevance looking ahead to the new ERA monitoring system (see Section 3.3), and/ or need to be complemented through additional indicators.

Although there has been a major evolution within some priorities in terms of policy approaches and the relative importance of particular topics, for instance, the growing importance of open science and access to data, the EMM indicators often remain relevant, but need to be complemented by additional new indicators in the new ERA.

Table 2-4 - Examples of the evolution in ERA Priorities over time and impact on indicator relevance

Priority	Comments
Priority 2b – ESFRI - research infrastructures	• The 2015 indicators were perceived as remaining relevant, such as the number of planned ESFRI projects that each MS / AC was planning to participate in, whether each MS/ AC has prepared a national roadmap, and the number of landmark ESFRI projects that have gone ahead. • However, significant investment in pan-European RIs has already been made, and the cohort of different infrastructures, complemented by major investment in e-infrastructures, has reached a more advanced maturity level. • . In future, whilst some areas of ESFRI activities will focus on continuity, there will also be new areas of importance, such as opening up access to pan-European RIs to a broader spectrum of researchers, including to researchers from applied research, industry and SMEs. There is also a strong emphasis on open access and using e-infrastructures to provide virtual access to knowledge and data available through these pan-EU RIs. • New data sources are expected to become available in future. This opens up the possibilities to include new indicators. Data on investments at national level in pan-European RIs was not available on a comparable basis in 2015, but is now.
Priority 3 - Open Labour Market for Researchers	• P3 was concerned with promoting an open labour market for researchers, but also their career development. The indicators focused more on labour market mobility, and the main indicator to do with career development was perception-based (Share of researchers expressing satisfaction that the hiring procedures in their institution are open, transparent and merit-based). • As only one indicator was adopted at each level (e.g. input, output, outcome/ impact), not all operational objectives could be monitored effectively. For instance, there were no indicators relating to the eradication of barriers to labour market mobility across borders, or to intersectoral researcher mobility. • Regarding examples of indicators that have become obsolescent, under P3, the output indicator "the number of researchers' posts advertised through the EURAXESS job portal per 1,000 researchers in the public sector" was regarded as only partially useful in shedding light on the number of researcher positions available advertised on a website fostering international mobility, however, very much an indirect indicator. • As EURAXESS is only one means through which researcher positions are advertised by universities, data is partial. Likewise, the input indicator (share of doctoral candidates with a citizenship of another EU Member State), was viewed as not being relevant in all countries, as there are already high numbers of researchers from other MS in some countries, and attracting more would contribute to brain drain. • Conversely, attracting researchers back to their home Member State could in many of the widening countries be an explicit policy priority (e.g. progress towards reversing brain drain).

Priority	Comments
Priority 5b – Open Access	• There has been progress in the past 5 years in moving beyond open access, to a fully-fledged open science approach, in which open data is increasingly prominent, science communication and citizen science are more widely recognised and open access publishing and open data are linked to improving career assessment of researchers to incentivise them beyond conventional career metrics. • Open access publishing gained support via green Open Access (OA) in some institutions, a number of countries supported gold OA, while diamond OA developed as a third strand – each demonstrating progress through different types of indicators. • Important new initiatives have been launched, such as the European Open Science Cloud (EOSC) and the launch in March 2021 of #OpenResearchEurope, the European Commission's free open access publishing platform for scientific articles that presents the results of research funded under Horizon 2020 and Horizon Europe. However, despite the changes in the field of open access, the indicators within the ERA remained the same, thereby not capturing the essence of ongoing developments related to the issue of priorities changing over time.
Priority 6 - international cooperation	• Quantitative indicators can indicate strategic progress. However, quantitative data on the volume of activity e.g. number of researchers undertaking cross-border labour market mobility, number of bilateral exchanges with third countries, the data does not allow assessment of progress in the *quality* of international cooperation, nor to assess what has been achieved through international cooperation activities.

Stakeholder feedback confirmed that some indicators were selected driven by **data availability at EU-level** as MS were reluctant to collect new data when the EMM was agreed to in 2014. The use of EU data had the advantage the data was comparable. However, a disadvantage was an over-dependency on existing EU data, resulting in many context indicators being selected that were less able to report directly on ERA implementation.

The Priorities and types of activities being supported through the ERA Roadmap in 2015-2020 will differ in some instances in future due to programming changes between Horizon 2020 and Horizon Europe. For instance, the **Joint Programming Initiatives (JPIs)**[21] which operated in FP7 and Horizon 2020 which pooled national research efforts to promote transnational cooperation under Priority 2a will be replaced by **European Partnerships.** However, irrespective of the specific programming instrument (e.g. the JPIs in H2020, as opposed to Institutionalised European Partnerships in Horizon Europe), as there will remain a strong emphasis on partnerships, the indicators will arguably continue to remain relevant.

- Several interviewees pointed out that **indicators are not neutral.** This depends on the extent to which the policy objective(s) that particular indicators are meant to address is considered an important priority across ERA participant countries. A useful indicator from the perspective of some countries may not be useful in others. For instance, attracting European or international researchers is a major priority in some countries, but others already have large number of non-national researchers, and arguably going any further could exacerbate brain drain/ gain issues which are of concern to widening countries.

[21] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/joint-programming-initiatives

- Linked to the point about neutrality is the issue that positive or negative quantitative progress does not automatically mean that the situation has got better or worse without qualitative interpretation to analyse what the data actually means.
- Interviewed stakeholders also made the point that – since indicators are not neutral – some indicators are more important to some Member States than others. It was important to remember that Member States predominantly wish to gauge their own performance over time rather than compare their R&I system to other Member State performances.
- An example was provided from Germany that **benchmarking performance against the EU average is not helpful for all countries.** As Germany has a large population, it strongly influences the determination of an EU average. Therefore, benchmarking its R&I performance could risk ending up comparing itself against an EU average it has itself determined. **Measuring progress against a particular country's own baseline situation, rather than against other ERA countries and focusing on trends analysis rather than absolute values were suggested as alternatives to overcome this problem.** This point was also made by Swedish stakeholders. Alternatively, the benchmarks could be determined by a median figure or the 75th percentile.
- Regarding **composite indicators**, some indicators (produced by the JRC) were included in the indicator system and reported on in the 2016 ERA Progress Report. However, composites were dropped in the 2018 ERA Progress Report, following feedback from national authorities responsible for R&I. There were difficulties for national Ministries in understanding how the composite indicators had been computed, and in checking whether the data was correct, and what it meant for their country.
- One composite remains under P1 (more effective national research systems), the **Adjusted Research Excellence Indicator (REI)**[22] which aggregates four indicators relating to scientific and technological research excellence, the "production" of high-impact publications and patents, and the ability of institutes to attract outstanding research grants and participate in researcher exchanges to pave the way for future excellence and to develop efficient research capacity. This data is computed by the JRC, and is also used as an indicator in the EIS.

2.4.4 Feedback on the EU-level indicator system at national level

Stakeholders' views on the relevance, utility and efficacy of the EU-level indicator system put in place in 2015-2020 from a national perspective is now considered. Regarding how far ERA participant countries have used the common set of indicators in the EMM in their reporting on NAP implementation, it was up to EU-27 MS and ACs to determine whether to use the full set of 24 indicators, a partial subset, or whether to go beyond this minimum set of indicators and to introduce additional indicators specific to national ERA monitoring and NAP implementation. The findings were that:

- Overall, the monitoring indicators was broadly accepted by national Ministries, although some indicators were perceived as being more relevant and useful than others.

[22] Adjusted Research Excellence Index 2020 - Methodology Report G Caperna, 2020, https://ec.europa.eu/jrc/en/publication/adjusted-research-excellence-index-2020-methodology-report

- Some indicators were considered to be contentious in terms of their ability to measure ERA progress. An example was the number of researcher posts advertised on EURAXESS. Many posts are advertised through other sources, and the indicator does not shed light on progress towards merit-based, transparent and open recruitment either, although it is a proxy for mobility.
- Whilst interviewees found the number of indicators (24) to be proportionate, there were challenges in the manageability of indicators in some countries, with the lack of resources a key barrier to effective monitoring. In **Slovenia,** only 18 out of 24 indicators were used, and there were limited resources in the Ministry to undertake ERA monitoring.
- Type and number of indicators at national level vary. Some countries have introduced specific complementary indicators to engage in monitoring at country level such as **Portugal**, whilst others have only used the indicators in the EMM, which is the case of **Switzerland,** which stuck to all EMM indicators to increase comparability across countries.
- In the case of countries who relied heavily on their existing national strategies for their ERA Roadmap implementation efforts, indicators were generally developed closely in line with national priorities, thereby often differing from the EMM indicators (e.g. in **Spain**).
- There are different approaches in terms of organisational responsibility for ERA monitoring at national level. This influences the degree of ownership felt at national level.
- There was a perception in some countries that as the data is provided at EU level, and monitoring data analysis is carried out by the EU through the biennial ERA Progress Reports, MS are not as involved as they would like to be. Some stakeholders felt they were one step removed from ERA monitoring as they were not directly involved in the ERA Progress reports and country profile development or signing off. However, this contrasts with the message at the time from some MS which was that they did not want to collect any new national monitoring data and would be dependent on EU data.
- Some stakeholders had the impression that monitoring activities focused on the EU and national level, without regional involvement. The new EMM could also consider the involvement of the regional level in the context of a multi-level governance.
- The EMM did not include indicators relating to the societal benefits and impacts of European R&I. As the new ERA puts a strong emphasis on these elements, e.g. on the contribution of European scientific research to the Sustainable Development Goals (SDGs), some indicators are suggested in the indicator system (see Section 3.6 – proposed indicators for the ERA Scoreboard).
- The EMM avoided setting targets, as there was no consensus at that time that this would be appropriate (given shared competence for R&I, difficulties in comparing performance between countries under some priorities, reflecting the heterogeneity of R&I systems). Considerations as to whether a small number of targets could be considered is outlined in section 3.4.5.
- Overall, some interviewees questioned the suitability of the EMM to monitor country level progress. One stakeholder suggested that EMM should only be used to measure progress at EU level, whereas NAP monitoring required a different, country-specific approach. Both monitoring exercises, they described, "would measure two different angles of the same effort", complementing the understanding of progress made whilst also accounting for country level differences.

- Performance data did not have direct implications for the MS or AC concerned. There was little evidence of countries revising their ERA national action plans to reflect either under-performance or over-performance. It was unclear whether good performance results in national ERA implementation at the Member State level against the indicators would help countries to stay on track in striving towards the objectives in their NAPs. Likewise, it was unclear if poor results led to changes being introduced, or created more distrust.

Overall, the interviews suggested that the monitoring system generated performance information and data that was interesting and sometimes also useful, but not actioned. In fact, most countries did not actively use the EMM. However, it should be recalled that the ERA Roadmap Process was a voluntary one, and it is clearly different given the legal base from say the European Semester process, when there may be implications stemming from MS' performance.

2.4.5 Data sources

Annex 1 lists existing EU data sources used to support the EMM indicators. These include a combination of Eurostat and other EU data sources, and survey data, which is often but not always perception-based. Among the issues relating to data sources are whether the existing data sources (linked to indicators defined in the EMM) will continue to be available to serve ERA monitoring and with the same frequency of reporting as previously, or longer time lags. Secondly, the question as to whether any new data sources are likely to become available needs to be taken into account.

Additional considerations to data sources and data availability is provided in section 3.3.6.

2.4.6 Lessons learned from the EMM

Lessons learned from the choice of indicators and the EMM overall refers to general considerations, such as the overall balance of number and type of indicators, data sources and data availability as well as key aspects like the need to define progress to agree on a shared understanding of the concept for more effective monitoring. For instance, an increase in a given indicator might not necessarily mean nor capture the extent of progress understood as improvement made, as well as considerations around specific indicators, data sources and suggestions for the future EMM.

Overall, although national stakeholders considered the EMM to be useful also if not perfect, no country revised its NAP nor adjusted its measures based on monitoring findings, suggesting a weak link between the monitoring effort and the policy and decision-making dimension. This was further the case as monitoring happened at EU level and did not involve national stakeholders, who considered the EMM indicators to be only partially suitable to measure progress at national level in the context of very different R&I systems.

An outline of lessons learned addresses both dimensions, the overall design of the EMM as well as the selection of individual indicators.

Design of the EMM:

- There is general consensus that no ERA monitoring mechanism will be perfect. Stakeholders agree that the **goal is to design the best possible monitoring mechanism** to further progress in the ERA, and which allows to understand the progress made by individual countries over. For that purpose, defining the monitoring priority, either to focus on the national or EU level, is key.

- A balance needs to be found between the EMM as being simple and easy to understand by stakeholders at the same time as applicable to all countries, and the NAPs, which allow for countries to target their own actions. There will not be a one size fits all approach to monitoring at country level as this would be ineffective.
- Consensus around the **interpretation of key terms** is relevant to ensure the design and agreement on an effective monitoring system. In relation to the revitalised ERA priorities, "excellence" is an example of key term that could lead to differences in interpretation and would need to be addressed.
- Consensus also around **what is understood as progress in ERA implementation** and how to measure it is needed in the context of very different national R&I systems and baseline situations.
- In common with other indicator systems, **quantitative indicators were needed to help measure progress, but qualitative monitoring of the NAPs has proven useful** in assessing progress by helping to interpret and contextualise performance data. This **two-level approach** could continue to be relevant in the future with some adjustments, as NAPs and the EMM are likely to require different indicators to measure progress at these two levels effectively.
- An **increase in the value of a given indicator might not translate into progress in all cases,** just like a decrease in value might not necessarily translate into a step backwards. Especially the challenge around different baseline starting situations could be overcome by establishing a softer approach to measuring progress beyond hard indicators, possibly following a similar approach to the ERAC monitoring effort of 2020 which aimed to measure progress in terms of extent of implementation (measures adopted/ ongoing (<50%, >50%)/ measures that have not been adopted/ cancelled).
- However, for certain priorities or in the case of some actions and measures, it could be better to **complement the EMM by assessing country progress using country-specific indicators instead.** A softer and more qualitative approach could help to strengthen assessment of progress in areas where contextual factors have a strong influence in determining the type of measure appropriate, the types of measures and their implementation (e.g. structural reforms to strengthen the effectiveness of national ERA implementation).

Learnings on indicator selection:

- Achieving **stability in the indicator system** is important for longitudinal comparability reasons, and crucial to ensure the long-term vision of the ERA beyond political, agenda and leadership changes at country and EU level. The new EMM should aim to ensure at least some continuity in some indicators so as to reinforce the longer-term direction of the ERA, whilst also selecting new indicators to reflect the new momentum under the new set of strategic ERA priorities.
- The **time-lag of certain indicators** and the frequency of data collection efforts needs to be taken into account when selecting indicators. Combining long-term monitoring such as OECD datasets with a more agile data collection activity through designated surveys e.g. a 3-year Europe-wide survey related to specific ERA priorities, the MORE survey, additions to the OECD's R&D surveys in the form of add-on ERA-related indicators, etc. could provide a relevant balance with which to overcome the time-lag aspect.

- Existing and potential new indicators should be reviewed to check **data availability** across countries, considering differences in data collection among MS and ACs. For example, Ireland did not collect data on the number of EU PhD students[23] and does so only for third country nationals. Potential reliance on OECD data would lift the burden of additional data collection and ensure an inclusive approach towards ACs too.
- **Trade-offs are needed in the selection of indicators**, such as whether a longer or shorter list of indicators should be adopted at Priority level, the resulting burden on data collection at country level and the choice of indicators themselves. Quantitative indicators are perceived to be insufficient by themselves to measure progress, given differences between countries. A greater emphasis should be placed on qualitative indicators in future to measure quality and degree of implementation of the measures, e.g. type of international cooperation partnerships and the quality and impact of the activities being supported rather than the number of international cooperation partnerships set up alone, which is only an indicative output.
- There was a **general consensus around the use of a headline indicator for each priority,** with additional complementary indicators. A similar format could be suitable in future for the ERA scoreboard, but with more visual progress monitoring. This approach would allow for good usage of the scoreboard at different levels, with the headline indicators used mainly by political and governance actors like the relevant Ministries whilst more operational indicators would provide more granular information for national policy makers and wider R&I stakeholders.
- The indicators **did not differentiate between results** (intermediate outcomes) **and impacts** (longer-term outcomes), as there was instead only an outcome/ impact indicator. Separating the two could be beneficial to better capture outcomes. Results are more readily quantifiable, whereas impacts often require qualitative assessment.
- **The collection of new, objective and factual data sources could be useful to supplement perception-based survey data.** Whilst new, objective data could be collected e.g. on researchers' working conditions and remuneration, survey data can serve as a validation tool and provide context regarding ongoing measures and progress, especially in instances where data does not give the full picture (e.g. use of the MORE Survey of Researcher Mobility to assess progress towards merit-based, transparent and open recruitment).
- **Proxy indicators serve a useful purpose as** they indicate strategic achievements, but indicators to assess the measurement of progress directly should also be included.
- The focus should be on choosing **indicators that are accepted as being neutral** by stakeholders. This would mean avoiding context-specific indicators, especially quantitative indicators and to balance these with more qualitative indicators, to allow for a more representative and accurate measurement of progress and degree and quality of progress.
- The future indicators should result from an **inclusive, participatory process** with ERA countries to ensure buy-in and ownership. Although this was the case in the 2014 EMM indicator selection, where MS and ERAC delegates played a key role, this should be

[23] This has now changed and there is nationality data available for students demonstrating that data sources for indicators will change over time.

accompanied by additional communication for shared uptake and visibility across countries. Value could be gained by engaging with key European stakeholder organisations whose national members may be asked to provide data for indicators (e.g. universities providing details of student and researcher mobility).

- **Involving country representatives in the monitoring mechanism**, possibly with the role of observers or with a more active role, could strengthen the impact of the monitoring and evaluation efforts carried out at EU level. This could further lead to greater efforts at national level to adjust measures based on the progress evaluation and increase the ownership at national level.
- It is important to include and **link the monitoring mechanism to the policy design process** so as to ensure that R&I policy is evidence-based. Monitoring indicators will need to be carefully selected as they will be used by politicians and stakeholders in their decision-making and policy-making efforts.
- **ERA Scoreboard average and / or top scores could be used as a benchmarking tool** for countries performing less well, and serve as an inspiration source to learn more about successful measures to encourage best practice sharing among countries.

A short case study example of the extent to which particular indicators may be regarded as an important ERA priority in some countries, but not in others is provided in the box below.

The interviews with national stakeholders, the online survey answered by different types of stakeholders as well as the Workshops and Steering Committee meetings served as relevant channels to obtain feedback on lessons learned from the EMM to incorporate them into the design and implementation of the monitoring mechanism of the revitalised ERA priorities in the coming years.

Box 2-1 – Attraction of international talent as measure towards P6 International cooperation

The number of non-EU PhD students as share of all PhD students is the output indictor of the ERA EMM to measure progress for Priority 6 International cooperation. However, this has proven problematic due to different realities at country level which result in different priorities across ERA countries:

- Attracting talented researchers from different EU countries and third countries is a major priority in some EU MS such as Lithuania or Netherlands, where efforts are being undertaken to increase the share of international PhD students.
- Countries with an already high share of foreign researchers such as Switzerland, Denmark and Ireland do not consider this to be a priority. In these cases, the good performance on this particular aspect and indicator, renders less significance to this priority, allowing to focus efforts elsewhere.
- A third set of countries rather focuses their efforts in retaining national researchers, who often prioritize opportunities in other generally more prestigious countries. This includes Bulgaria but also Lithuania and Denmark. Retaining talent is already a challenge in itself, thereby constituting the focus over attracting international talent at least in the short and medium term.
- Given the different starting situations across countries, contextual indicators prove problematic in capturing progress as not encompassing nuances nor the factors playing into the individual contexts.

3 A NEW ERA POLICY FRAMEWORK AND MONITORING AND INDICATOR SYSTEM

3.1 THE NEW ERA POLICY FRAMEWORK

In this section, forward-looking elements of the study are analysed. The evolution of the ERA policy framework through the launch of the revitalised ERA Communication in 2020 is examined. The implications of the new ERA policy framework for the development of a revised monitoring and indicator system to monitor implementation through the development of a future ERA Scoreboard, are considered.

3.1.1 The 2020 ERA Communication

The new ERA Communication was adopted on 30th September, 2020,[24] accompanied by a Staff Working Document (SWD),[25] outlining the vision for detailed ERA implementation. The new ERA Communication is structured around four strategic priorities, presented in Table 3-1.

Table 3-1 - Revitalised ERA Priorities 2020

Revitalised ERA Priorities 2020	Description
1. Prioritising investments and reforms	The objective will be to accelerate the green and digital transitions and to increase competitiveness, and to accelerate the speed and depth of the recovery.
2. Improving access to excellence	Striving towards greater excellence and stronger R&I systems across the whole of the EU. Ensure that best practices can be disseminated faster across Europe to spread excellence, including in widening countries.
3. Translating R&I results into the economy	R&I policies should aim at boosting the resilience and competitiveness of our economies and societies.
4. Deepening the ERA	Further progress on the free circulation of knowledge in an upgraded, efficient and effective R&I system, by moving from an approach of coordination towards deeper integration between national policies.

Source: Revitalised ERA Communication, 2020

The **Council Conclusions on the Future of the European Research Area** (December 1st, 2020)[26] stressed a number of issues, such as:

[24] Brussels, 30.9.2020, COM(2020) 628 final, Commission Communication A new ERA for Research and Innovation
[25] COMMISSION Staff Working Document accompanying the Commission Communication: A new ERA for Research and Innovation, SWD/2020/214 final
[26] Council conclusions on the New European Research Area, Brussels, 1 December 2020
https://data.consilium.europa.eu/doc/document/ST-13567-2020-INIT/en/pdf

- The new ERA should be based on shared responsibilities, through the participation of stakeholders and citizens in ERA governance, building on the diversity and strengths of the European R&I ecosystems, being responsive to smart directionality;
- The importance of regular dialogue and developing corresponding policy support instruments beyond financial support, including provision of analysis, guidance, advice, technical support, monitoring and data analytics activities;
- The need to build on the strengths of the European R&I ecosystem and the diversity of Member States' R&I policy frameworks. This is necessarily based on a voluntary approach but should ensure broad national participation in concrete ERA actions;
- The role of fundamental research in ensuring excellence, attractiveness and the competitive edge of R&I ecosystems;
- The importance of "deepening the ERA" so that it becomes a shared goal of the EU and Member States to strive for better working, employability and other relevant framework conditions and to unlock cooperation potential and the connectivity in the ERA of researchers at, project, programme and institutional level;
- The added value of strategic and concrete ERA actions is to be increased by jointly designed and implemented actions according to an agreed selection methodology, based on criteria accounting for EU and national added value, efficiency, effectiveness, relevance, coherence and impact; and
- The Commission's role in stimulating and incentivising Member States to make the reforms and investments necessary to achieve better interoperability in the EU, with financial support through relevant EU programmes and instruments (especially the EU R&I Framework Programme).

The **ERA Forum for Transition**, an Expert Group co-chaired by the Commission and the Member States, was charged with developing the new ERA by way of a co-creation process between the EC and the Member States. The ERA Forum is playing a key role in shaping the future **ERA policy agenda,** in particular the development of the **ERA Pact.** The ERA Forum has held a number of meetings to date, for instance to review the **ERA pilot initiatives**, and to agree the joint policy priorities in the new ERA Pact. In the second half of 2021, it will review the recommendations in this report regarding the new ERA Scoreboard and wider monitoring mechanism.[27] [28] A **"permanent Forum"** is expected to steer and coordinate the further implementation of the new ERA from 2022**.**

The new ERA should have a **multi-level ERA governance framework** to be designed by the **ERA Forum** integrating contributions from the **Pact for Research and Innovation in Europe**, also to be designed by the ERA Forum. The December 2020 Council conclusions defined the principles for designing the new ERA governance model (Box 3-1).

[27] https://ec.europa.eu/info/news/commission-launches-new-era-forum-transition-2021-feb-08_en
[28] https://era.gv.at/news-items/era-forum-for-transition-established-to-realise-the-new-european-research-area/

Box 3-1 - Principles for the new ERA governance model

According to the December 2020 Council conclusions, the new ERA governance model should be driven by the following principles:

- **Inclusiveness**: Involvement of all Member States including regional authorities, the European Committee of the Regions, R&I stakeholders and civil society, where appropriate.
- **Effectiveness**: Defining lean governance processes appropriate to develop and implement the ERA actions by setting common objectives and deciding on the necessary steps to implement ERA initiatives, involving relevant sectoral policies.
- **Coherence**: Striving for more exchange and cooperation between regional, national and EU-levels to address structural issues within and outside the remit of R&I policy.
- **Efficiency**: Linking up with the proposed Horizon Europe strategic planning process to enhance the alignment of R&I policies and measures at an early stage, thus broadening the scope and impact of national and EU R&I actions.
- **Evidence-informed approach**: Fostering, in close cooperation with the Commission, a review of the ERA monitoring system including its indicators and reporting procedures considering the proposal of the Commission of establishing a yearly ERA scoreboard, and seeking to provide technical and expert assistance to Member States for the improvement of national ERA monitoring activities and their connection to the European Semester and the deployment of their Recovery and Resilience plans.
- **Relevance**: Policy-driven priority-setting through, inter alia, an appropriate role of the Council as well as policy debates through regular ERA ministerial conferences involving stakeholders and partners beyond the Member States, as appropriate.

3.1.2 Recent developments: the ERA Pact and the ERA governance architecture

The "Pact for Research and Innovation in Europe", hereinafter called 'ERA Pact', was adopted by the European Commission and published in July 2021. It sets out a shared vision and joint strategy for taking forward the implementation of new ERA policies. It builds on common values and principles for research and innovation in Europe and plans engagement with research and innovation stakeholders. The ERA Pact is at this stage a proposal, and will be considered for adoption by the Council as a Recommendation during the Council meeting of November 2021. Four strategic objectives have been set, supported by 15 different thematic priorities. The priorities for joint action that have been established are outlined in the table below.

Table 3-2 ERA Pact priority areas for joint action

ERA Pact priorities	Description
1. Deepening a truly functioning internal market for knowledge	Sub-priorities include: • Open Science • Research Infrastructures • Gender equality, equal opportunities and inclusiveness • Careers and mobility of researchers and research assessment and reward system • Knowledge Valorisation • Global engagement
2. Taking up together the challenges posed by the twin green and digital	Sub-priorities include: • Challenge-based ERA actions

	transition, and increasing society's participation in the ERA	• Synergies between R&I policy, education policy and the EU Skills Agenda • Synergies between R&I policy and industrial policy, in order to boost innovation ecosystems • A more active citizen and societal engagement in research and innovation in all its dimensions
3.	**Amplifying access to research and innovation excellence across the Union**	Sub-priorities include: • More investments and reforms in countries and regions with lower R&I performance • Synergies between Union, national and regional funding programmes • Increased collaborative links and excellence-based integration of research-performing organisations from countries with lower research and innovation performance
4.	**Advancing concerted research and innovation investments and reforms**	Sub-priorities include: • Support to prioritise and secure long-term research and innovation investments and policy reforms • Coordination of research and innovation investments

Source: ERA Pact, 2021

The draft Council conclusions of 7 September 2021[29] clarified a number of issues with regards to the ERA governance architecture:

- The Council will retain its decision-making and policy guidance role, based on the priorities of the ERA policy agenda (to be prepared by the Commission) and the mid-term assessment of the policy cycle.
- The future Council Presidencies are invited to consider within their planning of Competitiveness Council agendas an item for reporting on the progress of ERA implementation at national levels and organising an ERA ministerial conference to guide the evolution of the ERA.
- ERAC is maintained in its current form of an advisory body co-chaired by the Commission and the MSs.
- The ERA Forum, a body co-chaired by the Commission and Member States to be established by 2021, will assume responsibility for coordination and reinforced implementation of the new ERA.
- A key difference between ERAC and the ERA Forum is that ERAC can provide advice to the Council, whereas the ERA Forum will be responsible for the implementation of the policy agenda in a coordination between the member states and the Commission.
- The implementation of ERA Actions can involve the creation of time-limited and objectives-bound sub-groups of the ERA Forum. Standing sub-groups for the governance of individual ERA Actions or priorities could be justified when they are in place for advice on the entire policy cycle.

In terms of the implications for this study of the ERA Pact's publication and the September 2021 draft Council Conclusions, the evolution in strategic priorities between the publication of the 2020 ERA Communication and the new texts have been reviewed. In carrying out the indicator shortlisting, the new classification of priorities in the ERA Pact has been used (see Section 3.3.4)

[29] https://data.consilium.europa.eu/doc/document/ST-11622-2021-INIT/en/pdf

and the new elements in the governance architecture have been taken into account in finalising our recommendations on the ERA governance (section 4.2.1).

3.1.3 Links between the new ERA and other key EU policies

The Council Conclusions highlight links between the ERA and the political priorities outlined in the Von der Leyen Presidency in the 2019-2024 period: the **EU Strategic Agenda 2019-2024** underlines the need to increase research efforts by addressing the fragmentation of European research, development and innovation and recognises that Europe needs to do more to ensure equality between women and men, and to foster equal opportunities for all.

The new ERA will contribute towards putting in place the necessary framework conditions and setting the overall direction for Member States and the EU to deliver on their research, innovation and investment agendas, putting the Sustainable Development Goals (SDGs), the European Green Deal and Digitalisation as primary focus areas of the proposed thematic actions. The new ERA Communication also stresses the need for EU R&I policies to contribute to addressing the immediate challenges posed by the COVID-19 pandemic and the need to support research into coronaviruses and the development of vaccines, but also medium-longer term socio-economic challenges.

The **dual digital and green transitions**, as set out in the Communication on a European Green Deal[30] and Communication on A Europe fit for the digital age[31], will depend on the capacity of European Researchers to attain ambitious scientific and technological breakthroughs in the respective fields. Such breakthroughs will be more likely to happen with common approaches and cooperation schemes developed in the ERA framework. The "**New industrial strategy**" fosters a new approach to innovation, to be fuelled by increased investments in disruptive and breakthrough research[32].

Horizon Europe (2021-2027), the **EU Framework Programme for R&I** is the most important instrument at EU level for supporting and implementing the ERA. In addition to funding the development of European Infrastructures, there are new elements in Horizon Europe that offer direct support to the new ERA objectives. These include:

- the next generation of R&I European partnerships that offer increased opportunities for joint programming to lead into significantly increased joint action;
- the European Innovation Council (EIC) that aims to bring more breakthrough technologies to market and make it easier for small businesses to grow to a global level of operation; and
- the requirement for public organisations of the EU to have Gender Equality Plans as a pre-condition for participation in programmes funded by Horizon Europe as of 2022.

Other centrally-managed EU programmes, such as the **Digital Europe Programme**, can be mobilised to support the objectives of the new ERA.

[30] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[31] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age_en
[32] European Commission (2020) A New Industrial Strategy for Europe COM(2020) 102 final

The new ERA should align with **Cohesion Policy and the new Recovery and Resilience Facility**. These major EU funding programmes support R&I investment and reforms decided by the Member States in agreement with the Commission.

Cohesion Policy supports R&I investments as key to bridging the innovation divide in Europe and achieving stronger economic and social convergence. In 2021 – 2027, five main Policy Objectives will drive investments under Cohesion Policy. Of direct relevance to the new ERA is policy objective 1**: Smarter Europe, through innovation, digitisation, economic transformation and support to small and medium-sized businesses**, as this aims to: (a) enhance research and innovation capacities and the uptake of advanced technologies; (b) reap the benefits of digitisation for citizens, companies and governments; (c) enhance growth and competitiveness of SMEs; and (d) develop skills for smart specialisation, industrial transition and entrepreneurship.

The importance of Research and Innovation investments for new EAR P3 is further highlighted in the introduction - starting in the 2014 – 2020 period - of the concept of **Smart Specialisation Strategies (S3)** in EU Cohesion Policy. S3 supports regional prioritisation of innovative sectors, fields or technologies through the 'entrepreneurial discovery process', a bottom-up approach to reveal what a region does best in terms of its scientific, technological and economic attributes and strengths.

Smart specialisation can be considered as a meta-policy. As further discussed in Section 3.1.3, it is a policy process rather than an innovation policy in its own right that is based on participatory approaches involving different stakeholder groups related to R&I and economic development.

The **Recovery and Resilience Facility (RRF)**[33] was created in 2020 to address the negative social and economic impact of the COVID-19 pandemic. Its aim is to promote the economic, social and territorial cohesion of the EU, by improving the resilience, crisis preparedness, adjustment capacity and growth potential of the Member States. RRF provides large-scale financial support to public investments and reforms addressing the country-specific challenges identified in the European Semester and promoting the green and digital transitions. To access support from the Recovery and Resilience Facility, Member States have to submit **Recovery and Resilience Plans (RRP)** that set out their reform and investment agenda for the years 2021-2023.

In their February 2021 meeting, the EU ministers in charge of Research and Innovation recognised that the RRF offers a unique opportunity to strengthen the ERA and to make it more impactful and broadly agreed that investments and reforms in R&I systems should be appropriately reflected in the national RRPs. [34]

3.1.4 Opportunities for synergies with other R&I funding instruments

A major challenge for the new programming period 2021 – 2027 will be for the new ERA to build **strong synergies** with the Cohesion Policy / S3 and new Recovery and Resilience Plan processes. The study on the ERA Policy framework found that in the period 2015-2020 the synergies between ERA and Cohesion Policy/S3 were not well developed.

[33] https://ec.europa.eu/info/strategy/recovery-plan-europe_en
[34] https://www.consilium.europa.eu/en/meetings/compet/2021/02/26/

Specific aspects of these policy systems that are relevant to the ERA policy framework are presented in Table 3-3 below. A common feature with ERA is that, Cohesion Policy and RRF are based on a framework defining general objectives that is decided at the level of the Council, while each Member State has to develop National Strategic Documents and Operational Plans (OP). However, unlike ERA, the OPs are based on guidelines and detailed templates to be used to define priorities and expected results, along with associated actions and resources. The corresponding roadmaps are then used to monitor physical and financial progress in the implementation of the programmes.

Table 3-3 – Main characteristics of related EU policies

	Cohesion Policy / S3	Recovery and Resilience Facility
High-level policy engagement	Priorities at EU level are defined at the level of the European Parliament and the Council of European Union MS Governments are in charge of defining the strategy (NSRF) and implementation (OPs)	The Facility is a dedicated instrument designed to tackle the adverse effects and consequences of the COVID-19 crisis in the EU. MS Governments are in charge of strategy and implementation
Inclusive stakeholder engagement	The MS strategy and Operational Programmes are developed in partnership with: • regional, local, urban and other public authorities; • economic and social partners; • relevant bodies representing civil society, including research institutions and universities	Support under RRF should be additional to the support provided under other EU instruments. It is for the benefit of the MSs to follow the partnership approach followed in the context of the ESIF
Clearly defined & quantifiable objectives & targets	Detailed descriptions provided in each Operational Programme	The policy areas to be supported are structured in six pillars[35]. MSs develop detailed RRPs based on these pillars to be approved by the European Commission
National agenda setting process	Extensive consultation process with all stakeholders involved in the partnership agreement	MSs may use a similar approach as the one for ESIF
Monitoring system in place	Monitoring committees with balanced representation of MS authorities and intermediate bodies and of representatives of the partners	The RRPs are monitored through the European Semester reports. The EC will develop by December 2021 a Recovery and resilience Scoreboard to measure progress of the implementation of the RRPs of the Member States in each of the six pillars.

Looking more closely into **Cohesion Policy / S3**, a recent study by the JRC on the governance aspects of S3 describes Smart Specialisation as a "complex policy space", involving different levels of government and governance arenas as well as a mix of objectives, policy domains and

[35] These are: (a) green transition; (b) digital transformation; (c) smart, sustainable and inclusive growth, (d) social and territorial cohesion; (e) health and economic, social and institutional resilience; (f) policies for the next generation, children and the youth, such as education and skills.

instruments.[36] In this sense it has a lot of similarities with the ERA policy process which covers multiple policy domains and different levels of government.

S3 has some commonalities with the ERA in that it attempts to promote institutional change, especially in less favoured regions. A big difference with the ERA policy process is that it has 'enabling conditions' ('ex-ante conditionality' in the 2014 – 20 period) that require certain conditions to be met before Cohesion Funding for R&I can be received. In a number of EU Member States, the dependency on Cohesion Funding as a source of investment in R&I is very high, and thus the high-level political commitment to taking part in the S3 processes is strong.

The S3 process was supported by a comprehensive guideline and thematic background papers. In addition, the S3 Platform, managed by the Joint Research Centre has provided additional guidance with information and resources and dedicated workshops and seminars for policy makers across Europe to enhance policy learning. There was no structured S3 template or a very detailed description of what should be included in an S3 Plan in order to encourage a process of building up from the ground in the regions and to take account of the large variety of circumstances and in the priorities chosen by these regions. The European Commission employed external reviewers to assess the quality of the S3s and to help the regions to improve their plans.

The aforementioned JRC study concluded that smart specialisation has made policy- making and governance of innovation policy more inclusive, as the process was based on extensive stakeholder involvement (businesses and their network organisations, universities, local, regional and national authorities and so on) nationally and regionally. S3 strategies are, therefore, stakeholder-driven and involve extensive consultation, including new actors not previously involved in the development of R&I strategies. This is fully compliant with the principle of inclusiveness from the new ERA governance model (Figure 3-1). Another important result was that the S3 policy process has improved inter-government coordination across policy levels and domains. In comparison to most ERA NAPs, developing the S3s was a more extensive exercise, often taking 6-9 months and involving many actors.

The main recommendation of the JRC study for the future of smart specialisation is that it should recognise more explicitly the need to upgrade the quality of governance and policy capacity in order to ensure institutional reform. This holds true for the ERA policy process as well.

The potential for strategic links between Smart Specialisation strategies and the objectives of the new ERA should be highlighted. For example, many Smart Specialisation strategies prioritise knowledge transfer, innovation and partnership working through an ecosystem-based approach, which could be highly relevant to Priority 3 of the new ERA. Moreover, S3 strategies also incorporate actions necessary to improve national or regional research and innovation systems, which could contribute to Priority 1 of the new ERA by helping to strengthen the effectiveness of R&I systems and by bringing the necessary R&I actors together.

The ERA also has a role to play in the **European Recovery Plan** and in the development and implementation of **RRPs.** The new ERA Communication mentions for example the role of the Forum for Transition in helping to focus the new ERA process by *"working with the Member States to*

[36] Guzzo, F. and Gianelle, C., Assessing Smart Specialisation: governance, EUR 30700 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-37673-6, doi:10.2760/48092, JRC123984.

prepare the R&I angle of the national recovery plans, so as to maximise the benefit from cohesion funds, to implement the industrial strategy through work on industrial ecosystems and to discuss regulatory and non-regulatory initiatives to create a favourable framework for R&I in the EU". (pg. 7, new ERA Communication). The RRPs will become the main reference document on the Member States' forward-looking policy initiatives. Given the complementarities with the European Semester, Member States are encouraged to integrate the RFP and their National Reform Programme in a single document that will provide an overview of the reforms and investments that the Member State will undertake in the next years, in line with the objectives of the Recovery and Resilience Facility.

The policy cycle for Cohesion Policy - especially the aspects related to Smart Specialisation - and the Recovery and Resilience Facility offer useful insights with implications for the design of the ERA policy framework, providing, as they do, clear examples of initiatives with strong political ownership and high degree of stakeholder involvement.

3.2 STUDY APPROACH TO THE FUTURE OF THE ERA POLICY FRAMEWORK

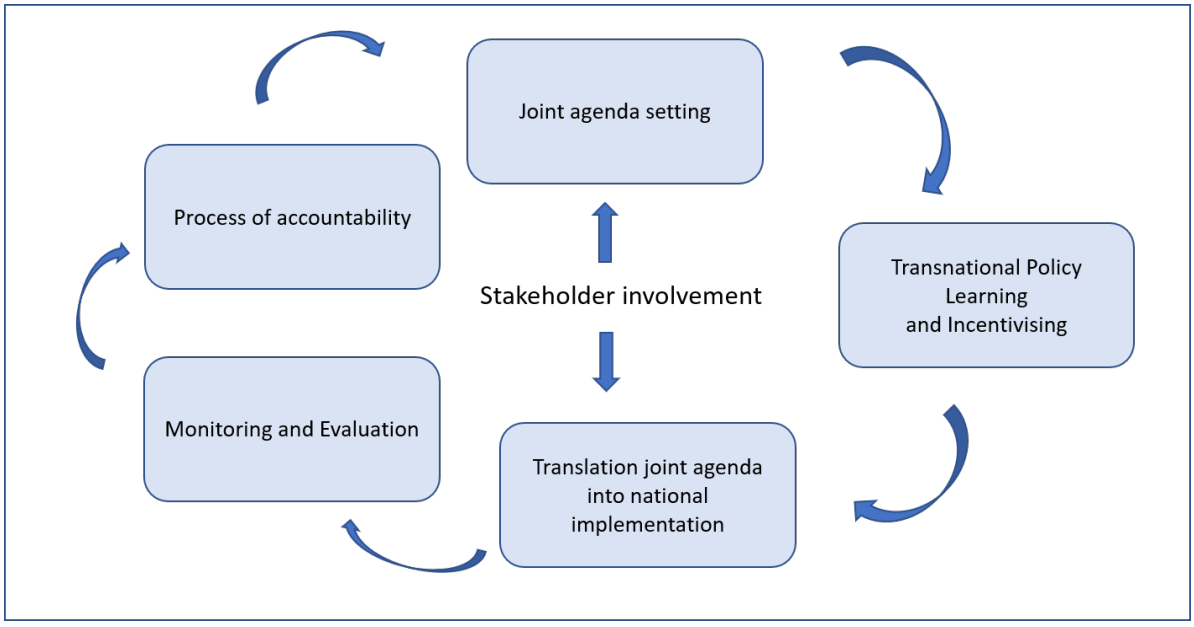
The ERA Policy Framework includes its governance, monitoring and advisory system. ERA governance concerns the processes that are used for interactions between the European Commission, national governments and stakeholders and that lead to policy decisions and measures. As stated in the Treaty of the European Union, research and innovation policy is a shared competence.

3.2.1 ERA governance

As a helpful tool for developing the analysis of the ERA governance framework from a structural perspective, we will examine the **key functions** of governance in the ERA policy cycle to structure the findings of the empirical work. This can be used both for the lessons learned from the past and the reflections provided by stakeholders on the future ERA.

The following Figure 3-1 provides a simplified schematic of the aspects of the policy cycle that are typical of the ERA governance process.

Figure 3-1 - The ERA Governance Cycle's key functions



An ERA policy cycle has a number of additional complexities and phases compared to the more common national policy cycle. The five key functions of the ERA governance can be shortly described as follows:

- The **joint agenda setting** currently involves Member States, Council, ERAC and the various Standing Working Groups (SWGs), the European Commission and ERA Stakeholders (participating in the ERA Stakeholder Platform). In addition, the ERA Forum for Transition has since February 2021 played a role in informing the debate regarding the development of a joint ERA policy agenda and on how to monitor ERA implementation. The Forum is composed of Member State representatives (and one representative from each EEA/EFTA Country).
- The new ERA has the ambition to widen the types of stakeholders (e.g. industry, researchers and citizens so as to include both the public and the private sector). This will allow them to be involved in agenda-setting (with more policy dialogues) as well as expand the linkages to other policy domains (e.g. the Green Deal, Digitalisation, Cohesion funds and smart specialisation). It will require additional mechanisms for consultation and input into the agenda-setting process. Key issues are what system to use for developing new actions and how to develop this in a systematic manner, in line with other strategic planning cycles.
- The ERA activities provide additional mechanisms for **policy learning**, for instance in the ERAC SWGs and the Policy Support Facility (PSF), so as to encourage reforms and the exchange of good practice between the Member States and Associated Countries. Our study brings evidence that this has provided very helpful stimuli to adopting new approaches in national R&I systems. The new ERA governance regime aims to develop even stronger incentives to promote change and foster reform and this process needs to be integrated into the ERA policy development and implementation lifecycle.
- An essential step for the success of ERA is the **translation** of the joint policy agenda and objectives into **national policy implementation**. The national landscapes for implementation are very diverse and the future governance framework will need to take account of this heterogeneity.
- This study includes a strong focus on the **monitoring and evaluation** of the ERA (particularly the EMM) and the new ERA Scoreboard, whose precise form is still being debated (e.g. whether this should be strategic and report on headline indicators or whether there should be a broader indicator set for national level reporting, etc.). It is not only the content of the monitoring system, but also how it is organised and published, and who is responsible for this process (the degree of co-ownership) that will influence ERA governance arrangements and the governance cycle, and determine how the Scoreboard will be used and fed back into the policy cycle. The study will reflect on the role of monitoring and scoreboard in the wider ERA governance system. This includes the reporting and feedback on progress made across all, and in individual Member States.
- The last phase of the Governance Cycle can be labelled as **accountability.** These are the elements in the governance process where Member States report on the progress made towards the achievements of the specific ERA objectives and reforms most relevant to them, and the feedback provided by other Member States and the European Commission on the degree of progress. In the ERA governance system, this has characteristics suggestive of an Open Method of Coordination (OMC) approach in that the ERA – and monitoring aspects – are voluntary, but mutually agreed between the Commission and the

Member States. The new Pact for Research and Innovation for Europe and the Forum for Transition will define what the partnership model and coordination mechanism will look like in the future.

Stakeholder involvement is particularly important in the joint agenda setting phase of the cycle as well as in the phase of translation of ERA objectives into national implementation, and thus both at transnational and at MS/AC level.

The main input for the reflections on these aspects of the governance framework comes from interactions with stakeholders through interviews, a survey and a policy workshop held in June 2021.

3.2.2 Analysis of the policy cycle key functions

3.2.2.1 Joint agenda setting

Key documents such as the Council Conclusions on ERA Governance [37] stress the importance of a close partnership between the Member States (MS) and the European Commission in jointly working towards the strengthening of ERA and cooperating with the countries associated with the Research Framework programmes (Associated Countries (AC)).

The importance of this partnership was confirmed in the interviews that were conducted by the study team. While the earlier years of the ERA process (before 2015) were described in interviews as a more top-down and European Commission-driven process, the partnership model of ERA evolved from that time, partly due to the involvement of Member States in the ERA Roadmap process.

While the European Commission has the right of initiative to shape the ERA, ERAC, the EU's strategic policy advisory committee has been an important vehicle for the policy coordination of ERA, and as a bridge between Member and Associated States and between the MS and AC and the Commission. In 2015, its mission was set out to provide, at an early stage, advice on the identification and design of strategic priorities for policy initiatives on research and innovation relating to the development of the ERA.[38] For the purpose of ERA coordination, ERA-related (Standing Working) Groups were defined with responsibility for the implementation of a designated Priority.

The debates in ERAC and the ERA-related SWGs have been the main platform of joint agenda-setting concerning the ERA priorities and the ERA Roadmap. It was generally considered positive that while the ERA Roadmap provided a common framework for actions to be taken at national level, but without being prescriptive. There was sufficient flexibility to allow this to be translated into the specific national context and to reflect differing levels of performance. The voluntary aspect was considered by some stakeholders to be the most appropriate means of building an ERA based on a partnership model. However, other stakeholders interviewed were concerned that there is a risk if everything remains voluntary in future that the Commission will not play a more active steering role, and/ or that their own government representatives will not take ERA seriously enough.

[37] Council of the European Union, 2018, Governance of the European Research Area, 14516/18
[38] Council of the European Union, 2015, Review of the ERA Advisory Structure, 14875/15

Apart from the legal situation that national R&I policies are within the Member States' mandate and under national sovereignty, a number of interviewees suggested that a non-voluntary approach could become counter-productive and lead to a 'box-ticking' approach, rather than provide a genuine platform for the achievement of common objectives under the ERA.

The main positive element of the ERAC approach identified by interviewees was the exchange of experiences and ideas in ERAC meetings and particularly in the SWG meetings. There were some participants in the priority-specific ERAC SWGs who provided examples of inspiration taken from other countries on how to implement specific actions and policy instruments.

The feedback on the ERA-related ERAC Working Groups was quite diverse across the ERA Priorities. While some were reported to work well, creating added value with specific reports, guidelines and an active role in the EMM process, others were considered by interviewees to have run out of steam very early on and to be repetitive in their annual activities.

Some interviewees mentioned a general pattern of a limited number of MS representatives being very active, while others took a more passive role. One reason suggested for a lack of productivity on the part of the SWGs was the absence of a secretariat and dedicated resources for the WG to produce studies or to collect specific data. Nevertheless, a number of SWGs did manage to produce outputs based on MS surveys, collated and analysed by WG members. It seems that the WGs that were reported as most effective were those relating to priorities with a relatively narrow set of clear common objectives (e.g. gender equality and the common research infrastructure roadmaps). Strong leadership (mostly by the Chair) was also mentioned as a factor for effectiveness in developing a joint policy agenda.

The interviews also highlighted a number of critical issues with regard to the joint agenda setting process:

- While ERAC was meant to be a high-level committee (originally intended to be at Director - General level), over the years, the representation at ERAC consisted of (senior) policy officers from the national ministries and agencies. This has meant that the proximity to high-level decision making has decreased and ERAC members were often not in a position to translate agreements reached in ERAC meetings or in SWGs into national policy decisions. This hampered the efficiency and efficacy of the joint agenda-setting process. Obviously, this pattern varies across MS/AS and there are also examples of good practice where ERA feedback to high level decision functions very well.
- A small number of interviewees characterised the ERAC meetings as being overly-formal and not very dynamic. The setting does not allow for much room to have in-depth debates on ERA priorities, or for instance regarding the degree of progress that has been made in terms of institutional, structural and administrative reforms in individual MS.
- Several interviewees suggested that there is a gap between setting high-level targets, such as those in the ERA Roadmap and the SWG papers, and in turn, the translation of those targets into specific actions at MS level. This led to quite different interpretations of the same target (e.g. open labour market) across different Member States.
- The suggestion was that there should be more guidance or support to bridge this gap.
- Some interviewees mentioned that communication by the Commission on its plans for the future development of the ERA lacks transparency at critical moments. The launch of the Forum for Transition was given as an example of a Commission initiative that took many MS representatives by surprise. However, a point to balance this observation is that the

Forum is very new, and is still in the process of defining how its members will work with the Commission to ensure good governance in future ERA implementation. Moreover, planning for the joint ERA policy agenda feeding into the ERA policy framework is at an early stage.

Overall, the feedback was that the ERA process needed a closer alignment and engagement with high-level policy decision makers and in particular, with the Ministers responsible for research and innovation (R&I). Some suggested that the Competitiveness Council was not the right setting for a discussion on ERA as there are often too many topics on the agenda besides the ERA. In the past, attempts have been made to hold annual Ministers Conferences on strategic considerations for the ERA, but this has not led to a sustainable discussion forum. The reasons put forward for this included a low level of political interest in ERA topics, and a lack of stimulating and challenging meeting agendas that could attract Ministerial attention.

The ERAC final report on the achievements of the GPC concludes that while MS/AC have shown strong commitment to funding joint activities in the short and medium term, there is a lack of a more long- term commitment based on a common strategic agenda. The report makes a plea for a closer link between the JPIs, GPC, ERAC and MS under the lead of the Competitiveness Council, including a proactive role of the EC in the Joint Programming Process.[39]

Nevertheless, adding the topic of R&I to the European Semester did raise the attention paid to the issue of investment in R&I and was said to have empowered Ministers of Education and Science to negotiate for more funding within their own countries.

Another point raised that needs to be tackled in the future is the limited alignment of the development of ERA reform strategies with parallel European oriented policies and particularly the Smart Specialisation Strategies (S3). Particularly for MS that are very reliant on Structural Funds (ESIFs) for their R&I funding, the S3 provides a strong prioritisation process for R&I investments. It also provides the opportunity to link regional authorities and actors with the ERA process. Feedback from members of the ERA Forum for Transition emphasised the importance of multi-level governance in ERA implementation. The example of stakeholder engagement in the development of smart specialisation strategies could be seen as an example of good practice and could be considered as a model to be adapted and used to help develop a new generation of ERA National Action Plans.

Stakeholder involvement at the joint agenda setting stage of the ERA process was raised as a topic by a considerable share of the interviewees. In the 'old' ERA this was formally organised through the Stakeholder Platform. Representatives from the science community originally welcomed this but the Platform met less regularly and more on an occasional basis in the final years of the Roadmap's implementation. The consensus feedback is that in the future this stakeholder involvement should be organised in a more structured manner both at trans-national level and in the MS/AC. Particular comments on the stakeholder involvement in the old ERA were:

- Stakeholders from the applied and industrial research communities were critical of the ERA Stakeholder involvement process and ERA Stakeholder Platform. Several stakeholder representatives voiced the opinion that topics related to innovation were not really on the

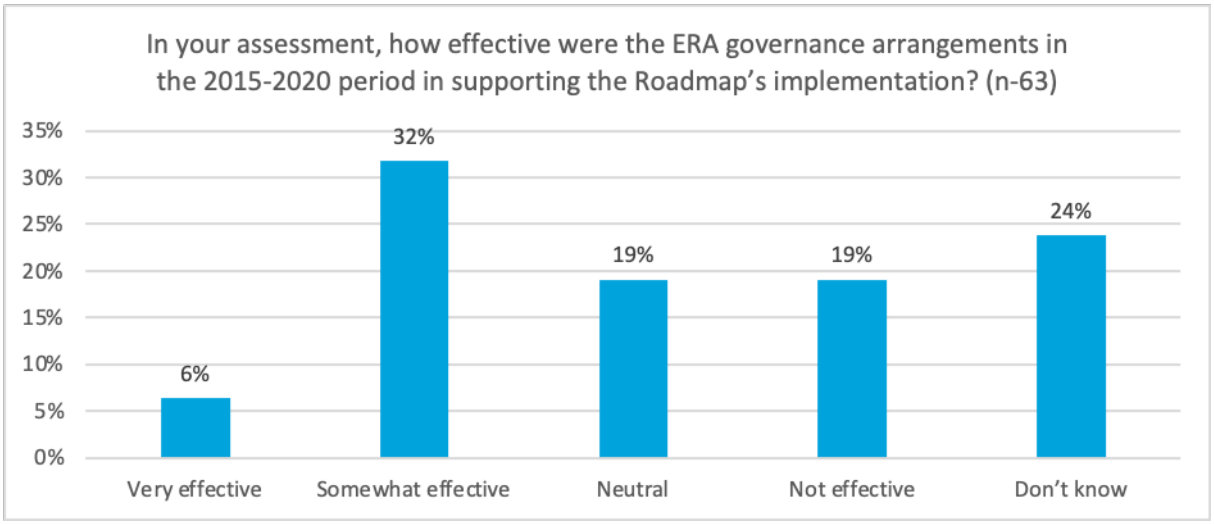
[39] Final Report of the GPC Task Force on the analysis of the Long-Term Strategies of the Joint Programming Initiatives, ERAC/GPC, 1306/18, 14 September 2018.

agenda of the ERA debates and the Stakeholder Forum. The discussions were too much focused on fundamental research and the position of researchers at universities. The representatives felt disengaged and therefore did not participate actively in the Stakeholder Forum at later stages.

- It was not only stakeholders from industry or applied research who commented on the strong dichotomy between on the one hand science and research and on the other hand innovation. A number of policy makers also commented on this. There was a positive response to the new ERA that is moving towards thinking in terms of R&I eco-systems and a closer interlinkage between research and innovation.
- The current set up of ERA governance provides little opportunity to include other key actors in the R&I policy system such as regional and local government authorities and national R&I funding agencies responsible for implementing many ERA related measures
- Overall, interviewees questioned whether it was effective to have only a single ERA stakeholder platform for interaction between different types of stakeholders across all the diverse topics covered by the ERA. As participants engage in topics that are of direct interest to them, it was suggested that the setting up and operation of different stakeholder platforms for different topics would probably have led to a greater engagement from the participants. However, others suggested that the stakeholder involvement should not replicate the silos that exist in different R&I communities. These views were also strongly voiced in the policy workshop held in June 2021.

The figure below shows how effective stakeholders thought ERA governance arrangements were during the 2015-2020 period.

Figure 3-2 - Effectiveness of the ERA governance arrangements in 2015-2020



Source: ERA Monitoring Survey

3.2.2.2 Transnational Policy learning and incentives

As mentioned, one of the most positive effects of the ERA processes and transnational coordination platforms that interviewees mention is the policy learning from meeting and discussing with likeminded policy makers from other countries. This type of exchange also created a better understanding of the R&I systems in other countries and established personal networks of policy makers that can easily get in contact with each other for joint activities. The SWGs were identified

as the best opportunity for this as the policy interests are more focused on the topic of the (sub)-Priority. Interviewees report that they have learned how other countries have designed and implemented policy instruments and how they interact with policy decision makers and the wider stakeholder community. This is very conducive to trust building, an essential element of the ERA partnership approach. The peer pressure to act stemming from the ERA exchanges was also mentioned as an additional incentive to keep progress going. There was a strong plea from interviewees that ERA needs to retain transnational personal exchanges of this type.

The Policy Support Facility (PSF) was set up to support Member States, Associated Countries and Candidate Countries with the reform of their R&I systems. Mutual Learning Exercises (MLE) are explicitly geared to exchange experiences between countries and the participants in the MLEs from the Member States were often also active in ERA related governance bodies. ERAC was closely involved in choosing the topics for the MLEs. And indeed, for instance the MLE on International Collaboration worked in close alignment with SFIC, the SWG for priority 6. The MLE on Alignment between national and EU R&I policies was also at the heart of the ERA and focused on what governance and policy changes could be made nationally to improve alignment with ERA objectives. However, the majority of MLEs focused on specific topics such as research integrity, open science, public procurement for innovation and performance-based funding, all topics that help improve the R&I systems.

The national PSF Peer Reviews (PR) conducted by external peer experts were intended to support Priority 1 and particularly the reform of research and innovation systems. This PSF tool has been used by Denmark, Estonia, Malta, Poland, Hungary, Bulgaria and neighbouring countries Ukraine and Moldova so there is little overlap with the case study countries for this study on the ERA Framework. Thus, it is not surprising that this type of PSF support in reaching the ERA objectives was rarely brought up in the interviews.

The national case studies for this study looked into incentives for achieving ERA objectives. Overall, the view was that the carrot is a better incentive than the stick. External incentives to change practices in national institutions were, for instance, changes in the funding rules for Horizon Europe regarding the adherence to the Charter and Code of Conduct and the widening of MS funding possibilities to allow Research Infrastructures to be co-funded with Structural Funds.

3.2.2.3 Translation of the joint agenda in national (and European) implementation

Other parts of this study provide a comprehensive analysis of the implementation of ERA measures in Member and Associated States and the national governance models that influenced the implementation. These findings are synthesised the Final Report of this study. The following Table 3-3 provides a concise summary of the governance aspects that have influenced the ERA implementation at national level.

Table 3-4 - Governance aspects supportive of or hampering ERA implementation at national level

Governance aspect	Supportive	Hampering
MS/AC representation in ERA governance bodies	• National representatives have proximity to national policy decision making and feel involved in EU level ERA decision-making • Personal engagement of individual	• Weak engagement of national representatives with ERA process • No visibility to high-level policy makers

	national representatives with ERA priorities	• Insufficient human resources available to cover ERA and other EU activities
MS/AC national R&I strategies	• National R&I strategies have integrated and are aligned with EU policy objectives • Active involvement in ERA instruments • Mature R&I sector of strategic relevance	• National R&I strategies not aligned with EU policies • Limited involvement in ERA instruments • R&I sector of limited strategic relevance
ERA coordination in MS/AC	• ERA representatives have strong ERA coordination system in MS/AC • NAP produced in coordination with relevant ministries and agencies	• ERA involvement remains in one Ministry (unit) with weak coordination with other ministries /agencies • NAP produced by one Ministry (or unit)
Stakeholder engagement	• Stakeholder communities well organised • Relevant stakeholders are informed regularly on ERA (instruments) • Strong participation in successive Framework programmes • Relevant stakeholders are consulted on the development of NAP measures	• Stakeholders not involved in any ERA instruments • No visibility of ERA objectives in the R&I system • Limited participation in successive Framework programmes
Timing	• NAP process was well aligned with national STI strategy process and outcomes • Encouraging ongoing national debates	• NAP came too early to align with upcoming national STI strategy or national STI strategies were not sufficiently updated to capture ERA priorities • ERA priorities not visible in national debates

A major point of feedback from stakeholders related to the lack of guidance that the ERA Roadmap gave in terms of operational implementation of high-level objectives at the national level. This was mostly described as a gap between the high-level objectives as described in the ERA Roadmap and the translation of that into specific objectives, actions and targets at national level. This was particularly the case for countries with considerable reform and catching up challenges. As the ERA Roadmap process was agreed voluntarily between the Commission and the Member States, there was considerable flexibility for ERA participant countries to implement the roadmap, and to develop National Action Plans (NAPs) in a way that was deemed most appropriate to their national R&I situation. This led to a great variety of NAPs in terms of ambition and detail.

While the PSF Peer Reviews were meant to support this process by analysing the R&I system and providing recommendations regarding which reforms should be made, these came too late in the process to help develop and update the NAPs, albeit that the first PSF Peer Review of Bulgaria and a Pre-Peer Review of Hungary took place in 2015.

A recurring topic in our interviews is related to the representation of national actors in the ERA governance organisations. The fact that a majority of the ERA-related governance structures typically had representatives from the Ministries of Education and Science, meant that representatives of Ministries and agencies responsible for applied and industrial research and innovation were less informed about and involved in the ERA policies. Depending on whether nationally there was a wider policy coordination system set up, some interviewees stated that there

was not sufficient transparency on the ERA political framework because a lack of communication and cooperation by their national counterparts. With the new ERA emphasising innovation but also opening up to new policy dimensions such as the Green Deal and Digitalisation the national representation in ERA related governance bodies needs to be re-considered in order to have a more holistic policy approach.

The European Commission has also progressed in implementing instruments to underpin and support ERA objectives. Examples that came up in the interviews are for instance the facilitating role played for Priority 2B by supporting the legal framework ERIC and coordinating with other DGs to ensure the use of Structural Funds.

3.2.2.4 The governance of monitoring and evaluation

Other parts of the ERA study[40] have reported comprehensively on the EMM system and its role in the ERA Policy Framework. In this particular section, the focus is on the governance aspects of the EMM in transnational policy coordination.

The study findings have revealed a dilemma regarding the 'ownership' of, and engagement in the monitoring and evaluation process. On the one hand, the representatives of the Member States interviewed would like to be more closely involved in national data gathering and analysis and in feeding in their feedback to help interpret monitoring data and in producing and signing off the country fiches that form part of the biennial ERA Progress reports. They express a concern that they have had limited influence in terms of producing their national profile report and the bi-annual ERA progress reports, since these are produced by the Commission with the support of external contractors. On the other hand, quite a number of Member States stated that they do not have sufficient human resources available at the level of Ministries, national R&I bodies and funding agencies to be more actively involved in monitoring and reporting tasks. The advantage of contracting out the monitoring process is perhaps value for money, but the downside is the lack of engagement of the MS/AC as well as possibly the risk of lack of continuity.

An ERA *ad hoc* working group on monitoring was originally set up in 2013 to develop a new approach to ERA monitoring in the context of the newly-agreed set of six ERA priorities. Later in the process, following the adoption of the ERA Roadmap and guidance document, further work was undertaken in 2015-16 to develop the EMM indicators. However, the group had a specific remit to set up the initial monitoring and indicator system and was only intended to operate for a defined period.

Later on, it was decided that the Standing Working Groups would take over responsibility for the monitoring of their own priority in order to ensure follow up. Further indicators were then developed relating to the state of play in implementation at the priority level. The involvement of different SWGs in monitoring was partially effective, but also arguably led to some degree of fragmentation in monitoring efforts, as there was a lack of a holistic view that could assess progress in some areas of national ERA implementation (e.g. Priority 1, strengthening the effectiveness of national R&I systems). For each priority area, the approach to monitoring progress towards the achievement of key policy objectives adopted was different. For instance, on the Priorities related to Research Infrastructures (2B) and International Collaboration (6), additional surveys and benchmarking

[40] This is a central element of Task 1 and Task 2 of this study and its key findings are summarised in Policy Brief 1 of this study assignment.

exercises have been conducted, supporting the exchange of information on policy actions and progress.

Regarding the effectiveness of the ERAC SWG in carrying out monitoring activities (the ERAC was made responsible for leading on monitoring at the priority level in 2015-2020), the SWG for Priority 2a, the GPC, focused on transnational cooperation, was viewed as a good practice model. It led the way in terms of developing ideas on how to monitor ERA implementation and the progress in national measures and actions mentioned in the NAPs. Variants of this approach to monitoring, which put an emphasis on whether measures had gone ahead, gone ahead with delays or been cancelled, were then tried out in other SWGs.

As the data systems are quite diverse across different ERA participant countries and as the ERA Roadmap guidance and ERA monitoring system (the EMM) did not provide any strict guidelines on the data to be generated and collected, the EMM has some limitations, according to a number of interviewees. For example, on open access only a small number of countries have the data on publicly funded research publications available. A lack of resources to engage in monitoring at national level, and resistance and a lack of consensus among some stakeholder groups as to what should be monitored, and a lack of political will to develop comprehensive R&I datasets hampered the consistent implementation of the monitoring and indicator system in all ERA countries. Suggestions were made by some interviewees that there should be at least one ERA delegate per country that can act as a liaison point between the Commission and national institutions responsible for collecting and interpreting specific data.

An additional governance issue hampering the monitoring system from being sufficiently holistic is that in some countries, evidence was identified that only a single national Ministry was engaged in the ERA process, with limited involvement of other relevant Ministries. A number of interviewees reported that information on the EMM and progress reports is not well-shared across relevant policy actors in the particular MS or AC concerned. This can lead to incomplete information being fed into the ERA Progress reports (particularly into the country fiches).

Moreover, the ERA Progress Reports are developed by external consultants commissioned by the European Commission. Due to the scale of work required to review extensive monitoring data across all ERA participant countries, national Ministries were not always interviewed as part of the process of finalising the country fiches produced in the 2018 ERA Progress Report. It was stressed that it is important to factually verify the findings in the ERA country profile reports through at least one interview with the responsible Ministry before the ERA country profiles are signed off. For the future ERA, the question of ensuring buy-in and ownership for the EMM – and responsibility for the final sign off of country reports - are issues that need to be addressed. In addition, there are questions regarding the need to put in place the necessary human and financial resources to develop a coherent and comparable set of monitoring data across all ERA participant countries (MS/AC).

There are broader issues in relation to the need to strengthen the engagement of wider national and regional R&I stakeholders in monitoring and reporting processes to foster buy-in. It may not be practical to involve wider R&I actors in core monitoring activities, given the need to work mainly with EU-level datasets disaggregated at the national level, where Ministries are better placed to perform an analysis of the data.

However, the broader spectrum of R&I stakeholders could be brought in, such as through ERAC representatives in particular thematic areas of the ERA to comment on the degree of progress, or absence thereof that has been made. Wider actors such as universities and other Research

Performing Actors (RPOs) could be invited to take part in policy debates once ERA monitoring data is available about their country, to debate what the ongoing policy implications are in particular areas. This would help to ensure better linkages between ERA monitoring data, and actionable follow-up, including updating of national R&I policies/approaches to reflect any weaker areas of performance.

1.1.1.1 *The process of accountability*

The implementation of the ERA objectives is a voluntary process inspired by the Open Method of Coordination (OMC), an EU policy-making process, or regulatory instrument, formally initiated by the Lisbon European Council in 2000. The OMC does not result in EU legislation, but is a method of soft governance which aims to spread best practice and achieve convergence towards EU goals in those policy areas which fall under the partial or full competence of Member States. Since binding EU rules cannot be used as the means to achieve convergence among Member States in such cases, OMC relies on other mechanisms. These mechanisms involve establishing guidelines, quantitative and qualitative indicators and benchmarks, and national and regional targets, backed by periodic evaluations and peer reviews.[41]

Thus, the European Commission has no legal mandate to enforce the implementation of any of the ERA objectives on its Member States, let alone the Associated countries. The ERA Progress Reports, based on the NAPs were collectively decided as a tool for Member States to report on their progress in the ERAC meetings.

The effect of peer pressure and 'naming and shaming' was certainly mentioned by quite a number of interviewees as an incentive to take policy action. This was mentioned mostly in relation to gender equality (P4), a clear objective with clear figures showing the performance of institutions and their progress over the course of time. The effect of discussing the ERA Progress Reports and NAPs in the plenary ERAC meetings was commented on with a mix of opinions. There were quite some interviewees who stated that the discussions were at a general and high level of abstraction so individual countries were rarely put into an uncomfortable position of being required to justify their limited progress. The discussions in some of the SWGs had more substance on the content of the policy actions taken. Nevertheless, in quite some Priority areas it was considered difficult to assess progress in each MS. An example given was on the Priority 6 where it is difficult to give a valuation whether more international collaborations are necessary for a good performance.

The lack of a clear structure for the NAPs, and in some cases the non-existence of a NAP, the absence of measurable targets in the ERA Roadmap and the NAPs hampered a peer review type assessment of whether the MS had made progress in the view of interviewed stakeholders. There seemed to be a consensus amongst the interviewees that a more directive approach to make MS more accountable for their progress on ERA objectives was not a solution and would harm the partnership approach. Nevertheless, a better and more in-depth form of dialogue and better guidance if there were to be future Roadmaps and NAPs were seen as improvements to the process of accountability.

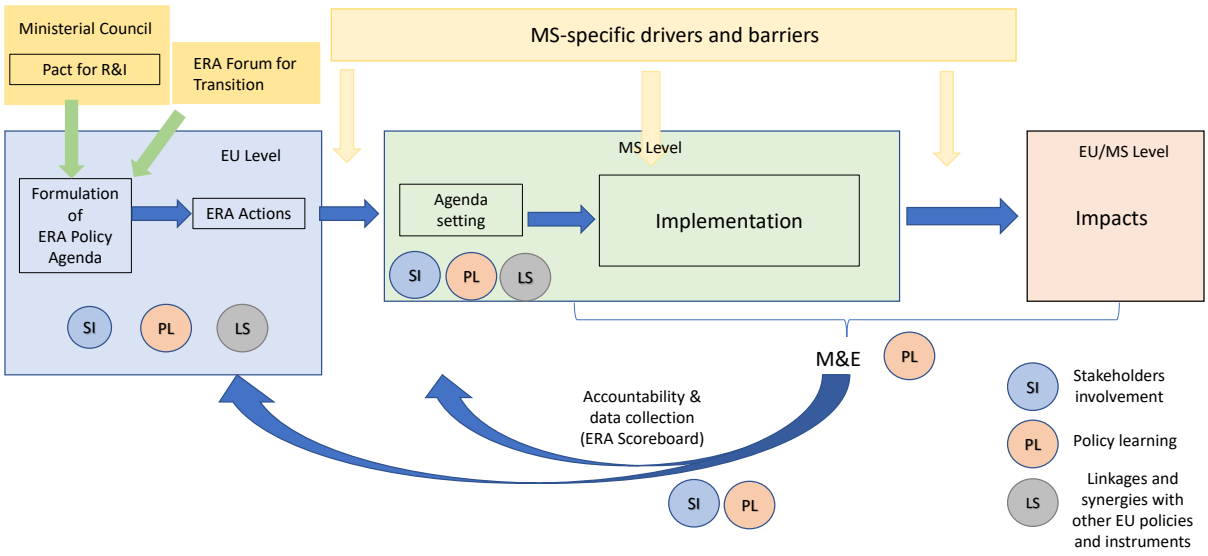
[41] https://www.europarl.europa.eu/EPRS/EPRS-AaG-542142-Open-Method-of-Coordination-FINAL.pdf

3.2.3 Analytical framework on the future of the ERA

The analytical framework presented in section 2.3.4 is also relevant for establishing a forward-looking approach to the new governance of ERA. Figure 3-3 below applies the underlying intervention logic of the ERA process to the arrangements contemplated for the new ERA described in section 3.1 above. The objective is to help assess whether these propositions address issues where specific efforts and changes are needed according to the lessons learnt from the 2015-2020 period. In particular, it is useful to determine whether the proposed arrangements are likely to adequately handle barriers and drivers identified both at MS and EU level (Section 2.3.2), and to draw the lessons from the 2015-2020 Roadmap experience (Sections 2.2 and 2.3).

As introduced in section 3.1, while it is expected that the newly created governance mechanisms such as the ERA Forum for Transition, the Pact for Research and Innovation in Europe, and later on the "permanent Forum" will determine the design of the new ERA policy agenda, a number of propositions are already on the table and are referred to in the figure below.

Figure 3-3 - ERA Policy cycle / intervention logic: the Future ERA



Source: own elaboration

For example, a relevant proposition relates to the necessity and strategic importance of establishing clear and deep linkages with other strategic EU policies and R&I funding instruments (LS in the figure above). This is valid in the definition phase of the ERA policy agenda as well as in the phase of agenda setting at the national level. In the latter case, the synergies with Smart Specialisation strategies seem particularly relevant.

Other elements of the ERA policy cycle which need to improve have to do with the involvement of stakeholders and policy learning. While it is imaginable that stakeholders' involvement would start from the very outset of the cycle, this study has shown the importance of involving not only high-level government representatives from the MS, but also a wider set of stakeholders including the academic *and* the business word and regional and other local-level stakeholders (SI in the figure). A greater emphasis on policy learning might also help reduce the disparities across MS in terms of the development of the NAPs and their implementation (PL).

Finally, a more regular follow-up of NAP implementation and impacts, through M&E, coupled with a deeper policy learning mechanism, might contribute to the prompt adjustment of strategies, targets, and roadmaps, thereby making the roadmap a truly living document. These processes, in turn, if accompanied by data collection and publication through the ERA Scoreboard, might increase the visibility and buy-in of the ERA, potentially leading to more tangible impacts.

The sections below examine in more detail whether the features of the new ERA adequately respond to the challenges that are to be addressed.

3.2.4 Results from the benchmarking analysis of comparable policy governance/monitoring systems

In Annex 6 of the report, a detailed benchmarking assessment is provided, based on lessons learned from other comparable policy governance/monitoring systems. In particular, the following were reviewed: (1) the European Semester process (2) the climate and energy policy monitoring used by the Commission and (3) the Bologna Process, an example of an Open Method of Coordination (OMC). The purpose was to analyse comparable monitoring and reporting systems with the aim of identifying approaches and practices that could be adapted to the ERA policy framework.

The analysis focused on aspects related to (a) political commitment; (b) the development of strategies and roadmaps; and (c) monitoring practices. The extent to which these could be relevant for the ERA policy framework and associated monitoring processes was considered, including how progress monitoring may fit into the EU policy development cycle. The main characteristics of the different OMCs are presented in Table 3-4 below:

Table 3-5 – Main characteristics of related EU policy systems

Characteristic	The European Semester	The climate and energy policy monitoring	The Bologna Process
High level policy engagement	Ministers in charge of economic development and finance	Ministers in charge of energy, environment and climate change	Ministers of Education of participating countries
Inclusive stakeholder engagement	Involvement of national, regional and local authorities, social partners and representatives of civil society	Involvement of energy and climate protection stakeholders	Higher Education stakeholders
Clearly defined & quantifiable objectives & targets	Plan of reforms to achieve targets set out in Country Specific Recommendations	Defined in national energy and climate plans (NECPs) and long-term strategies (LTSs) discussed and agreed with the Commission	• Long-term targets/ commitments agreed • Bi-annual target setting
National agenda setting process	Coordination at ministerial level to prepare National Reform Plans	Coordination at ministerial level	Higher Education stakeholders
Monitoring system in place	Commission publishes a country report for each MS analysing its economic situation and progress in implementing the country-specific economic policy recommendations issued during the previous cycle	Bi-annual assessment of progress towards the Energy Union objectives and 2030 targets both at the EU level and with respect to each Member State conducted by the Commission based on data provided by MSs	Stocktaking reports, based on information by national authorities

The main learning points in terms of the design of the new ERA policy framework are now discussed below. Reference should be made to Annex 6 for the detailed supporting analysis.

High-level political ownership and commitment

National Governments are directly involved in the governance of all three EU policy systems, including the development of national strategies and their implementation. In each case, the bodies in charge of legislative and reform processes are involved in all cycles of implementation. High-level Ministerial meetings take place regularly.

Inclusive stakeholder engagement

A lesson learned relevant to all three policy systems is that stakeholders need to be actively engaged in the process, and their buy-in needs to be secured. In contrast, whilst the ERA Roadmap and ERA Stakeholder Pact in 2015-2020 initially brought relevant stakeholder together, the momentum was lost over time in terms of continued stakeholder engagement and adequate representation of all sectors (e.g. academia was represented, but industry and applied research was only engaged initially).

Clear policy objectives and quantitative goals / targets

Each policy system has been developed to serve a well-identified overarching objective. The European Semester has been formed to ensure convergence and stability within the EU. The climate and energy policy monitoring follows actions moving towards reaching the targets of the 2030 Climate and Energy Policy Framework Objective. The Bologna Process was created to develop an attractive and competitive Higher Education system in Europe.

National agenda setting process

There is close interaction with the Commission in the development of national roadmaps and timeframes for the targets to be achieved, which are agreed at ministerial level in each MS. The targets and roadmaps are reviewed at specified intervals. The new plans take into account progress achieved in previous periods. Agreeing the overarching framework for national level implementation at Ministerial level helps to ensure political and stakeholder buy-in.

Ensure appropriate linkages between monitoring activities and policy follow-up

For the three existing EU policy frameworks and systems considered, specific mechanisms and bodies have been put in place for monitoring, evaluating impact, ensuring that adequate capacity is available to generate, share and process relevant information and to develop commonly-agreed policies and their updates. The need to ensure that monitoring activities are integrated into the policy development and implementation lifecycle is a good practice that should be considered in future ERA implementation, both at national and EU levels.

A key issue is that if the Open Method of Coordination (OMC) is the desired approach that would underpin ERA implementation under the Joint ERA Pact, a key issue is to identify what is still missing in the current plans for ERA governance that could help to address the above-mentioned criteria?

3.3 FUTURE ERA SCOREBOARD AND A WIDER MONITORING AND INDICATOR SYSTEM

This section outlines key strategic considerations for a monitoring and indicator system, practical issues such as the prioritisation of what to measure and whether performance targets should be

set. It also presents an overview of considerations in relation to data sources and data availability. In section 3.3.10, a benchmarking of scoreboards is provided, including the European Innovation Scoreboard (EIS), which should serve as a reference when designing the ERA Scoreboard.

3.3.1 Strategic considerations for a new monitoring and indicator system for a new ERA

Among the main considerations for developing a new monitoring and indicator system for the new ERA are:

1. The Council Conclusions of December 2020 committed to the development of a new ERA Scoreboard, but left it open as to whether all ERA-related indicators would be included, or whether the Scoreboard would be supported by a broader monitoring and indicator system to replace the ERA Monitoring Mechanism in 2015-2020.
2. The new indicator system needs to reflect the new priorities in the 2020 ERA Communication, and the evolution in thinking following the joint efforts of the Commission and the ERA Forum members.
3. However, a balance needs to be struck so that some of the existing indicators in the EMM in 2015-2020 remain to provide some continuity (especially under the Priority of deepening the ERA, as issues such as researcher careers, gender equality, research infrastructures and Open Science will remain in the new ERA).
4. A challenge is that the indicator system needs to be developed in a way that reflects the new ERA policy framework and implementation architecture. For example, whilst a new generation of NAPs could be developed, there are alternatives under consideration. Likewise, regarding monitoring, whilst the approach was previously centred on monitoring and reporting on NAP implementation, but using centralised EU data, if NAPs are discontinued, alternatives could be pursued in terms of the types of indicators to be monitored across the ERA.

A more detailed summary of key developments influencing the evolution in the ERA monitoring and indicator system is now provided.

The **Council Conclusions on the Future of the ERA** (December 1st, 2020)[42] recognise the Commission's role in **encouraging and incentivising Member States to make the necessary reforms and investments** to deepen and broaden ERA integration, including through the provision of 'analysis, guidance, advice, technical support, **monitoring and data analytics activities'**. Monitoring is recognised as playing a useful role in areas such as international cooperation, tackling the "brain drain" and ensuring academic freedom. The latter are examples of new areas not previously monitored because no indicators were included under the EMM. The Conclusions also recognise *"the need for increased effort for coordinated multi-level foresight, evaluation and monitoring of the impact of R&I cooperation beyond Europe".* This implies an international benchmarking dimension should be incorporated into the ERA Scoreboard.

[42] Council conclusions on the New European Research Area, Brussels, 1 December 2020 https://data.consilium.europa.eu/doc/document/ST-13567-2020-INIT/en/pdf

The Council requested that there should be an evidence-based approach to ERA implementation. It called for "*a review of the ERA monitoring system including its indicators and reporting procedures considering the proposal of the Commission of establishing a yearly ERA scoreboard, and seeking to provide technical and expert assistance to Member States for the improvement of national ERA monitoring activities and their connection to the European Semester and the deployment of their Recovery and Resilience plans*".

3.3.2 Key issues in designing a new monitoring and indicator system

In order for a new ERA monitoring mechanism to be accepted and considered useful by key stakeholders, a number of elements are needed. In a new ERA context, there are different approaches to taking the monitoring and indicator system forward. The suitability of these approaches – and the optimal design of the ERA monitoring architecture - is in turn dependent on decisions to be taken by the Commission and the ERA Forum regarding the ERA policy framework and a strategic approach to monitoring and reporting. For example, the following still need to be determined:

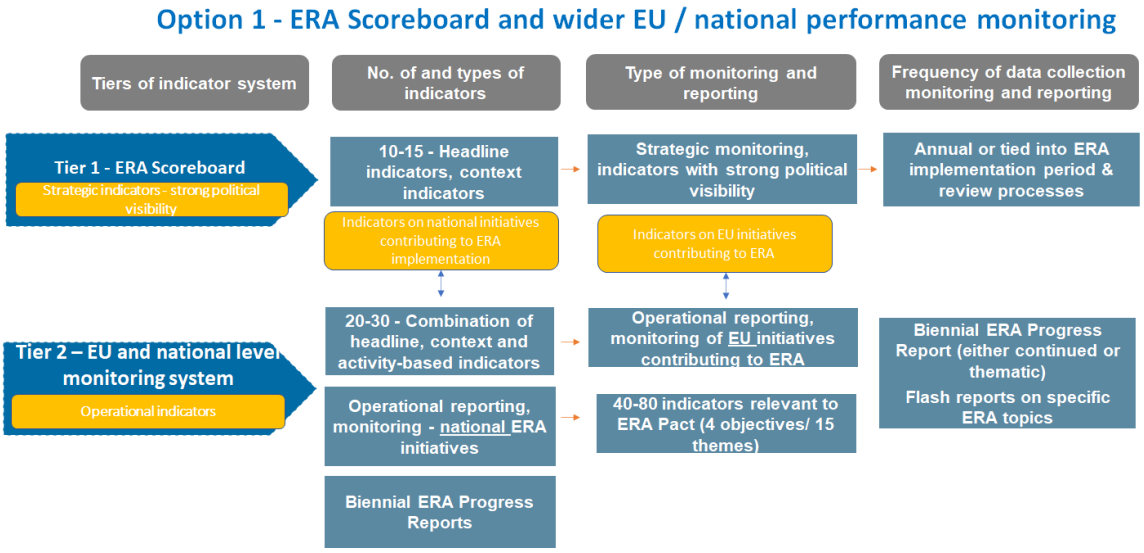
- Whether the Scoreboard should mainly be strategic and concentrate on headline, context indicators (dependent on reliable and frequent data availability), or will incorporate more operational indicators.
- Whether the ERA Scoreboard, and either a performance dashboard or a new broader monitoring and indicator system to replace the EMM, should be updated in real-time (where data permits) or be updated periodically.
- Whether there will be a new generation of NAPs, or the NAPs will be discontinued and replaced with an alternative approach, such as ensuring alignment between the ERA and national R&I policies, strategies and action plans through a policy platform.
- If the NAPs are discontinued, whether there will be a continuation of the biennial ERA Progress Report and country fiches - whilst the data was generated at EU level in 2015-2020, monitoring and reporting were driven by the need to assess NAP implementation and country-specific progress.
- The timeframe for ERA implementation (the period to 2030 has been suggested by the ERA Forum for Transition).

All of the above variables will influence the final design of the monitoring and indicator system.

As noted earlier, in the Council Conclusions, a commitment is made to **develop an ERA Scoreboard in 2021**. The form that the Scoreboard should take, and how it should be differentiated from the European Innovation Scoreboard (EIS), has been considered through this study. Some stakeholders commented that they already use EIS data extensively in their policy work, and appreciate the ability to compare their performance with other countries. However, it was recognised that the EIS is innovation-focused, whereas the former and new ERA policy frameworks are pursuing a broader set of objectives that extend beyond innovation alone.

Whilst there is a commitment to an ERA Scoreboard, there is a question as to whether the new Scoreboard should give equal weight to all the indicators chosen or focus on a small number of headline indicators, with a more detailed set of indicators being included instead in other tiers of the indicator system. In the following Figure, one possible structuring approach is outlined below. The key features of Option 1 are explained in detail in the options analysis later in this section:

Figure 3-4 – Option 1 - The ERA Scoreboard and broader monitoring and indicators system (with national indicators for the NAPs)



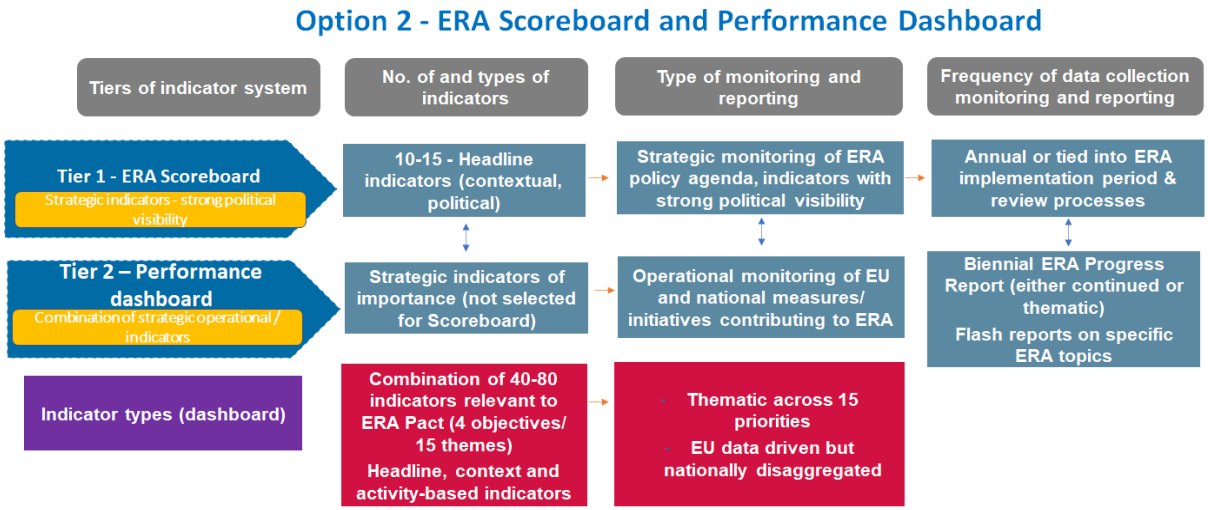
A strategic choice is needed as to whether all indicators should go into the ERA Scoreboard, both headline indicators and indicators relevant to national ERA NAP implementation, or if the indicator system should be streamlined. This would imply that the ERA Scoreboard could contain a select number of strategic indicators relevant to assessing overall progress towards the ERA.

The feedback received from national stakeholders is that if NAPs are to be continued, then a maximum of about 20-30 indicators would be realistic. However, there are very many wider indicators and data that can be gathered at EU level, so potentially, as per the second tier, a distinction could be made between (1) the minimum set of core indicators for the NAPs and 2) EU-level monitoring of wider Indicators that are of potential interest to all R&I stakeholders, but are not manageable in reports on in NAPs. For instance, whilst as many as 12-15 relevant Open Science indicators can be identified, realistically in NAP monitoring and reporting, only one or two could feasibly be included, given how many others there are to monitor and report on.

An alternative approach could be to combine the ERA Scoreboard with a performance dashboard containing a wider set of indicators, but without needing to report on national NAP implementation. This could open up new possibilities in reporting on a wider range of indicators, as there would not be the same constraint as there was in the EMM that the indicator system was mostly driven by what was manageable and proportionate for Ministries in terms of NAP reporting. In reality, there are a much broader range of ERA priorities and initiatives and measures at both EU and national level, as well as potentially many future joint actions.

The key features of Option 2 (in which there would not be any NAPs, but rather monitoring at EU level (with disaggregated data on national performance, though across a broader range of indicators). This is explained in detail in the options analysis below:

Figure 3-5 – Option 2 – ERA Scoreboard and Performance Dashboard



In designing an optimal indicator system for monitoring the ERA in future, there is a need to determine which types of indicators are needed. For instance, are headline and context indicators of strategic progress sufficient, or are these indirectly related to activities on the ground? Or are both types of indicators needed, both the more strategic and the more operational?

Given the uncertainty regarding the way forward on the overarching ERA implementation structure, an options analysis has been prepared, since the approach to be adopted will be dependent on decisions regarding the future ERA implementation system outlined above.

In the following table, three different options are outlined regarding how the ERA policy framework, monitoring and indicators might be implemented. It will then be for the Commission, members of the ERA Pact and wider EU R&I stakeholders to determine the optimal way forward in the second half of 2021.

Table 3-6 - Options analysis – overview of key features and implications for ERA monitoring and indicators

Options	Description of key features	Implications for ERA monitoring and indicators
Option 1 – Continuity with ERA Roadmap.	• Develop a **new and improved ERA Roadmap**, integrating guidance for the 2022-2030 period. • Develop a **new generation of NAPs**, with a common template being prepared, but retaining flexibility as to the content, provided the NAPs follow a common structure and cover the main ERA priorities. • **Continuation of biennial ERA Progress Reports and country fiches**, but with a revised and updated core set of indicators for NAP reporting purposes. • The new generation of NAPs would be **made available digitally via a Commission webpage** or **standalone portal** (as currently, there is no easy way of accessing all NAPs). The NAPs would be downloadable in PDF format. **Overall characteristics:** strong continuity, but with improvements based on lessons learned).	A three-tier approach to the indicator system consisting of: • 1) **ERA Scoreboard** with 15-20 headline indicators of a strategic nature[43]. • **2) Set of indicators for national monitoring and reporting purposes** for the NAPs (confined to 20-35 indicators to ensure proportionality and manageability for Ministries responsible). • 3) **Broader set of ERA indicators -** not included in the minimum core set of NAP indicators, but of interest to R&I stakeholders
Option 2 – Transition from National Action Planning to an Online Policy Platform	• **No NAPs, but make available relevant national documentation.** Instead of the development of NAPs, MS and ACs would instead ensure that their national R&I strategies and action plans and information about national institutional, administrative and structural reforms are made available to the Commission and other R&I stakeholders. Documentation would be made available via an **Online Policy Platform** and would be accessible by all R&I-related Ministries and broader stakeholders to facilitate information and good practice exchange. • **Ministries to update and align R&I strategies / action plans with the ERA.** Rather than producing a NAP, the role of national Ministries would instead be to ensure that their existing national R&I strategies and action plans are updated to align with as many of the new ERA priorities as possible, focusing on those most relevant to their country. • **Good practices would be shared** (possibly through the development of a common case study template), with ideas on transferable / replicable practices being submitted by Ministries and other R&I stakeholders. • **Biennial ERA Progress Reports and country fiches would be replaced** by a more thematic approach either with, or without a fixed timeframe. Flash reports could be prepared on particular ERA-related topics e.g. research careers, gender equality, research infrastructures, Open Science. • **As a sub-option, even under Option 2, the ERA Progress Reports could be continued, but alongside periodic flash thematic reports.**	• An **ERA Scoreboard** with 15-20 strategic indicators (contextual, based on reliable data frequently updated minimum annually) • A **Performance Dashboard** approach could replace the EMM set of indicators. This would contain a wide range of indicators at EU-level covering the 15 thematic priorities and 4 strategic objectives. Whilst comparable data would be provided at EU level, this would be disaggregated at national level across ERA countries. • The dashboard indicators need to be broad enough to include all the actions mentioned in the policy agenda (outlined in the ERA Pact). However, the actions will change over time, whereas the indicators need to remain stable. • As NAPs would no longer exist, there would be no dedicated set of NAP indicators, unlike in the ERA Monitoring Mechanism (EMM). However, Member States and Associated Countries could still monitor their own performance depending on which particular thematic priorities - and associated indicators – are most relevant to their ERA-aligned national R&I policies. • There could be greater flexibility in that country analysis of performance could focus on those priorities identified as being most

[43] Headline indicators are less directly linked to operational activities within the ERA, and instead are more contextual. However, they have the advantage they are based on reliable data available long-term (not linked to specific activities/ initiatives), which needs to be frequently updated, a minimum of annually.

	Overall characteristics: A break with the NAP approach of the past to avoid NAPs largely duplicating the content of existing national R&I strategies and action plans. This could also imply a move away from biennial progress reports, and more of a thematic monitoring and reporting approach, not necessarily driven by an assessment of national level progress, which would be up to individual countries to carry out, depending on which ERA thematic priorities they are interested in. More digitally-driven scope for information and good practice exchange. On the one hand, more centralisation of monitoring and performance data, however, analysing the data and drawing policy lessons would be more decentralised and less common, depending on which are the ERA policies, objectives and priorities most relevant to a particular country. Example – rather than looking at its performance on every aspect of the ERA, Germany might decide to look at how it is doing on gender equality, research excellence and Open Science in a particular year and then decide to look at other priorities in a subsequent year.	pertinent to a particular country (e.g. researcher careers, research infrastructures, gender equality or a combination thereof).
Option 3 – Transition from national Action Planning to a dual process of Joint Action and Country specific Action	• For the commonly-agreed ERA priorities and objectives, there would be an Online Policy Platform for all MS and ACs. • In an early stage of launching the new ERA a process is established where each MS or ACs defines a limited set (15-20) of key priority areas, in line with the Pact, where reform and progress is mostly needed to improve national the R&I system and align with ERA priorities. The key measures that will be implemented to address these priority areas are defined, with objectives in terms of resources, targets, outputs and impacts in comparison to the baseline situation. The time frame of these measures depends on the type of reforms/change planned and can vary between 3-10 years. Every three years a review and update of the key priority areas is made in dialogue with the Commission • This process of defining and elaborating the key priority areas and their measures should be supported by bilateral and multilateral dialogues as well as external support through the PSF. This allows for good practice exchange from multiple sources	• An **ERA Scoreboard** with 15-20 strategic indicators (contextual, based on reliable data frequently updated minimum annually) for those priorities where the targets for all MS and ACs are similar • A **Performance Dashboard** based on country specific priorities and targets that have been defined in a process of ERA Dialogues (bilaterally and multilaterally) in each MS or AC. It needs to be debated how far the performance dashboards are made public continuously, or updated periodically.

The corresponding advantages and disadvantages of the different options are now outlined in the subsequent table.

Table 3-7 - Options analysis - advantages and disadvantages

Options	Advantages	Disadvantages
Option 1 – Continuity, with improvements based on lessons learned.	• Continuity with the ERA Roadmap process, NAP development and implementation and ERA Progress reporting processes. • Scope to improve ERA Roadmap guidance and to develop a common template to structure the NAPs (whilst retaining flexibility on their content). • Longitudinal comparisons of performance over time possible. • Direct application of lessons learned from ERA Roadmap and NAP implementation in 2015-20.	• Less digital and dynamic than the concept of an Online Policy Platform, although continuing the NAPs does not preclude the use of such a platform to exchange information and good practices. • Risk of duplication in new generation of NAPs with national R&I strategies and action plans (as in first generation).
Option 2 –	• Centralised approach to making EU monitoring data available across a	• Could be missed opportunity to build on lessons learned from first generation of NAPs.

Transition from National Action Planning to an Online Policy Platform	broader set of ERA indicators meaning that more indicators across new ERA priorities could be monitored through a performance dashboard. • This would avoid the problem that Ministries can only manage 20-30 indicators in NAPs, but wider R&I stakeholders at national level may be interested in a wider set of indicators and priorities. More indicators could be included than would be possible if Ministries were responsible for analysing a set of indicators in NAPs. • Individual countries' Ministries and national and regional R&I stakeholders could then decide which topics they want to drill down into their country's performance, either in a particular year, or over the duration of the ERA. • Rather than having a fixed set of indicators for each country, there would be greater flexibility as there would be a wider set of EU indicators that ERA participant countries could choose from. • **Decentralised approach to the analysis** in that it would be up to national and regional R&I stakeholders and EU level stakeholders as to which aspects of ERA implementation to analyse and at which geographical level. • **More inclusive approach to monitoring, reporting and analysis of performance on ERA-relevant indicators.** Whereas in the EMM, the data was provided at EU level, and Ministries analysed their performance on a limited set of 24 indicators, wider R&I stakeholders could support the analysis based on a much wider set of data made available to all EU, national and regional R&I stakeholders rather than mainly focusing on Ministries.	• If no NAPs are produced, it may be more difficult to ensure adequate alignment between national R&I strategies and action plans and EU-level priorities in the new ERA (although this could be discussed and ensured through policy dialogues between the Commission and ERA participant countries). • The use of national R&I strategy documents in a portal may not be the optimal means to show any progress on ERA. There is also the situation in many underperforming R&I countries that they have reasonable to very good strategies, but underperform significantly in implementation. Strategies are often too broad and general to use as a yardstick for assessing progress/change. • There is also a question of differentiation from existing platforms. How will an online policy platform differ from the STIP and RIO Observatory that the Commission previously set up? • Risk that less resources are dedicated to the analysis of ERA performance across the ERA as a whole and/ or to country comparisons and to reviewing country performance across all ERA priorities. • If no ERA Progress Report is available, whilst thematically (e.g. gender equality, Open Science, researcher careers), progress could be assessed periodically, there would be a lack of an overview as to what has been achieved. An alternative could be continuing with a biennial report, but radically overhauling the approach so that the content is less driven by NAPs, and more thematic and cross-comparative as well as drawing conclusions about what has been achieved at the level of the ERA overall, and at the Priority level across all ERA participant countries in aggregate.
Option 3 An ERA Scoreboard, supported by detailed managerial / operational indicators	• Data in the Performance Dashboard could be directly linked to actions (measures rather than strategies) related to ERA priorities and a more direct attribution to ERA progress could be made. • Data are more context sensitive and record progress based on the situation in each MS / AC rather than the EU 'average' position • The approach includes an active dialogue which can easily be linked to national dialogues with regions, cities and stakeholders. • The approach which includes bilateral dialogue between the MS and the Commission can be more closely tied to the European Semester process.	• The approach of the Performance Dashboard could be more labour-intensive and require more time to establish, particularly the first time. • The Performance Dashboard may include a broad range of indicators. MS would be interested in country-specific performance in particular areas of ERA of interest to them, which would be flexible, but a simple EU-wide comparison of progress would be more difficult to establish.

Further elements of the options analysis could consider what should be the role of different expert groups, governance bodies and stakeholder in terms of their role in supporting monitoring and reporting on ERA implementation. Synergies between these stakeholders will need to be ensured to maximise the value of their individual contributions.

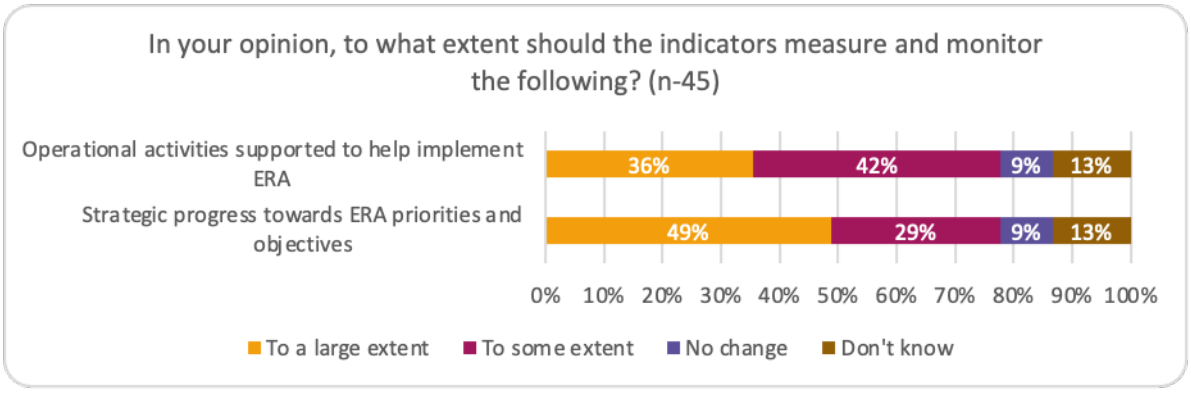
Table 3-8 - Options relating to role of different stakeholders in monitoring and reporting on ERA implementation

Type of stakeholder	Role in monitoring and reporting on ERA implementation
ERA Forum for Transition (informal expert group)	• Strategic periodic review role in analysing monitoring data to advise on progress towards implementation of the ERA policy agenda (across the 4 strategic objectives and 15 thematic priorities in the new ERA Pact). • Provide support to the Commission and any consultants working on flash reports and/ or ERA Progress Reports on data interpretation regarding the extent of progress in particular thematic areas of the ERA, and / or in specific countries.
Stakeholder Platform	• Irrespective as to whether the ERA Stakeholder Platform is continued or a new Stakeholder Forum is set up for new ERA implementation, national and EU R&I associations and other stakeholders (e g. CoR, EESC, OECD) have an invaluable role to play in supporting strategic monitoring. • For example, if thematic flash reports are prepared periodically, members of the Stakeholder Forum could provide insights to interpret the data and/ or assist in the analysis. Specialist expertise could be drawn upon to comment on the extent of progress in particular areas (e.g. Open Science, research infrastructures, research excellence/ longer-term fundamental research, applied research and knowledge valorisation). • The specific role could either involve reviewing/ commenting and editing thematic materials produced by the Commission and/ or consultants or they could make direct contributions to lead development of particular flash reports e.g. a report prepared by the EU R&I associations on research excellence in the ERA, drawing on data from the Performance Dashboard.
ERAC SWGs	• The feedback on the SWGs was broadly positive in terms of their role in monitoring at priority level, and in ensuring national buy-in. Whilst not yet determined whether the SWGs will be continued, the idea of including national technical experts with knowledge about particular areas of ERA implementation to assist in monitoring progress strategically and operationally in particular areas could be continued.
National Ministries	• National Ministries have a key role to play in the coordination of ERA actions at national level, and stakeholder feedback suggests that this could be strengthened in future. • Coordination at national level of the different Ministries involved could be further strengthened to ensure a comprehensive approach that would also increase visibility of ERA priorities and actions at national level. A more structured approach would also ensure continuity of ERA progress at national level independent from changes in government.
Independent external advisors	• Independent contributions from stakeholders external to the formal governance structures could provide further input to the process and serve as additional advice towards an inclusive future ERA in which different voices are heard. This could be the case of external consultants tasked with a specific report or monitoring effort, which could further serve as the basis for discussion in the next steps.

3.3.3 Considerations for the indicator selection

The implications of the strategic dimensions presented in the previous section will need to be considered in relation to the indicator selection and the broader configuration of the Scoreboard and monitoring mechanism. This section looks into ore specific aspects of indicator systems. Figure 3-5 presents the answers from the online survey in regard to the preferred type of indicators. Responses reflect the preference for strategic indicators over operational ones, the former understood as indicators measuring strategic progress made through efforts and measures aimed at advancing ERA priorities and objectives. These findings tie well together with the Council decision to create a new ERA Scoreboard focusing on strategic indicators for high-level decision-making as key priority for stakeholders.

Figure 3-6 - Aspects to be measured and monitored by the EMM (Q24)



Source: ERA Monitoring Survey

A further issue relates to the frequency of reporting. Moving to an annual Scoreboard is feasible, but perhaps only for a more limited indicator set. The study team received feedback that some Member States perceive annual reporting to be too frequent and burdensome for monitoring ERA implementation progress at national level. Therefore, the ERA Scoreboard could remain strategically-focused and annual, with more detailed assessment of national implementation being biennial.

It is useful to define alternative options in developing the future ERA monitoring system and to debate these in determining the best way forward. For example, in light of the new ERA Communication, some stakeholders might envisage a complete overhaul and major restructuring of the EMM with a new set of indicators. Other stakeholders may prefer a more incremental approach that seeks to ensure some stability and continuity with the former EMM in 2015-2020 to ensure longitudinal comparability. Examples of the advantages and disadvantages of different approaches to structuring the ERA Scoreboard are provided in the table below.

Table 3-9 –Strategic choices for the development of an ERA Scoreboard and wider monitoring system

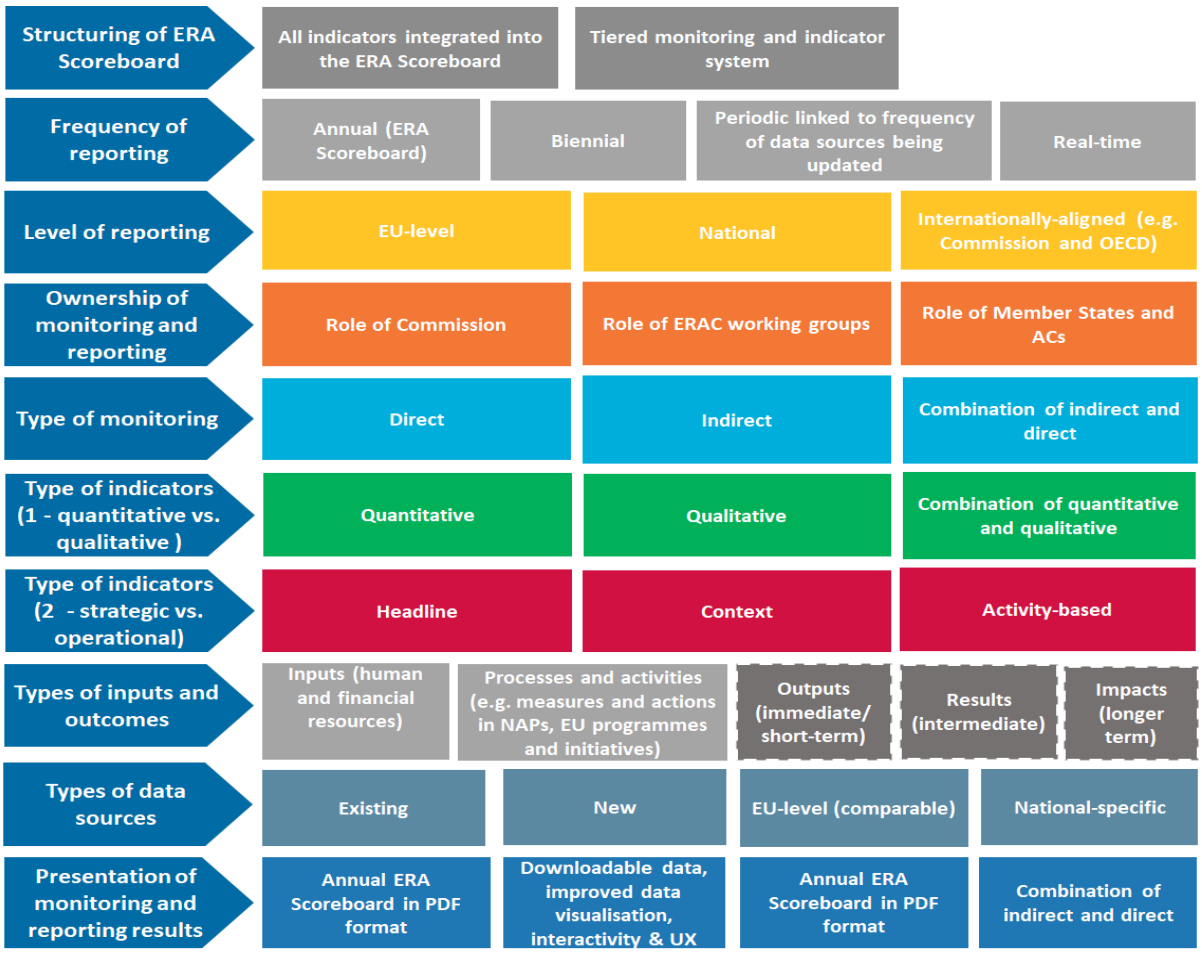
Options	Frequency of reporting	Advantages	Disadvantages
Option 1 – An ERA Scoreboard (with major	• Annual	• Reflects the significant changes envisaged in the new ERA Communication.	• Lack of longitudinal comparability e.g. with indicators used in the EMM and presented in the 2016 and 2018 ERA

changes to indicators)		• Easier for stakeholders to follow logic of indicator system if mirrors structuring of new ERA priorities.	Progress Reports. • National stakeholders stressed stability and continuity to be able to assess the evolution in their R&I performance (example – EIS, well-established, indicators don't change that much between annual series editions).
Option 2 – An upgraded EMM in ERA Scoreboard format (with minor changes to indicators)	• Annual	• Evolution not revolution. • Continuity with the ERA Progress Reports and country profiles. • Scope to include some new indicators.	• Would not reflect restructuring of the ERA strategic objectives in the new ERA Communication.
Option 3 - An ERA Scoreboard, supported by detailed managerial / operational indicators	• Annual but possibly some biennial	• If ERA Scoreboard is partly political, and confined to limited numbers of strategic indicators, there could be a need for additional operational indicators which would add further monitoring dimensions and could play an informative role at national level.	• Question mark on whether stakeholders understand indicator system if more than one tier.

Further considerations will be needed as to how the new ERA monitoring system might operate in practice.

The design and roll out of an ERA Scoreboard and indicator system involves strategic decisions. The implications would need to be debated and agreed upon by the European Commission, the ERA countries and broader ERA stakeholders. Figure 3-7 below provides an overview of the different dimensions to be discussed to the left and the different options available to the right, grouped by colour for easier overview.

Figure 3-7 - Strategic options for the monitoring and indicator system



Source: own elaboration

Aspects deliberated by the stakeholders in Workshop 1 covered all dimensions of the ERA Scoreboard architecture as these determine the broader monitoring system. The objectives to be achieved across different levels of monitoring and reporting activities, and the role and ownership of these activities across of the Commission, ERAC Working groups and the MS/ ACs needs to be very clear. Closely linked to the issue of the structuring of the scoreboard (see Figure 3-4), the type of monitoring and types of indicators selected were discussed among stakeholders, with consideration of trade-offs to balance the need for an indicator system that provides transparency as to the achievements of ERA implementation at EU and national levels on the one hand, but keeps the system manageable and proportionate overall. The following issues were debated in respect of the new ERA monitoring system during Workshop 1:

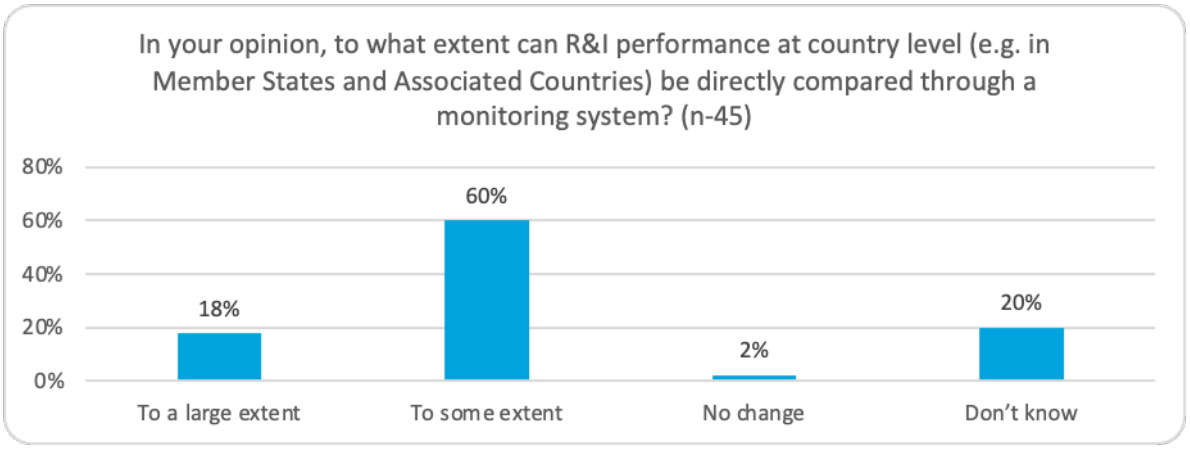
Box 3-2 Designing a new indicator system – structuring considerations

- Should the annual ERA Scoreboard focus on headline indicators of a politically visible nature, or also other types of indicators at the priority and sub-priority levels?
- Should there be different levels of monitoring indicators as part of a tiered approach?
- How many indicators should be included? How can a balance be struck between efficiency and effectiveness in the design of the monitoring system to ensure proportionality?
- Should the distinction between headline and operational indicators be retained? Can indicators be further streamlined?
- Should a performance dashboard approach be adopted, or should this be avoided for some ERA priorities due to comparability issues?

A further aspect to the design of the ERA Monitoring mechanism is the extent to which the ERA Scoreboard and the monitoring mechanism overall allow for comparison across countries and whether this is desirable and even feasible at all in the context of very diverse R&I systems.

Survey responses suggest that comparison among countries through a common ERA Monitoring system is possible to some extent. Respondents highlighted that this was possible and meaningful in areas where a baseline can be set (e.g. expenditure of R&I, emission targets) whereas in some other dimensions country specificities (e.g. strengths, weaknesses) do not only impact on the type of actions implemented but also on how these are implemented. This inhibits relevant comparison with actual formative effect. Integrating context specific information into the monitoring system would allow increased comparability, which is likely to be more insightful within individual countries e.g. across regions, and for one specific country over time rather than across countries. Overall, interviewees suggested that comparison through data normalisation and, when taken with caution, comparison among countries could highlight best practice and strengthen the learning from each element, especially among countries with similar R&I systems.

Figure 3-8 - Cross-country comparison of R&I performance (Q23)



Source: ERA monitoring Survey

In regard to the presentation of data from the ERA Monitoring mechanism, potential changes would make the presentation more visually striking to better communicate progress to different types of EU and national R&I stakeholders, and to the broader public. Examples are enhancing the data visualisation of monitoring data through the use of more infographics, allowing some data to be updated in real time, etc. Key questions addressed during the consultations with stakeholders are:

Box 3-3 Improving data visualisation and interactivity of the data for users

- Which other Scoreboards can be highlighted that represent good practices or could provide inspiration for the development of a possible ERA Scoreboard? [44]
- Modernisation – a report in PDF format at EU level and country reports only or complemented by performance benchmarking, downloadable and interactive data, more infographics?
- How could data visualisation be improved?
- Is the current biennial approach sufficient or could real-time be plugged in using cloud-based reporting and APIs?
- Could user interactivity be improved (e.g. users playing with data depending on variables of interest)?
- Is it helpful to compare MS performance easily, quantitatively (e.g. DESI)? Or are qualitative factors a limitation? How controversial?

3.3.4 What do we want to measure?

A key issue for debate is what do we want to measure? Among the considerations here are issues such as the balance between quantitative and qualitative indicators, how to ensure that the indicators are relevant, accepted and timely, etc. The **Better Regulation toolbox** (Tool 41) stresses the importance of applying the SMART and RACER criteria.

[44] Examples identified include the Single Market Scoreboard (https://ec.europa.eu/internal_market/scoreboard/), Digital Economy and Society Index (DESI), https://digital-agenda-data.eu/datasets/desi/visualizations, the European Innovation Scoreboard (EIS) https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en and Blue Economy Scoreboard https://blueindicators.ec.europa.eu/.

- The **SMART criteria** are: Specific, measurable, achievable/ attributable, relevant, and timely, time-bound and trackable; and
- The **RACER criteria** are: Relevant, Accepted, Credible, Easy and Robust.
- Further details regarding the relevance of taking the **SMART and RACER criteria** into consideration in the development of the indicator system are provided in Annex 1.

Developing specific indicators requires not simply the selection of metrics on the basis that they can be easily measured, but also an assessment of their relevance. This must be balanced with the challenge of gathering data at national level, especially when this can sometimes not be considered a priority and requires significant and sustained effort. Relevance should be for overall progress towards the New ERA to be measured centrally, but it will also be important that the indicators are of direct use to Member States for their own national monitoring.

There should be as much centralisation as possible in terms of what can be measured at EU and at Member State level.

A new opportunity for the new monitoring system and indicators in the new ERA is the potential application of Artificial Intelligence (AI) and digitalisation to interrogate national datasets and to extract relevant data automatically.

For example, work has been carried out by the Commission's DG RTD and consultants contracted by the Commission to use AI and web trawling software to maximise the potential value of Horizon Europe data in future by investing in studies to investigate the scope to use IT as a tool to extract complex data. For instance, impact pathways can be identified for supported research projects within the FPs to monitor what impacts these have had beyond project completion over time, for instance, for 5-10 years following closure of the research project.

A further example relates to the use of web-trawling tools to gather data to provide policy insights relating to the new ERA objectives. An example is the use of web-trawling to gather large datasets (big data) on the salaries and working conditions of researchers, and on job adverts for their recruitment (which could shed light on progress towards merit-based, open and transparent recruitment). Exploratory studies in this regard are being conducted as part of a contract for DG RTD on knowledge ecosystems, which includes a number of work packages on strengthening monitoring data using IT tools.

Whilst currently this approach might be confined to a limited number of more conventional indicators, such as citations and publications initially, it could be expanded over time to gather other information relevant to assessing impacts. It could be used to automatically generate information on how many datasets grant open access in particular areas. Among the questions however in relation to the use of new technologies are:

- How would an AI-driven mechanism work?
- How feasible is this approach? Which critical conditions need to be met for this to be achieved?
- Which other technologies could be used to generate new data that may be ERA-relevant?

It will also be necessary to select specific indicators. Among the strategic considerations for debate among the stakeholders there are the following:

Box 3-4 - Key issues for selecting a new set of indicators for the New ERA

- How many indicators relating to the six former ERA priorities remain valid in the new ERA?
- How robust and effective were the indicators of the 6 ERA priorities and are they still fit for purpose?
- What is the best way to ensure a smooth transition for MS and ACs between the EMM in 2015-2020 and the launch of a new, upgraded ERA monitoring system?
- How many indicators should be included in the new ERA Scoreboard?
- How can a balance be struck between efficiency and effectiveness in the design of the monitoring system to ensure proportionality?
- Should the distinction between headline and operational indicators be retained? If yes, should only the headline indicators go into the ERA Scoreboard and the other more detailed and operational indicators be further streamlined?
- How directly comparable is Member State and AC performance across the ERA priorities? Are qualitative indicators also needed? Are some priorities, measures and actions not comparable?
- How can the SMART and RACER criteria be applied to the new EMM in practice? In particular, how can we ensure that the indicators are accepted e.g. by politicians, ERA countries, ERAC members?
- Are data sources available to support the proposed new indicators? Is reporting frequency suitable?
- Would it be more effective if monitoring focused on assessing strategic progress (using context *indicators as proxies)*, or should more operational activity-based monitoring of ERA-relevant initiatives and measures be the focus? Or both?
- Should some monitoring of ERA implementation be undertaken qualitatively? If so, which?
- How best can the new ERA governance arrangements be reflected in the design and implementation of the new ERA monitoring system? How can the buy-in of ERAC members and MS authorities be ensured?

In addition to looking at how the previous ERA indicators could be adapted and integrated into the new indicator set, it will be important to look at how metrics that could capture the implementation of the four new ERA priorities can be identified and implemented. While there are broad similarities in the overall ERA context, the details of EU policies have evolved over time. Also, the four new objectives are interlinked, which means that there needs to be a subtle approach to identifying indicators and linking them to the specific policy. This may mean that indicators will not be easily compartmentalised and specific to any one given policy.

A further issue is that new indicators may be needed to reflect the evolution in existing ERA priorities and also emerging political concerns. For example, the international mobility of researchers (including intra-EU mobility, attracting international talents) was always considered to be a major priority, however, in some countries, this may exacerbate brain drain. The retention of researchers rather than promoting their mobility may in some cases be a more important priority. An aspect of international cooperation that did not appear in the past is the issue of academic freedom in the more general context of Foreign Interference. Connected to the latter is the extent to which data can be made fully open when there is lack of reciprocity from other global regions and/or issues of data sovereignty. These emphasise how the indicators for the New ERA, while retaining the previous relevant indicators, need to add new ones.

To illustrate this point, the examples of **Researcher Careers** and **Open Science** are considered as thematic case studies in Annex 4. These are relevant in all of the new ERA policy areas, and given recent developments may provide indicators that can be measured at both EU and national levels centrally.

How should indicators be collected, using which types of monitoring data?

A key issue in addition to "what do we want to measure" is "how do we want to measure it", and linked to this, how monitoring data in respect of particular indicators is collected. This is an aspect which will also determine the degree of reliability and success. There are alternative approaches, which are not always mutually exclusive.

Table 3-10 – Alternative approaches to data collection and monitoring

Alternative approaches	Advantages	Disadvantages
Using existing indicators, such as those produced by Eurostat the JRC and the OECD	• Reliable • Available annually usually • Stable over time for longitudinal assessment of progress • Not adding new information, but pulling it together in an ERA-relevant way	• Indicators already exist and are not necessarily innovative • Not adding any new information
Survey-based indicators, such as the MORE survey on researcher mobility	• More agile • Already being collected every 3 years for the last 12 years	• Perhaps less robust than official data. • Depend on a good response rate for reliability. • Time lag in data availability (e.g. between a large-scale survey of researchers and the survey results being analysed / published in report form)
New indicators e.g. pilot indicators under development by Eurostat	• Maintains innovation in the indicator system • Gathers new data able to provide new insights.	• Tends to be perception based but not always.
Take advantage of existing long-standing data collection mechanisms using well-tested scenarios and processes (OECD's R&D survey, European Labour Force Survey, etc.) and adding a limited set of new ERA-relevant questions to existing questionnaires.	• Short implementation phase, reliable, high-quality data collection process, fast transfer of data.	• There could already be demand from other areas to collect additional data on new indicators. • Could be reluctance to add additional data collection if there are concerns regarding survey fatigue.

Regarding the selection of different types of indicators to be included in the revised indicator system, the following table provides alternative strategic options to illustrate choices to be made between direct and indirect measurement of progress towards the new ERA.

Table 3-11 – Approach to monitoring in a new ERA monitoring and indicator system

Options	Explanation	Advantages	Disadvantages
Option 1 – direct monitoring of ERA implementation	• Across the ERA priorities, some concrete activities and initiatives are being supported. • These can be measured through direct, activity-based indicators (e.g. no. of European researchers benefiting from EU funded mobility grant.	• Output and some results indicators are easy to understand in terms of linking back to the activities being supported and to some degree, the objectives. Measurement of direct effects as activity-based	• Whilst output indicators are relatively easy to identify and define, these may not shed enough light on what progress is being made strategically towards the ERA priorities and objectives. • Some areas of progress may only be assessed robustly using a combination of a qualitative and quantitative approach, given the complexity (e.g. country-of assessing what role contextual factors) • Difficult to identify quantitative impact indicators directly related to activities.
Option 2 – monitoring ERA implementation at a strategic level	• Indirect indicators, such as context indicators relating to a country's R&I performance can be used as a proxy to assess progress in particular areas (e.g. strengthening the effectiveness of national R&I systems).	• In contrast with activity-based monitoring, the use of proxy indicators is useful in assessing strategic progress towards objectives.	• Over-reliance on context indicators as proxies may undermine the utility of the indicator system • If assessment of progress is dependent on context indicators, stakeholders may not be able to understand the links between the indicators selected and the activities taking place at EU level and on the ground. • Degree of attribution unclear (e.g. how far did ERA influence the evolution in context indicators, such as public expenditure on R&I, as opposed to national-specific factors?)
Option 3 – combination of operational and strategic monitoring	• Combination of direct and indirect indicators used to measure progress.	• Both headline (strategic) and operational (managerial) indicators can be monitored. • As both elements covered, could capture totality of outputs, results and impacts	• Implies increasing the number of indicators. • May require a combination of quantitative and qualitative assessment. • More demanding to implement in terms of human resources, data needs.

Data normalisation

An issue raised by some stakeholders was the importance of ensuring that ERA participant countries are compared on a like-for-like basis. This may require **data normalisation.** For instance, data can be normalised by country population size, or take into account other variables, such as researcher population (in the public sector), differences in GDP or on national expenditure on R&I. Such steps would eliminate country bias when making cross-comparisons. This issue was already on the radar of some of the SWGs in the 2015-2020 period.

As such, data normalisation was already referred to in the ERA Monitoring Handbook 2018. In fact, data reviewed for the indicators included in the EMM 2015-2020 were normalised to account for number of researchers for example for Priority 6, International co-publications with non-ERA partners per 1 000 researchers in the public sector. In this case, data was normalised by the number of researchers to account for size differences across countries, thereby allowing their direct comparison.

However, normalisation needs to be carefully considered so as to avoid for example unintended bias towards larger economies. In the case of participation to ESFRI projects and landmarks, these are normalised by the total number of ESFRI Projects and/or Landmarks across Europe rather than by the size a country's population or size of the economy in form of GDP. As indicated in the ERA Handbook 2018, large countries will naturally participate in a larger number of Research infrastructures, and potential revisions of normalisation in these cases could benefit the overall measuring effort for more representative monitoring.

Other challenges to be accounted for in data normalisation is the case of fluctuating denominators, which are in some countries not only diverging in short periods of time but also incomplete. As a result, when used to normalise an indicator, the final figure might no longer provide a representative picture of the actual situation and development in the given country. As suggested by the ERA Handbook 2018, a possible improvement to ensure a smooth historical trend would be using denominators of the structural aspect of the country which are less likely to drastically change in the short-term. Although this approach would possibly provide little information on the effectiveness of national research systems in relative terms, it does highlight the complexity of data normalisation for truly comparable data in a context of very diverse R&I systems.

3.3.5 Horizontal issues in the new ERA Pact - ensuring effective policy coordination and investments in reforms

This section considers the horizontal question of ensuring effective policy coordination in ERA implementation and monitoring (section 3.3.4.2), as well as cross-cutting priorities relating to the new ERA, namely: (1) investments and stimulating appropriate policy, regulatory, structural and institutional national reforms (section 3.3.4.3) and (2) developing appropriate policy and regulatory framework conditions at EU, national and regional levels conductive to successful and effective ERA implementation.

The purpose of this section is also to set out a longlist of indicators based on a provisional assessment. The rationale for the possible inclusion of certain indicators in the ERA Scoreboard is explained by priority.

3.3.5.1 Ensuring effective Policy Coordination in ERA implementation

The ERA Pact mentions that an enhanced monitoring and coordination mechanism is needed, so as to ensure progress towards the ERA priorities. There are a number of different dimensions to enhanced coordination, such as:

- A common ERA policy agenda;
- A dedicated ERA policy online platform; and
- Regular policy dialogues between the Member States and the Commission.

As these elements relate more to the modus operandi in terms of how from a coordination arrangements perspective, the new ERA will be implemented, there are only limited possibilities in terms of suitable indicators. However, basic output data, such as the Number of policy dialogues, could be quantified. In addition, qualitative indicators would be more appropriate, for instance, to assess the degree of progress being made by particular countries in ERA implementation. A simple 1-5 ratings where 1 – strong progress and 5 – no progress at all could be used, or a high, medium and low level of progress compared with the baseline situation when new ERA implementation commences.

Table 3-12 Inclusion of strengthening policy coordination in the new EMM

Cross-cutting Priority – Strengthening Policy Coordination	ERA sub priority or relevance to other EU policies	Indicator	Inclusion in new EMM?	Type	Rationale for inclusion/ exclusion in new ERA monitoring system
Ensuring more effective policy coordination on ERA	NA	Number of policy dialogues between government Ministries and R&I stakeholders at country level and the Commission.	Yes	Quant.	Absolute numbers will not be representative nor comparable, hence a need for data normalisation to reflect differences (e.g. in country size/ population).
Ensuring more effective policy coordination on ERA	NA	Qualitative assessment following policy dialogues: Overall degree of progress made by ERA participant countries compared with baseline (1-5 rating or high-medium-low scale could be used	Yes	Qual.	Whilst it requires making a judgement, following policy dialogues, the Commission could provide a simple assessment as to how much ERA-related progress particular countries have made
Ensuring more effective policy coordination on ERA	NA	Qualitative assessment following policy dialogues: Progress in alignment of national R&I strategies and action plans compared with the new ERA made by ERA participant countries compared with baseline (1-5 rating or high-medium-low scale could be used	Yes	Qual.	As above, but a judgement is also required on the degree of alignment with the ERA at national level, especially if NAPs are discontinued.

Policy dialogues have been suggested by the ERA Forum for Transition. Regarding the proposed indicators, the number of policy dialogues is a simple output. It will not provide great insights. However, it can be helpful at a basic level e.g. in providing an overview as to which countries have already had policy dialogues, what % of total ERA participant countries etc. Then whilst not as formal as the Semester Process, written qualitative feedback with a simple judgement and quantitative score indicating how far particular countries have made progress in two areas (1) ERA implementation overall and (2) degree of alignment of national R&I strategies, action plans etc. would be a good means of monitoring whether policy coordination and ERA alignment is actually taking place or not. In the course of policy dialogues, individual countries could be asked about what steps they are taking to implement the new ERA and this could be documented in a short meeting note. Other aspects of policy coordination are more difficult to develop indicators for. However, there could be simple indicators, such as the number of countries that have provided information about ERA implementation at national level via the Online Policy Platform.

3.3.5.2 Prioritising Investments and Reforms (cross-cutting)

Under the new ERA Pact, a high-level priority of cross-cutting relevance is the need to prioritise investments and reforms. This addresses not only the need to increase national R&I investments, but also the necessity of developing supporting framework conditions at EU and national levels to foster investment and reforms and setting voluntary national targets on R&I investments to secure the necessary investment in ERA implementation. In particular, the areas prioritised are:

- **Improving the framework conditions.** Public research and development expenditure and private R&I investments require an **adequate policy and regulatory framework** to maximise their effectiveness and efficiency and ensure an economic and social impact;
- **Reforming the R&I policy framework and / or national R&I systems, or implementing a transformative agenda** - requires mobilising appropriate resources (e.g. funding, human resources, skills, research posts) to drive change and improve the performance and output of the R&I system;
- Putting in place **voluntary national R&D&I investment targets** to increase overall R&D&I expenditure and also to strengthen scientific, technological, societal, or industrial orientations;

It is important to note that there are some specific quantitative voluntary targets on investment levels that would represent a political commitment by the MS and AC countries taking part in the ERA. These are worth repeating from the ERA Pact (where they draw on the targets in the earlier 2020 Communication), as they would need to be included in the indicator system:

> Confirm their intention to raise the Union-level investment in research and development in the following manner:
>
> (a) Increase the total expenditure on research and development to 3% of EU GDP ('3% target');
>
> (b) Increase the total public effort on research and development to 1.25% of EU GDP by 2030;
>
> (c) Increase the share of national public research and development expenditure committed to joint programmes, research infrastructures and European Partnerships to 5% of national public R&D funding by 2030;
>
> (d) a 50% increase in total research and development expenditure over the next 5 years for Member States lagging behind the EU average research and development expenditure as a percentage of GDP.
>
> (5) Establish, on a voluntary basis, national investment targets for the:
>
> (a) intended public effort in research and development, expressed as a percentage of GDP;
>
> (b) percentage of national public research and development expenditure committed to joint programmes, research infrastructures and European Partnerships;
>
> (c) expected increase in total research and development expenditure, for those Member States lagging behind the EU average research and development expenditure as a percentage of GDP.

Source: the ERA Pact, pg. 10/11

A longlist of indicators is provided below relating to investments and reforms. After the table, narrative is provided explaining key issues relating to indicator selection. It should be noted that some of these investment and expenditure-related indictors are also relevant to Priorities 3 and 4 of the new ERA Pact.

Table 3-123 Longlist of indicators – ERA Pact, investments and reforms

New ERA Priority areas	ERA sub priority or relevance to other EU policies	"Old" ERA priority	Indicator	Inclusion in new EMM?	Rationale for inclusion/ exclusion in new ERA monitoring system
P1	**R&I investment**	**P1**	**Gross Domestic Expenditure on R&D (GERD) as a percentage**	**Yes**	**GERD is strategic and contextual and a crucial measure of progress in the level of investments towards ERA goals. As a priority is to use public funds to boost private R&I**

			of GDP		**investment, this should be reported on or only GBARD as in EMM 2015-20.**
P1	**R&I investment**	**P1**	**Sub-indicator on GERD - Government Budget Allocation for R&D (GBARD) as percentage of GDP**	**Yes**	**GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals**
P1	**R&I investment**	**P1**	**Sub-indicator on GERD - GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector**	**Yes**	**GBARD is strategic and contextual, but remains a crucial measure of progress in the level of R&I investments towards ERA goals. The transnational element is important to assess the degree of transnational cooperation (former P2a).**
P1	**R&I investment**	**P1**	**Sub-indicator on GERD - Environmentally related government R&D budget, % total government R&D**	**Yes**	**Budget allocated through EU R&I expenditure to environmentally-oriented R&I is of importance in assessing the ERA (and FP) contributions to the Green Deal and environmental sustainability. As developed by the OECD, indicator would be internationally comparable. However, the inclusion of Green Growth indicators may add to the overall no. of indicators and proportionality is an issue.**
P1	**R&I investment**	**P1**	**Sub-indicator on GERD - Environmentally related R&D expenditure, % GDP**	**Yes**	**As above (except relating to actual expenditure on green growth)**
P1	**R&I investment**	**P1**	**Sub-indicator on GERD - Business Enterprise expenditure on R&D (BERD) as a percentage of GDP**	**Yes**	**Private sector R&D is a crucial component of total GERD. In widening countries, among others, there have been challenges in increasing BERD, which represents a major policy challenge.**
P1	R&I investment	P1	Gross National Expenditure on R&D (GNERD) as percentage of GDP	Yes	Important to include this as for some countries GDP is distorted by foreign direct investment (e.g. multinational Pharma, ICT and Medical Devices a significant component of GDP in Ireland).
P1	R&I investment	P1	Research and development expenditure of importance to green growth	Maybe	Green growth is crucial for the Green Deal and to assess the contribution of EU R&I in this regard. However, there could be risks in having too many expenditure-related indicators.
P1	R&I investment	n/a	EU R&I investments in green transition (million EUR) (e.g.	Maybe	Dependent on EU committing to commissioning periodic studies to

			Horizon Europe, R&I expenditure through ESIFs).		analyse the contributions to the green transition through EU R&I.
P1	R&I investment	n/a	R&I investments in digital transition (million EUR) (e.g. Horizon Europe, R&I expenditure through ESIFs, Digital Europe Programme).	Maybe	Dependent on EU committing to commissioning periodic studies to analyse the contributions to the digital transition through EU R&I.
P1	R&I investment	P2b	Availability of national roadmaps with identified ESFRI projects setting out investment needs	No	As ESFRI projects involve very significant expenditure, how far different countries have prepared national roadmaps continues to be a proxy for assessing access to research excellence esp. in widening countries (new P2). However, as they all appear to produce national roadmaps, could be dropped.
P1	R&I reforms	P1	Number of reforms implemented at national level	Yes	Simple output, not meaningful in itself, but more a starting point before assessing progress qualitatively (see next row).
P1	R&I reforms	P1	Types of R&I reforms implemented at national level (disaggregated between 1) administrative / institutional reforms and 2) structural reforms	Yes	Qualitative indicator as not possible to assess quantitatively easily.
P1	R&I investment	P1	National investment into pan-European RI projects (m EUR)	Yes	In the previous EMM, it was not possible to measure how much investment was being made as data was not comparable. Such data is now available, although data on national and regional RIs is not available on a comparative basis.
P1, P2	R&I investment, Improving access to excellence	P2b	Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner	Yes	Could shed light on the extent to which widening countries are participating in excellence as landmark ESFRI projects are about cutting-edge science and knowledge-sharing.
P1	R&I investment	P1	Extent of use of tax incentives for investment in R&I (million EUR)	Yes	As developed by OECD, would be internationally comparable.
P1	R&I investment	P1	Indirect government support through R&D tax incentives as percentage of GDP	No	As developed by OECD, would be internationally comparable.
P1	R&I investment	P2	Indirect government support through subnational R&D tax incentives	No	As developed by OECD, would be internationally comparable.

P1	R&I investment	P1	Number of investment projects to improve university research infrastructures	Maybe	Sub-indicators such as research infrastructure upgrading projects at national level in the university sector are of interest as they are part of the upgrading of R&I infrastructures beyond pan-European RIs funded through ESFRI.
P1	R&I investment	P1	Leverage effect (ratio between EU R&I funding and leveraging of national R&I funding e.g. through joint programmes, thematic partnerships and Seal of Excellence).	Yes	The extent to which EU R&I funding is able to generate leverage through increased national and regional R&I funding, including through joint programming and follow-up approaches in Horizon Europe is an important issue. This is a proxy for how well aligned EU and national R&I funding are. The seal of excellence is considered as indicators under P2.

R&I investments are evidently an area that has been given increased prominence in the revitalised ERA, reflecting the fact that although progress was made in some countries, overall, as an EU average, performance has fallen short of the 3% of GDP expenditure target on R&D.

Some of the above indicators were already included in the previous EMM, namely Budget Allocation for R&D (GBARD) as percentage of GDP and three indicators in the area of research infrastructures (ESFRI). Regarding investment-focused indicators, the focus was on GBARD alone. Whilst a target for GBARD of 1% was agreed in 2000, this has not been achieved. Accordingly, in the new ERA Communication, a suggestion was made that 1.25% should be set as a target in future. This indicator should be retained as it's quite important in assessing progress longitudinally in the key area of government expenditure.

However, beyond the issue of target setting is the broader question of whether **additional complementary R&I expenditure indicators** are needed, such as **Gross Domestic Expenditure on R&D (GERD)** as a percentage of GDP which provides aggregate data on national R&I spending (note - GBARD is a sub-indicator within GERD, so this would maintain consistency).

A perceived weakness of the ERA in 2015-2020 was an over-focus on issues most relevant to academic R&I. Although these will remain important, there could be a transition to measuring R&D&I investments based on a more holistic, ecosystems-based approach that accommodates industry and applied research spending on R&D&I wherever possible. Therefore, other sub-indicators of GERD, such as **Business Enterprise expenditure on R&D (BERD)** as a percentage of GDP, could therefore also be used as headline indicators. This would also be highly relevant in some of the former new Member States, where private R&I investment has been lagging (as highlighted in the EIS annual reports and in the RIO Reports developed by the JRC). Progress in BERD could be a proxy for improvements in excellence to some degree, since if a country is more dependent on GBARD then, there may be structural weaknesses in the national R&I system.

Key findings on measuring investments in the new ERA: Investments are becoming more prominent as an ERA priority, so there is an argument in favour of expanding the number of investment-related indicators.

Monitoring GERD at an aggregate level, along with GBARD and BERD could be suitable headline indicators that could be included in the ERA Scoreboard.

It is important not only to measure government expenditure but also other types of expenditure on R&I to provide **contextual data about progress, even if aggregate country-level expenditure on R&I is determined by a**

broad range of factors – e.g. degree of political commitment to the ERA, macro-economic situation/ financial availability to invest in R&I, political situation and commitment to R&I at national level, extent of incentives to stimulate private sector R&I investments.

Regarding the **monitoring of national reforms in the area of R&I,** this relates to the former P1 (more effective national research systems) but also to the new ERA P1. Feedback from stakeholders was that this is an area mainly requiring **qualitative assessment** as there is limited comparability between countries in assessing how far progress has been made with the types of reforms needed at national level, for instance of an **institutional, structural** or **administrative nature**. Indeed, there were no direct indicators previously to assess progress towards reforming R&I systems in the previous EMM.

The drivers underlying the need for reform, and whether reforms actually go ahead as planned, will vary considerably, as was shown in our analysis of the implementation of the NAPs (see Section 2.3). This will also depend on many national-specific factors. A qualitative approach to monitoring this aspect was therefore supported by stakeholders.

The above narrative is also relevant to the new ERA Pact Priority 3, which includes a broad range of investments that could support many different areas of ERA implementation, including national structural, institutional and administrative reforms.

3.3.6 ERA Scoreboard

The Council Conclusions of December 2020 committed to the introduction of a new ERA Scoreboard to "address progress at EU and national level, revise priorities and actions in the ERA Roadmap and to provide evidence and analysis for the European Semester"[45]. It was suggested that the new Scoreboard should be updated annually.

There are **various factors to consider in designing the new ERA Scoreboard**, including the imperative of striking a balance between ensuring continuity, whilst at the same time reflecting the importance of new areas and the growing number of ERA-relevant thematic priorities. Examples of issues for consideration are:

- The increased **prominence of R&I investment and reforms** in the new ERA Pact. This needs to be reflected through the inclusion of indicators in these areas. Reforms are however more difficult to assess quantitatively, and require qualitative assessment (e.g. the type of reforms being made (whether to systems and structures or administrative);
- The central importance of fostering **research and scientific excellence** within the ERA, and **expanding existing access to excellence to include more widening countries (and RPOs in those countries) through a continued focus on longer-term fundamental research**;
- The need to ensure that the new ERA is implemented in a holistic way that recognises the importance of both the **research dimension and the innovation aspects,** and the role of **industry and applied research** through cooperation between research actors in different sectors;

[45] Communication from the European Commission, September 2020: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0628&from=EN

- The **continuing importance of various thematic priorities from the previous ERA Roadmap** under the new Priority 1, deepening the ERA, namely through monitoring:
- Investment in landmark ESFRI research infrastructures and the imperative of maximising access to, and improving the usage of RIs jointly funded using national and EU funding;
- Progress towards enhancing **Researcher Careers and Mobility** (international, intersectoral), and of strengthening the supportive framework conditions to enhance career development both within, and outside academia;
- Progress towards **gender equality, but expanding monitoring to consider broader inclusion, equality and diversity-related goals**;

- **Open Science and Open Access to publications and datasets**, and the need to assess whether OS is being implemented in accordance with FAIR data principles, including whether international reciprocity is taking place;
- The role of European R&I actors in fostering knowledge transfer and in the dissemination and exploitation of research results.

Key **criteria for selecting indicators** to be included in the Scoreboard are:

- The need to select **strategic indicators** able to shed light on strategic progress towards the overarching ERA objectives, and to assess the ERA's relative attractiveness compared with Europe's global competitors. As a reminder, the ERA objectives defined in the Pact are:
  - **Priority 1 –** Deepening the ERA (a truly functioning internal market for knowledge)
  - **Priority 2 –** Taking up together the challenges posed by the twin green and digital transition, and increasing society's participation in the ERA
  - **Priority 3 –** Amplifying access to research and innovation excellence across the Union
  - **Priority 4 –** Advancing concerted research and innovation investments and reforms
- Given the strategic monitoring function of the Scoreboard, **headline and context indicators** would be more appropriate than activity-based monitoring. Such indicators are **politically-visible, longer-term, help to ensure continuity,** but are often not directly related to operational ERA-related policy initiatives and activities being supported on the ground (where the Performance Dashboard will instead come into play, where indicators can be determined thematically);
- Indicators should be selected based on **reliable and comparable data sources that are published frequently.** As a minimum, such data should be revised annually although some flexibility in this regard could be envisaged if a political decision is taken that the Scoreboard should be say once every 18-24 months and not annually.
- To ensure comparability, the ERA Scoreboard data must rely on **EU data sources drawn from centralised EU databases** (e.g. EUROSTAT, Community Innovation Survey, JRC). Conversely, for the EMM more broadly, national data sources could be used in certain instances if for example, there is no EU-wide data collection, progress could already be assessed in some countries.
- **If data is not yet available on a reliable, frequent and comparable basis, the indicator cannot be included unless there is a firm commitment to collect such**

data by the Commission, Eurostat and national statistical offices. The same principle applies to any indicators where international comparability is required, as this would need either to draw on existing indicator sets (e.g. developed by the OECD) or require their close future and ongoing cooperation. This could mean that some important new areas of monitoring where data is likely to become available in the next 2-5 years are not included in the Scoreboard yet but instead in the Dashboard. However, promising indicators shedding light on ERA implementation progress could be promoted to the Scoreboard as part of a future revision exercise (e.g. data on researchers' salaries and working conditions).

- **The approach to monitoring and reporting should be realistic and proportionate.** It would be unrealistic to report on all ERA thematic priorities in the ERA Scoreboard, as there are 15 thematic priorities in the ERA Pact. The number of indicators will **necessarily be confined to 15-20 indicators**. Instead, the 15 thematic priorities could be reflected in the next level of monitoring in the Performance Dashboard, with only some themes represented in the Scoreboard. This could include:
    1. Indicators relating to the ERA's global attractiveness
    2. Indicators pertaining to the thematic priorities considered most important by ERA stakeholders. For instance, researcher mobility and Open Science / open and FAIR access to data have grown in importance since 2015-2020.
- **The Scoreboard should be quantitative and be kept simple and easy to understand.** A lesson learned from the European Innovation Scoreboard is the need to focus on quantitative data initially. Over time, some qualitative analysis and interpretation regarding the evolution in monitoring data at EU and national level can then be provided to provide context. Conversely, in the wider monitoring and indicator system, there will be scope for the inclusion of qualitative indicators;

The following considerations are needed in the design of the future ERA Scoreboard:

- **The need to restrict the Scoreboard to a manageable number of 15-20 strategic indicators**. This would help to shed light on ERA implementation progress towards the 4 strategic objectives and 15 thematic priorities included in the ERA Pact.
- **The need for prioritisation.** Given that there are 15 different thematic priorities and it should therefore be recognised that not every policy/ thematic domain can be included in the Scoreboard.
- Whilst stakeholders at the workshop on indicators suggested the need for balance in the Scoreboard across the new ERA priorities**, more indicators are required to be included under some priorities than in others**, as they may contain multiple sub-priorities. For example, Deepening the ERA (new ERA, P1) includes some thematic areas that require continuity with the six previous ERA priorities (e.g. gender equality, careers and mobility of researchers, research infrastructures). There are consequently likely to be more indicators for new ERA Pact Priorities 1 and 2 than for Priorities 3 and 4, reflecting the number of thematic priorities/ Priority.

A proposition regarding the composition of the ERA Scoreboard – and the rationale behind the choices - is provided in the table below. It can be noted that the current configuration is comprised of a longlist of 27 indicators. This should ideally be reduced to a maximum of 15 indicators that the ERA Forum and wider stakeholders agree best shed strategic light on progress. Suggestions on shortlisting are provided

by bolding the 15 indicators that could be prioritised. However, it is for the stakeholders to determine final prioritisation.

Table 3-134 - Proposal for indicators for the ERA Scoreboard (shortlisted indicators in bold in indicator column)

No.	ERA Pact priorities	ERA Pact sub-priorities	ERA sub priority or relevance to other EU policies	Indicator	Definition	Rationale for inclusion	Data source	Frequency of data collection
1	P4	R&I investments	R&I investments	**Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP** **Annual update** **Long-term trend (averaged over 15 years)** **Short-term trend (averaged over 5 years)**	The total intramural expenditure on R&D performed in the national territory during a specific reference period.	The target of R&I expenditure of 3% of GDP has been in place for 20 years since the ERA was founded and the Lisbon agenda. However, this has not been achieved and there is a need to reaffirm it in the new ERA. GERD is strategic and contextual and an important measure of progress in the level of investments towards the ERA goals. As a priority is to use public funds to boost private R&I investment, this should be reported on or only GBARD as in EMM 2015-20.	Eurostat	Annual
2	P4	R&I investments	R&I investments	**Sub-indicator on GERD - Government Budget Allocation for R&D (GBARD) as percentage of GDP**	The government budget allocations for R&D (GBARD) divided by the gross domestic product (GDP) of a given country. GBARD represents budget provisions and not actual spending	The target of R&I expenditure of 1% of public expenditure has been in place for 20 years since the ERA was founded. However, in the new ERA, it has been agreed in principle that a 1.25% target should be set. GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals.	Eurostat	Annual

3	P4	R&I investments	R&I investments	**Sub-indicator on GERD - Business Enterprise expenditure on R&D (BERD) as percentage of GDP**	All R&D expenditures in the business sector (BERD)	Private sector R&D is a crucial component of total GERD. Private sector contribution towards R&D constitutes a major element towards further developing R&I systems, especially challenging in countries in which R&I is not of high strategic relevance.	Eurostat	Annual
4	P3	R&I investments	R&I investments (research excellence)	**Share of national public research and development expenditure committed to joint programmes, research infrastructures and European Partnerships to 5% of national public R&D funding by 2030.**	As per indicator.	Increasing the share of national public R&D expenditure committed to joint programmes, research infrastructures and European Partnerships to 5% of national public R&D funding by 2030 would be a proxy for ERA participant countries' commitment to research excellence	Eurostat/ national ministries (of research, education and science)	Annual
5	P3	R&I investments	R&I investments (transnational cooperation)	GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector	This indicator is the government budget allocations for R&D (GBARD) allocated to transnational cooperation normalised by the number of researchers from the public sector. Transnational coordinated R&D contains GBARD allocated to Europe-wide, bilateral or multilateral transnational public R&D programmes and GBARD allocated to	GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals. The transnational element is important to assess the degree of transnational cooperation (former P2a).	Eurostat	Annual

					transnational public R&D performers. [46]			
6	P1	a) Open Science	Open Science	**Share of publications available in open access (green, gold and diamond)**	This indicator is the proportion of a country's research publications available in open access (OA)[47]	Already in the EMM, as a key measure of OA publications.	Web of Science (WoS) [48]	Annual
7	P1	b) Research infrastructures	R&I investment, Improving access to excellence	**Share of new ESFRI projects in which a Member State or an Associated Country participates (ESFRI)**	The proportion of new ESFRI projects in which a given country participates as a percentage of the total (**normalised to reflect country size).** New projects are either planned or under development.	ESFRI projects involve significant R&I expenditure. This indicator is therefore useful for both new ERA P1 and P2 i.e. the level of investments in pan-European RIs (P1) and how far different countries contribute to these as a proxy for assessing access to research excellence.	ESFRI Executive Secretary	Annual
8	P1	b) Research infrastructures	R&I investment, Improving access to excellence	**Share of operational ESFRI Landmarks in which an ERA participant country is a partner**	The proportion of ESFRI landmarks in which a given country (Member State or an Associated Country) is a partner. The data would need to be normalised to reflect country size.	Could shed light on the extent to which widening countries are participating in excellence as landmark ESFRI projects are about cutting-edge science and knowledge-sharing.	ESFRI Executive Secretary	Annual

46 For this indicator, only the GBARD allocated to Europe-wide transnational public R&D programmes and the GBARD allocated to bilateral or multilateral public R&D programmes are taken into account. This is because these latter two components address cooperation through programmes, while the third sub-category (GBARD allocated to transnational public R&D performers) does not involve joint programming and therefore does not contribute to ERA sub-priority 2a (implementing joint research agendas).
47 Peter Suber's definition (6) of gratis OA refers to the removal of barriers to access; gratis OA thus includes libre OA, which refers to the removal of price barriers as well as permission barriers. In addition to the proportion of total OA, the indicator is also produced for two sub-types of OA: gold and green.
48 1findr has been discontinued by Elsevier

9	P1	b) Research infrastructures	R&I investment, Improving access to excellence	Million EUR planned investment in new ESFRI Projects by ERA participant country (as a percentage of GDP)	Planned investment in new ESFRI Projects (Million EUR). This will require a calculation to assess level of investments in ESFRI compared with GDP.	ESFRI projects involve significant R&I expenditure. A distinction can be made between planned future projects and existing projects (see next row) This indicator is therefore useful for both new ERA P1 and P2 i.e. the level of investments in pan-European RIs (P1) and how far different countries have contributed to existing landmark projects is a proxy for assessing access to research excellence.	Quantitative assessment at national level	Data now available at EU-level – previously unavailable.
10	P1	b) Research infrastructures	R&I investment, Improving access to excellence	Million EUR investment in existing ESFRI Landmark Projects (by ERA participant country) (as a percentage of GDP)	Planned investment in existing ESFRI Landmark Projects (Million EUR). This will require a calculation to assess level of investments in ESFRI compared with GDP.	ESFRI projects involve significant R&I expenditure. A distinction can be made between planned future projects and existing projects (see next row).	Quantitative assessment at national level	Data now available at EU-level – previously unavailable.
11	P1	c) Gender Equality	Gender Equality	**Share of women in grade A positions in HEIs**	The proportion of women occupying the highest-level research positions (Grade A) in HES to the total of Grade A positions	Already in the EMM. Enables tracking progress made with regard to women's presence at the highest level of academia (breaking of glass ceilings) by analysing its trend through time.	DG Research and Innovation—WiS—Women in Science database	Annual
12	P1	d) Careers and mobility of researchers	International mobility, Brain drain/ gain	**Share of doctoral students from outside the EU**	The proportion of Non-EU doctoral students to the total number of doctoral students in a given country.	Already in the EMM and should be retained, as a key measure of international mobility. In the context of global engagement, Europe's attractiveness for researchers globally as a destination is a useful proxy.	Eurostat	Annual
13	P1	d) Careers and mobility of	International mobility, Brain	**Share of doctoral students with a nationality from**	This indicator is the proportion of doctoral candidates with a	Already in the EMM and should be retained (see ERA Monitoring Handbook 2018). Whilst not a policy priority in all EU countries (some	National Ministries and	Annual

		researchers	drain/ gain	**another EU country**	citizenship of another Member State to the total number of doctoral candidates in a given country.	of whom have high numbers of EU researchers already), proxy for fostering the mobility of researchers, and also for assessing brain drain/ gain nexus. Weakness in data however is that not all MS collect data on intra-EU mobility (e.g. IE), as EU researchers are not differentiated from nationals. Ideally, in order to capture brain drain/ gain issues, two-way mobility should be monitored not only the proxy indicator for how many doctoral students come from another country	Eurostat	
14	P1	d) Careers and mobility of researchers	Intersectoral mobility	**Share of doctorate holders employed outside academia (5 years after graduation)**	Share of doctorate holders employed outside academia and higher education, 5 years after graduation	Proxy for the degree to which researchers' skills are portable to other sectors and of their employment potential to use PhD qualifications in other sectors. Ideally the minimum for the indicator should be after 5 years, as a substantial number of PhD graduates do postdocs and typical surveys of PhD graduates show a large number in the academic sector. More doctorate holders are employed outside academia, simply because they can't get jobs in academia (increase in the supply of doctorates exceeds the number of academic positions available). Sometimes, researchers' skills are highly valued and PhDs are in strong demand in the private sector (example – AI, STEM subjects). The problem is that not all researchers can easily get jobs if their research and other skills are not fully valued by non-academic employers. Practical training and skills during the PhD (for both academic and non-academic careers) that are promoted to and recognised by employers could possibly help alleviate this situation.	OECD CDH dataset At EU level, working group within the EC is examining improving statistics on career tracking of researchers.	Every 3-5 years

15	P1	e) Knowledge Valorisation	Research Excellence	**Adjusted Research Excellence Indicator (AREI)**	This indicator defines the research excellence of a country through a composite indicator integrating four components: share of top 10% most highly cited publications per total publications (data source: CWTS); PCT patent applications per population (OECD); European Research Council (ERC) grants per public R&D (DG-RTD, Eurostat, OECD) and participation in Marie Skłodowska-Curie fellowships (DG-EAC).	Continuity with previous EMM – but only proposed composite indicator in Scoreboard[49].	Calculations by European Commission, Joint Research Centre, Competence Centre on Composite Indicators and Scoreboards (JRC-COIN)	Composite indicator, calculated based on data from Science-Metrix, OECD, World Bank, Eurostat, DG RTD, DG EAC
16	P1	e) Knowledge Valorisation	Research Excellence	Highly cited papers by discipline (top 1%, top 10%)	These internationally standardised indicator shows the scientific papers that are among top 10% most cited in the world in a particular field of research.	Although citations need to be used in a cautionary way alongside altmetrix (to avoid those universities with more funding to dominate the rankings by getting their research into the best (and most expensive) journals. Complementary indicators include: Normalized Citation Impact, Journal Normalized Citation Impact. These could be help to overcome the above mentioned concerns regarding the fairness of citations metrics.	Citation indexes	Annual
17	P1	e) Knowledge	Technology	**Number of patent applications to the EPO**	Number of patents by technology area: e.g.	Patent registration data is included in the EIS. Useful proxy for how innovative and applied	European Patent	Annual

[49] General feedback was that composite indicators should be avoided and that MS find it very difficult to understanding how their particular performance has been calculated, even though the JRC's methodology and the indicators used to calculate it are transparent.

		Valorisation	transfer	**(disaggregated by sector/ technology area)**	nanotechnology, ICT, biotechnology, health, environmental-related technologies), applicant type: Public Research Organisations, universities, etc.	research being conducted is. [50] Patent indicators are also available through centralised international databases, meaning that international data comparability could be achieved. In widening countries, this may be useful barometer of progress towards research excellence.	Organisation	
18	P1	e) Knowledge Valorisation	Innovation	Number of patent applications to the EPO with non-EU co-inventors in percentage, by priority year	Co-inventions represent the international collaboration in the inventive process.	Non-EU co-inventors working together with EU co-inventors is a measure of the internationalisation of research.	OECD Patents Statistics	Annual
19	P1	e) Knowledge Valorisation	Innovation	Number of high-tech patent applications to the EPO (by priority year per million inhabitants)	The data refers to the ratio of patent applications made directly to the European Patent Office (EPO) or via the Patent Cooperation Treaty and designating the EPO (Euro-PCT), in the field of high-technology patents per million inhabitants of a country. The definition of high-technology patents uses specific subclasses of the International Patent Classification (IPC) as defined in the trilateral statistical report of the EPO, JPO and USPTO.	Patents co-registered with international researchers capture innovation and international cooperation in their contribution towards economic growth. It is a highly contextual indicator; However, it will be difficult to specify intra- EU co-invention which would be more ERA-related, so indicator contextual.	Eurostat, PATSTAT database (EPO); OECD	Annual
20	P1	e) Knowledge	Knowledge	**Share of products and/or processes**	See ERA Monitoring Handbook, 2018, Page 21.	Indicator to assess the link between academia and cooperation with other sectors, especially	Eurostat	Annual

[50] Patent data has some weaknesses in terms of the comparability of the data between countries. For instance, some countries tend to over-patent, whereas others may under-patent due to commercial confidentiality concerns and/ or cultural reasons.

		Valorisation	transfer	**produced by innovative firms when cooperating with higher education institutions or public/private research institutions**	Definitions for assessing progress through cooperation towards performance and growth are provided.	industry.		
21	P1	f) Global engagement	Bibliometrics and international cooperation	**International co-publications with ERA partners per 1,000 researchers in the public sector**	This indicator measures, using fractional counting, the number of publications of an ERA country (or region within the ERA) involving at least one co-author from another ERA country. The number is presented relative to the given country's (or region's) researcher population size.	Already in the EMM. It is a good proxy to measure the outcomes resulting from transnationally-allocated research funding. It provides a proxy for research excellence and internationalisation.	WoS and Eurostat	Annual
22	P1	f) Global engagement	Bibliometrics and international cooperation	Number and share of publications with international collaborative authors	As per indicator	Evidence that increased international research collaboration increases national research excellence.	Quantitative assessment at national level	Data available in Scopus, Web of Science
23	P2	g) Challenge-based ERA actions	R&I investment	**Sub-indicator on GERD - Environmentally related government R&D budget, % total government R&D**	The data refer to government budget appropriations or outlays for R&D, expressed as a percentage of total R&D expenditure	Budget allocated through EU R&I expenditure to environmentally-oriented R&I is of importance in assessing the ERA (and FP) contributions to the Green Deal and environmental sustainability. As developed by the OECD, indicator would be internationally comparable. However, the inclusion of Green Growth indicators may add to the overall no. of indicators and proportionality is an issue. GERD part of OECD S&T indicators.	Green Growth Indicators Database, OECD	Annual
24	P2	g) Challenge-based ERA actions	R&I investment	**Sub-indicator on GERD -** Environmentally related R&D expenditure, % GDP	The data refer to government budget appropriations or outlays for R&D, expressed as a percentage of total R&D	As above (except relating to actual expenditure on green growth).	Green Growth Indicators Database, OECD	Annual

					expenditure			
25	P2	h) Synergies R&I/ education/ EU Skills Agenda	Human resource development/ career development of researchers	% of top 100 and Horizon Europe beneficiary organisations holding the HRS4R award.	As per indicator	Would link to research excellence by checking how many of the leading universities and Horizon Europe beneficiary organisations hold the HRS4R award. However, a disadvantage is that perhaps not all leading universities may wish to participate and they may use other mechanisms to ensure that they are delivering transparent, merit-based and open recruitment of researchers.	Qualitative/ quantitative assessment at national level	Data not currently collected
26	P2	j) Societal engagement in R&I	Societal impact of the ERA	No. and share of countries/regions where research agenda/roadmaps/projects/ policies are co-designed with citizens, civil society and end-users (e.g. through dedicated co-design meetings, citizen consultations)	As per indicator	An important means of ensuring the relevance of the ERA, and alignment with societal concerns, is co-design activities with citizens and/or societal actors such as civil society organisations.	Qualitative/ quantitative assessment at national level	Data not currently collected
27	P2	j) Societal engagement in R&I	Societal impact of the ERA	No. of countries and/or regions where there are citizen and civil society co-creation (e.g. citizen science) strategies at national and regional level	As per indicator	An important means of increasing the quality, relevance and trust in science. It could also be assessed whether there are adequate targets/monitoring and/or funding mechanisms in place to support citizen and civil society co-creation.	Qualitative/ quantitative assessment at national level	Data not currently collected possibly collected through DG REFORM's Structural Support Reform Programme)

	P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	R&I reforms	Number of long-term reforms i) proposed and ii) implemented at national level	Quantitative review of number of reforms 1) proposed and 2) implemented at national level. Basic information about the types of reforms could be collected e.g. 1) administrative / institutional reforms 2) structural and/ or 3) policy reforms	Simple output, not meaningful in itself, but more a starting point before assessing progress qualitatively (see next row).	Qualitative/ quantitative assessment at national level	Data not currently collected (possibly collected through DG REFORM's Structural Support Reform Programme)

The proposed ERA indicators is meant to inform strategic discussions between the Commission, the Forum for Transition and wider R&I stakeholders after this study's publication. Further feedback from the Forum will be key to finalising the ERA Scoreboard design and composition.[51] A consensus by stakeholders should be aimed for regarding indicator selection for the Scoreboard as this is likely to be the most visible element of the new monitoring mechanism.

It is difficult to arrive at a perfect set of indicators. These will often be contextual, or provide proxies for assessing strategic progress. There is also a debate regarding which indicators should be included in the ERA Scoreboard, and which only in the Performance dashboard, which will contain a broader set of indicators, mainly operational, but also some strategic (i.e. those that don't make the shortlist for the ERA Scoreboard due to constraints on the number of indicators in the latter.

A few examples are now provided of the debate regarding whether specific indicators should be included in a high-level Scoreboard or not, and what factors might influence this **beyond data availability, reliability and comparability**.

The first example is from the area of **researcher mobility.** In the EMM, both intra-EU and extra-EU researcher mobility was monitored. However given brain drain concerns, some countries may be less inclined to promote intra-EU mobility, and it could therefore be necessary to monitor the extent to which mobile researchers from widening countries eventually return to their home country ('balanced brain circulation', as stressed during the Croatian EU Presidency).

A related question is which indicators are strategic enough to justify inclusion in the Scoreboard. For example, if intra-EU mobility of researchers is already widespread, it is arguably less strategically important than the extra-EU mobility of researchers, which is a proxy for the relative attractiveness of the ERA as a global research destination. However, we have suggested including both intra-EU and extra-EU mobility in the Scoreboard, as stakeholders supported this.

A second example as to how determining a Scoreboard poses some difficulties in selecting an acceptable set of indicators covering the main policy objectives and thematic areas is the idea of challenge-based ERA actions relating to the **green and digital transition.** Whereas environmentally-related government R&D expenditure (e.g. governmental and total) is already being collected by the OECD, with a pilot by Eurostat, less work has been done in capturing R&I expenditure contributing to the digital transition.

A third example is the issue of **societal involvement in R&I**. Whilst this is arguably an area of increased importance, given that citizen science is more prominent than was the case 10 years ago, it is quite difficult to determine quantitative indicators to measure progress. A more qualitative assessment would be necessary to assess progress, and qualitative indicators are more appropriate for the dashboard.

These examples are intended to explain the challenges in determining what goes into the first version of the ERA Scoreboard. Given the importance of FAIR data principles, FAIR data should be monitored. However, it may not be realistic for the ERA Scoreboard to include the different dimensions of FAIR (**F**indability, **A**ccessibility, **I**nteroperability, and **R**euse), as each aspect would

[51] https://ec.europa.eu/info/news/commission-launches-new-era-forum-transition-2021-feb-08_en

need related sub-indicators. Therefore, there may be too many indicators to assess whether data is FAIR for this to be considered in the Scoreboard unless a composite indicator could be developed which weighted different criteria. However, it should be mentioned that such a composite indicator does not yet exist, which is why the FAIR-related indicators have been included in the Performance Dashboard under P1, rather than in the ERA Scoreboard.

Having presented the detailed list, a simplified overview of the proposed indicators for the ERA Scoreboard is provided below:

Table 3-145 – Summary longlist of indicators for potential inclusion in ERA Scoreboard

No.	ERA Pact priorities	Indicator	Target
1	R&I investment	Gross Domestic Expenditure on R&D (GERD) as percentage of GDP (annual). Additionally, a rolling long-term trend (average GERD over 15 years) and short-term trend (average GERD over 5 years).	3%
2	R&I investment	Government Budget Allocation for R&D (GBARD) as percentage of GDP	1.25% by 2030
3	R&I investment	GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector	n/a
4	R&I investment	Increase the share of national public research and development expenditure committed to joint programmes, research infrastructures and European Partnerships to 5% of national public R&D funding by 2030;	5% by 2030
5	R&I investment	Business Enterprise expenditure on R&D (BERD) as percentage of GDP	n/a
6	Open science	Share of publications available in open access (green, gold and diamond)	n/a
7	Research infrastructures	Millions of EUR 1) planned investment in new ESFRI Projects and 2) existing investment in ESFRI Landmark Projects (by ERA participant country)	n/a
8	Research infrastructures	Share of new ESFRI Projects (under development) in which a Member State or an Associated Country participates (ESFRI)	n/a
9	Research infrastructures	Share of operational ESFRI Landmark projects in which a Member State or an Associated Country is a partner	n/a
10	Gender equality	Share of women in grade A positions in HEIs	n/a
11	Careers and mobility of researchers	Share of doctoral students from outside the EU	n/a
12	Careers and mobility of researchers	Share of doctoral students with a nationality from another EU country	n/a
13	Careers and mobility of researchers	Share of doctorate holders employed outside academia, 5 years after graduation	n/a
14	Knowledge Valorisation	Share of product and/or process innovative firms cooperating with higher education institutions or public/private research	n/a

		institutions	
15	Knowledge Valorisation	Number of patent applications to the EPO (disaggregated by sector/ technology area)	n/a
16	Synergies research/ innovation/ industrial policy	Number of patent applications to the EPO with foreign co-inventors in percentage, by priority year	n/a
17	Synergies research/ innovation/ industrial policy	Number of annual high-tech patent applications to the EPO per million inhabitants	n/a
18	Global engagement	Share of publications with international collaborative authors	n/a
19	Global engagement	International co-publications with ERA partners per 1,000 researchers in the public sector	n/a
20	Synergies R&I/ education/ EU Skills Agenda	% of top 100 and Horizon Europe beneficiary organisations holding the HRS4R award.	n/a
21	Societal engagement in R&I	No. and proportion of countries/regions where research agendas/roadmaps/policies are co-designed with citizens, civil society and end-users (e.g. through dedicated co-design meetings, citizen consultations)	n/a
22	Societal engagement in R&I	No. of countries and/or regions where there are citizen and civil society co-creation (e.g. citizen science) strategies at national and regional level.	n/a
23	Research Excellence	Adjusted Research Excellence Indicator (AREI)	n/a
24	Research Excellence	Highly cited papers by discipline (top 1%, top 10%).	n/a
25	Prioritise long-term R&I investments and policy reforms at all governance levels	Number of reforms implemented at national level	n/a
26	Investment	Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP • Sub-indicator on GERD - Government Budget Allocation for R&D (GBARD) as percentage of GDP • Sub-indicator on GERD - Business Enterprise expenditure on R&D (BERD) as percentage of GDP	n/a
27	Investment	GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector	n/a
28	Challenge-based ERA actions	**Sub-indicator on GERD -** Environmentally -related government R&D budget, % total **government R&D** **Sub-indicator on GERD –** Environmentally-related R&D expenditure **(public, private)**, as a % GDP	n/a

3.3.6.1 New indicators lacking data availability – future ERA Scoreboard candidates

Through this study, many examples of new indicators have been identified. For some of these, there is data available, and they could therefore be included either in the Scoreboard or Dashboard.

However, in other cases, the indicators themselves offer promise in terms of potential inclusion in the Scoreboard as they are strategically useful. However, there is no data available presently.

In some instances, the Commission – or associated working groups and expert groups – are already working on additional indicators and data sources, whereas in others, there may be uncertainty as to who will actually collect the monitoring data. In some cases, additional data would be "nice to have", but there is a need for the Commission (including the JRC), Eurostat and/or the OECD to commit to collecting the data regularly in future.

In some instances, there are already pilots to collect data that could be useful for ERA monitoring in future. For instance, DG RTD's Universities Unit is engaging in initiatives to improve objective monitoring data in areas such as:

- Post-doctoral researcher career tracking;
- Salaries and working conditions of researchers

Similarly, in the area of open science, there is a Task Force working on EOSC to determine what types of monitoring data on open access, open data and open science should be collected. Selected examples of indicators that could be considered in the ERA Scoreboard on a reserve list if relevant data were to be collected in future on a reliable and comparable basis are now provided:

Table 3-156 - Reserve list for ERA Scoreboard (new indicators where data may be available in the near future)

No.	ERA Pact priorities	ERA Pact sub-priorities	ERA sub priority or relevance to other EU policies	Indicator	Definition	Rationale for inclusion	Data source	Frequency of data collection
1	P1	a) Open Science	Open Science	Number of open science datasets contributed to the European Open Science Cloud (EOSC)	Number of national contributions to the European Open Science Cloud (EOSC)	Starting point to measure open science at national level in the form of OS datasets contributed, however complex to measure and only partially captures the value of EOSC.	European Open Science Cloud (EOSC)	Data not yet available, but EOSC developing rapidly and data expected to be available shortly.
2	P1	a) Open Science	Open Science	Share of open science datasets contributed to the European Open Science Cloud (EOSC) Share by Member State (EU and national open datasets)	Percentage share of national contributions to the European Open Science Cloud (EOSC) as a percentage of total EU and national open datasets.	Starting point to measure open science at national level in the form of OS datasets contributed, however complex to measure and only partially captures the value of EOSC.	European Open Science Cloud (EOSC)	Data not yet available, but EOSC developing rapidly and data expected to be available shortly.
3	P1	c) Gender Equality	Gender equality	Share of R&I organisations with a Gender Action Plan (GAP) or strategy at EU and national levels	Share of entities at national / EU level that have formally adopted a Gender Action Plan (GAP) or gender strategy.	Useful to expand monitoring beyond GEPs in Horizon Europe to examine how far gender action planning in R&I is taking place outside the EU RTD Framework Programmes.	Qualitative/ quantitative assessment at national level	Data could also be collected from broader stakeholders but this would require resource
4	P1	c) Gender Equality		Women in Management Boards in Universities and Research Institutions, as % of total	Women in Management Boards in Universities and Research Institutions, as % of total	Women in corporate boards has been monitored increasingly in recent years and could be monitored in relation to RPOs, such as universities and research	Quantitative assessment at national level	Data not currently collected

						institutes.		
5	P1	Mobility and careers of researchers	Careers of researchers	Salaries of researchers	Salary in EUR of researchers by career grade	Salaries of researchers could provide objective measure of progress towards objectives relating to strengthening researcher careers/ overcoming the precariousness of researcher careers.	New data source being created (DG RTD's University Unit has the lead	Data not currently available. Once collected, annual
6	P1	Mobility and careers of researchers	Careers of researchers	Working conditions of researchers	Working conditions of researchers by career grade	Working conditions of researchers could provide objective measure of progress towards objectives relating to strengthening researcher careers/ overcoming the precariousness of researcher careers.	New data source being created (DG RTD's University Unit has the lead	Data not currently available. Once collected, annual
7	P3	m) Collaborative links across RPOs in Europe	Widening participation	Participation rate (in %) of total participants of RPOs from countries with lower research and innovation performance into European scientific networks	As per indicator	Proxy would provide insights into progress made by countries with lower research and innovation performance towards joining European scientific networks as a sign of integration and R&I excellence	Quantitative assessment at national level	Data not currently collected, but could be collected relatively easily

Prospective factual indicators, such as researchers' salaries and working conditions could be interesting in providing strategic insights in future. However, as the data is not yet available, the data cannot yet be included in the ERA Scoreboard. This depends when reliable and comparable data is likely to be available. The same can be said of the indicator relating to post-doctoral careers of researchers and how successful they are in getting jobs outside of academia (a policy priority, given that there is an over-supply of PhD and post-doctoral researchers relative to the number of academic positions.

3.3.7 Review of Priorities in the new ERA Pact and identification of indicators

This section contains a review of the four new Priorities in the ERA Pact and seeks to align these with a new proposed indicator system. A longlist of indicators is outlined, with some suggestions on a shortlisting made in the same tables (see indicators that are in bold).

3.3.7.1 Priority 1 - Deepening a truly functioning internal market for knowledge

Priority 1 of the new ERA focuses on deepening the ERA with a view to developing a **truly functioning internal market for knowledge**. This encompasses some important thematic priorities supported under the ERA previously, such as **Open Science, Research infrastructures, Gender equality, equal opportunities and inclusiveness, Careers and mobility of researchers and research assessment and reward systems and Knowledge Valorisation (including IPR management and exploitation**). This ought to bring a degree of continuity as most of these topics were also in focus in 2015-2020, albeit that some themes will receive increased attention in the new ERA. It is therefore important to consider retaining at least some indicators from the former EMM. It is therefore indicated wherever this is the case.

In the following table, an overview of the new ERA P1 (ERA Pact) proposed indicators is provided:

Table 3-167 - Longlist of indicators –ERA Pact Priority 1 (Deepening a truly functioning internal market for knowledge)

ERA Pact priorities	ERA Pact sub-priorities	Indicator	Definition	Rationale for inclusion	Data source	Frequency of data collection
P1	a) Open Science	Extent of national contributions to the European Open Science Cloud (disaggregated according to key metrics e.g. share of OS datasets, share of open publications shared, share of pieces of open software shared) (qualitative)	National contributions to the European Open Science Cloud	Provides a qualitative assessment of contributions to EOSC, which complement quantitative data. Strong indicator of commitment to Open Science, especially at a national level.	European Open Science Cloud (EOSC)	n/a
P1	a) Open Science	Incentives for open science practices (qualitative)	Qualitative assessment of incentives for open science practices in the public and the private sector	Describes qualitatively the incentives and would complement quantitative indicators.	Qualitative assessment at national level, smart specialization strategy	Data not currently collected
P1	a) Open Science	Number and share of RFOs with a policy requiring their research to be published in open access	As per indicator	Encourages RFOs to make all publications available in OA. It is important to monitor the progress of implementation of this policy and where progress does not take place.	Quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Number and share of FAIR and open digital objects shared with EOSC (EU and national data).	National contributions to the European Open Science Cloud	Given the importance of FAIR data principles, there should be at least 1 FAIR data-related indicator. Starting point to measure open science at national level in the form of FAIR and open digital objects shared with EOSC, however considered to only partially capture the value of EOSC. Disaggregated sub-indicators could be: • Number of pieces of open software shared to EOSC (EU and national data) • Number of OS datasets contributed to the European Open Science Cloud (EOSC) (EU and national data) • Number of pieces of open software shared to	European Open Science Cloud (EOSC)	Data not currently collected

				EOSC (EU and national data)		
P1	a) Open Science	Number of RFOs that reward open science practices in research assessment	As per indicator	Provides a quantitative assessment, however does not provide an overarching view.	Quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Number and share of open science datasets contributed to the European Open Science Cloud (EOSC) (EU and national open datasets)	National contributions to the European Open Science Cloud	Starting point to measure open science at national level in the form of OS datasets contributed, however complex to measure and only partially captures the value of EOSC.	European Open Science Cloud (EOSC)	n/a
P1	a) Open Science	Number of open access journals	As per indicator	The adoption of open access can be measured with the establishment or transformation of journals to open access journals. This indicator can help the movement away from hybrid publishing.	European Open Science Cloud (EOSC)	n/a
P1	a) Open Science	Share of open access journals	The percentage of journals that are open access compared with the total number of journals	The adoption of open access can be measured with the establishment or transformation of journals to open access journals. This indicator can help the movement away from hybrid publishing.	Quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Number and share of trusted repositories	The repository maintains all applicable licenses covering data access and use and monitors compliance. The repository accepts data and metadata based on defined criteria to ensure the relevance and understandability for data users. The repository guarantees the integrity and authenticity of the data. The repository enables reuse of the	For long-term sustainability, preservation and reusability of the digital research objects repositories need to comply with relevant standards (for example with having a CoreTrustSeal certification).	European Open Science Cloud (EOSC)	n/a

			data over time, ensuring that appropriate metadata are available to support the understanding and use of the data.			
P1	a) Open Science	Researchers' engagement in social networking services	Share of researchers using social networking services for research purposes	Engagement in Researchgate.net etc., indicate collaborative readiness. Would, however, be challenging to quantify effectively.	Qualitative assessment at national level	Data not currently collected
P1	a) Open Science	Share of open FAIR datasets	Quality criteria on FAIRness and IP protection : copyrights and associated rights for data and datasets, eventual patents on technical solutions for managing the data in the datasets (storage, extraction, analysis,….).	Qualitative indicator which goes beyond number of OS datasets and looks into their quality, including size of files and content. Likely to be complex to measure and compare across countries.	Qualitative assessment at national level	Data not currently collected
P1	a) Open Science	Number of RFOs that integrate open science methodologies and open science practices in research assessment	As per indicator	Provides a quantitative assessment, however does not provide an overarching view.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Number of universities and RPOs that integrate open science practice in researcher recruitment and career progression	As per indicator	Provides a quantitative assessment, however does not provide an overarching view.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Percentage of research digital objects from EOSC Association members which are deposited in trusted repositories that are made as open as possible	As per indicator	Given the importance of EOSC, this indicator is crucial for measuring the research data supporting EU science.	European Open Science Cloud (EOSC)	n/a
P1	a) Open Science	Percentage of the active data spaces that take up data management practices, including the FAIR data principles, and provide into the EOSC ecosystem	Percentage of the active data spaces that take up data management practices, including the FAIR data principles, and provide into the EOSC ecosystem	Given the importance of FAIR data principles, there should be at least 1 FAIR data-related indicator.	European Open Science Cloud (EOSC)	n/a

P1	a) Open Science	Qualitative assessment of OA policies in NAPs and other information sources	Availability and Qualitative assessment of OA policies in NAPs and other information sources	Provides more concrete analysis of progress made with regard to actions undertaken to improve OA.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	a) Open Science	Quality of OS datasets	National contributions to the European Open Science Cloud (qualitative)	Qualitative indicator which goes beyond number of OS datasets and looks into their quality, including size of files and content. Likely to be complex to measure and compare across countries.	Qualitative assessment at national level	Data not currently collected
P1	a) Open Science	RFOs providing funds to cover costs of OA publishing	The indicator is reported as a list of 58 RFOs with a binary value (yes/no) that indicates if the RFOs provide funds to cover the costs of OA publishing. Other information is also reported, such as membership of Science Europe, presence or absence on MELIBEA and ROARMAP databases and mechanisms of OA publishing cost coverage.	Facilitates the publishing of articles in OA.	MELIBEA, ROARMAP and Science Europe Open Access Survey Report	Annual
P1	a) Open Science	Share of publications available in open access (green, gold and diamond)	This indicator is the proportion of a country's research publications that are available in open access (OA) as per Peter Suber's definition (6) of gratis OA, which refers to the removal of barriers to access; gratis OA thus includes libre OA, which refers to the removal of price barriers and permission barriers. In addition to the proportion of total OA, the indicator is also produced for two sub-types of OA: gold and green.	Already in the EMM and should be retained, as a key measure of OA publications.	1findr and WoS - note that 1findr has been discontinued by Elsevier	Annual
P1	a) Open Science	Share of RFOs' publications available in OA	The indicator is reported as a list of 58 RFOs with a binary value (yes/no) that indicates if the RFOs provide funds to cover the costs of OA publishing. Other information is also	Facilitates the publishing of articles in OA.	1findr and WoS	Annual

			reported, such as membership of Science Europe, presence or absence on MELIBEA and ROARMAP databases and mechanisms of OA publishing cost coverage.			
P1	b) Research infrastructures	Share of new ESFRI Projects (under development) in which a Member State or an Associated Country participates	The proportion of ESFRI projects in which a given ERA participant country participates	ESFRI projects involve significant expenditure. This indicator is useful for both new ERA P1 and P2 i.e. the level of investments in pan-European RIs (P1) and also how far different countries contribute to these is a proxy for assessing access to research excellence (new P2) are both of interest. This indicator could be expressed as share of value of ESFRI projects as a proportion of GDP, which would make it a stronger indicator of involvement than the share of projects, though the latter would be easier to measure.	ESFRI Executive Secretary	Annual
P1	b) Research infrastructures	Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner	The proportion of ESFRI landmarks in which a given ERA participant country is a partner.	Could shed light on the extent to which widening countries are participating in excellence as landmark ESFRI projects are about cutting-edge science and knowledge-sharing.	ESFRI Executive Secretary	Annual
P1	b) Research infrastructures	Availability of financial instruments/venture capital	Venture capital deals/bn PPP$ GDP Level of venture capital deals/bn EUR/ annum	Access to R&I finance is important for research actors, such as start-ups and SMEs, university spin-offs etc. However, this is an area already covered by InnovFin financial instruments (e.g. equity, guarantees) funded under H2020 with a follow-up expected in Horizon Europe. Monitoring data from these programmes could be interesting for R&I stakeholders. However, difficult to identify the funding gap based on a review of which actors have accessed the funding so far and less relevant to the ERA as such, highly contextual indicator.	WIPO Invest Europe	Annual

P1	b) Research infrastructures	Number of national Roadmap projects which are also ESFRI projects	Research infrastructure projects at national level accepted for the ESFRI Roadmap (and ESFRI project proposals in preparation).	Indicator for the relationship ESFRI and National Roadmaps	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of national Roadmap projects which are also ESFRI Landmarks	Number of national Roadmap projects accepted for the ESFRI RM (and ESFRI project proposals in preparation i.e. former ESFRI projects successfully implemented and prepared to be ESFRI monitored).	Indicator for the relationship ESFRI and National Roadmaps	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	National funding secured for RIs (ESFRI and others with a significant share of European users) as a % of total national research funding and its growth rate	Percentage of total national research funding dedicated to research infrastructures	Existence of ESFRI inspired national RI roadmaps, the periodicity of their updates and the participation in the ESFRI Roadmap, is only a first approach that only roughly indicates the level of EU-wide alignment and integration of the national systems. Inspiration stemming from ESFRI discussions and processes (as good practice examples), is informally but continuously shaping national RI policies and affects the various kinds of RIs and shall be more thoroughly investigated.	Quantitative assessment at national level	Data not currently collected on a comparable basis
P1	b) Research infrastructures	Number of European / international user accesses (% per RI)	Number of user accesses at the European / international level	Existence of ESFRI inspired national RI roadmaps, the periodicity of their updates and the participation in the ESFRI Roadmap, is only a first approach that only roughly indicates the level of EU-wide alignment and integration of the national systems. Inspiration stemming from ESFRI discussions and processes (as good practice examples), is informally but continuously shaping national RI policies and affects the various kinds of RIs and shall be more thoroughly investigated.	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of RIs with policies on open access	Number of RIs with policies on open access to publications and datasets	Existence of ESFRI inspired national RI roadmaps, the periodicity of their updates and the participation in the ESFRI Roadmap, is only a first approach that only roughly indicates the	Quantitative assessment at national level	Data not currently collected

				level of EU-wide alignment and integration of the national systems. Inspiration stemming from ESFRI discussions and processes (as good practice examples), is informally but continuously shaping national RI policies and affects the various kinds of RIs and shall be more thoroughly investigated.		
P1	b) Research infrastructures	Number of RIs with policies for nationwide / ERA-wide / international provision of open data	Number of RIs with policies for provision of open data	Existence of ESFRI inspired national RI roadmaps, the periodicity of their updates and the participation in the ESFRI Roadmap, is only a first approach that only roughly indicates the level of EU-wide alignment and integration of the national systems. Inspiration stemming from ESFRI discussions and processes (as good practice examples), is informally but continuously shaping national RI policies and affects the various kinds of RIs and shall be more thoroughly investigated.	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Million EUR planned investment in new ESFRI Projects (by ERA participant country) as a percentage of GDP	Planned investment in new ESFRI Projects (Million EUR)	ESFRI projects involve very significant expenditure; this indicator would show planned investment and serve as proxy for	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Million EUR investment in landmark ESFRI Projects (by ERA participant country)	Investment in landmark ESFRI Projects (Million EUR). Note – data was previously not available on a comparable basis.	ESFRI projects involve very significant expenditure. This indicator is therefore useful for both new ERA P1 and P2 i.e. the level of investments in pan-European RIs (P1) and also how far different countries contribute to these is a proxy for assessing access to research excellence (new P2) are both of interest. This indicator could be expressed as share of value of ESFRI projects as a proportion of GDP, which would make it a stronger indicator of involvement than the share the number of projects, though the latter would be easier to measure.	Quantitative assessment at national level	Data newly available

P1	b) Research infrastructures	Share of developing ESFRI Projects and operational ESFRI Landmarks in which a Member State/Associate Country is a partner	The proportion of ESFRI project and landmarks in which a given country is a partner	n/a	ESFRI Executive Secretary	Annual
P1	b) Research infrastructures	Number of permanent and temporary researchers and technical staff working with the research and technology infrastructure	Number of researchers and technical staff working at/with the RI	n/a	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Foreign direct investment in research and technology infrastructures	Foreign direct investment in research and technology infrastructures (Million EUR)	n/a	Quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of research and technology infrastructures belonging to an established Research and Innovation ecosystem (including cluster networks with a Europe-wide reach)	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of technology infrastructures belonging to an established network of technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Total turnover from projects with industry involving the use of research and technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Total turnover from projects with SMEs involving the use of research and technology infrastructures (Million EUR)	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected

P1	b) Research infrastructures	Number of projects with industry involving the use of research and technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of start-ups being created connected with research and technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Percentage of total turnover of industrial projects with partners outside EU involving the use of research and technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of Horizon Europe projects involving the use of technology infrastructures	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	b) Research infrastructures	Number of research and technology infrastructures included in smart specialisation strategies	As per indicator	n/a	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	c) Gender Equality	Share of women in grade A positions in HEIs	The proportion of women occupying the highest-level research positions (Grade A) in HES to the total of Grade A positions	Already in the EMM and should be retained. Enables tracking the progress made with regard to women's presence at the highest level of academia by analysing its trend through time.	DG Research and Innovation—WiS—Women in Science database	Annual

P1	c) Gender Equality	Gender dimension in research content (WoS)	This indicator relates to the proportion of a given country's scientific production (measured by the number of peer-reviewed scientific publications by full counting, see Annex 1 for more details) in which a gender dimension has been identified in the research content relative to the same proportion at world level. The resulting indicator is a specialisation index (SI), whereby a score above 1 means that a country is specialised — i.e. it puts more emphasis on the gender dimension in its research output — relative to the world, while a score below 1 means that it is not specialised relative to the world.	Already in the EMM and should be retained. Enables monitoring the extent to which researchers incorporate this aspect in their research content and track gender equality in research	WoS (Clarivate Analytics)	Annual
P1	c) Gender Equality	Share of R&I organisations which have a Gender Equality Plan (GEP), at EU and national levels, and per type of legal entity	Share of entities at national / EU level that have formally adopted a Gender Action Plan.	Monitoring efforts towards gender equality is a key aspect of the ERA in future. Although diversity and inclusion go beyond gender, this is a relevant indicator to monitor also in continuation of the EMM. Gender Equality Action Plans will be a requirement for all FP projects in Horizon Europe, which is a strong incentive, however this indicator would provide an overview of GEPs in all R&I organisations at country level. Would require additional data collection at national level.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	c) Gender Equality	Share of R&I organisations that have: Gender Equality Plan (GEP) in Horizon Europe A Gender Action Plan (GAP) or gender equality strategy or similar instrument at EU and national levels (by type of organisation)		Monitoring efforts towards gender equality is a key aspect of the ERA in future. This indicator would take a more comprehensive view and provide a broader view of progress towards gender equality at country and EU level.	Qualitative/ quantitative assessment at national level	Data not currently collected

P1	c) Gender Equality	Availability of a Gender Equality Plan (GEP) for organisations participating in Horizon Europe	Existence of a Gender Equality Plan (GEP) for organisations participating in Horizon Europe	Gender Equality Plans provide concrete steps and actions to be undertaken to improve gender equality. Gender Equality Action Plans will be a requirement for all FP projects in Horizon Europe, which is a strong incentive. A simple Yes or No answer could be collected. However, as it's a requirement and all FP projects will by definition have one, this calls into question how useful and effective it would be as an indicator.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	c) Gender Equality	Share of female PhD graduates	The proportion of women PhD graduates to the total number of PhD graduates. Some of the text below has been taken directly from the She Figures Handbook 2015 (DG Research and Innovation, 2016a).	Already in the EMM and should be retained. Enables tracking the progress made with regard to gender balance in career progression	Eurostat	Annual
P1	c) Gender Equality	Women in Management Boards in Universities and Research Institutions, as % of total	As per indicator.	Enables tracking the progress made with regard to women's presence in senior positions in academia	Quantitative assessment at national level	Data not currently collected
P1	c) Gender Equality	Women in Research Boards, as % of total	As per indicator.	Enables tracking the progress made with regard to women's presence in senior positions in academia	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	c) Gender Equality	Women as leaders of universities and RPO, as % of total	Women as leaders of RPO, as % of total	Enables tracking the progress made with regard to women's presence in senior positions in academia	Eurostat, She Figures, WiS databases; DG Research and Innovation	n/a

P1	c) Gender Equality	Female R&D researcher as percentage of total R&D researcher (HC) - Business enterprise	Researchers by sector of employment: Adapted from OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. Business enterprise sector (for R&D data): OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. R&D personnel by sex : Adapted from OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. Headcount (HC) of R&D personnel: OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development.	Enables monitoring the share of female R&D researchers in the private sector, increasing knowledge transfer, mobility and researcher careers. Developed by UNESCO UIS	UNESCO UIS	Annual

P1	c) Gender Equality	Female R&D researcher as percentage of total R&D researcher (HC) - Government	Researchers by sector of employment : Adapted from OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. Business enterprise sector (for R&D data): OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. R&D personnel by sex : Adapted from OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development. Headcount (HC) of R&D personnel: OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development.	Enables monitoring the share of female R&D researchers in the government sector, increasing knowledge transfer, mobility and researcher careers. Developed by UNESCO UIS	UNESCO UIS	Annual
P1	c) Gender Equality	Female R&D researcher as percentage of total R&D researcher (HC) - Higher education	As above	Enables monitoring the share of female R&D researchers in higher education, enhancing researcher careers. Developed by UNESCO UIS	UNESCO UIS	Annual
P1	Cooperation with other sectors	Number of national participations in public-private Partnerships in R&I	As per indicator	Extent of participation in some public-private Partnerships (e.g. the ERA-LEARN) was monitored in the EMM. Examples to replace ERA-LEARNING could be the number and composition of European Institutionalised Partnerships. Public private partnerships will grow in importance in future due to the EU policy drive towards strategic autonomy in key industrial sectors (e.g. see EU industrial strategy). PPPs are important in the industry-R&I nexus and in an applied research context. However, absolute numbers will not be comparable.	Quantitative assessment at national level	Data not currently collected

P1	d) Careers and mobility of researchers	% Horizon Europe funds allocated to bodies with the HRS4R award	% Horizon Europe funds allocated to bodies with the HRS4R award	An incentive for R&I actors to take up the HRS4R award is that it is a requirement for applicants in H2020 projects to adhere to principles of transparent, merit-based and open recruitment of researchers. The HRS4R award enables them to meet this criterion. However, as there are other means of achieving this goal, this would be one proxy among others for the transparent, merit-based and open recruitment of researchers.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Availability of a framework for the mobility of researchers between Industry, RTOs and Academia.	Availability of a framework for the mobility of researchers between industry and academia	Many RTOs have KPIs focused on the "transfer of heads" to and from Industry and Academia. All Research Performing Organisations should be included here to cover intersectoral mobility over the wide range of RDI Ecosystem actors. Answer: Yes/ No	Qualitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Availability of career tracks outside academia	Existence of career tracks outside academia	There are too many skilled researchers relative to academic positions. Therefore, monitoring of career tracks for researchers outside academia.	Qualitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Average salaries of researchers	Average salaries of researchers / year	Salaries of researchers could be a proxy for open, transparent and merit-based recruitment of researchers, for instance, shedding light on gender pay differentials. However, whilst a study is underway to collect such data, it does not yet exist at EU level. There could also be risks in terms of unintended consequences i.e. could the publication of salaries lead to upwards or downwards salary inflation / deflation pressure and could this exacerbate brain drain.	Quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Average salaries of researchers (disaggregated by gender)	Average salaries are calculated based on salaries paid to researchers employed by public institutions in the last year.	This indicator would need to be normalized to provide an insight into progress towards gender equality.	Quantitative assessment at national level	Data not currently collected

P1	d) Careers and mobility of researchers	Extent to which intra-EU researchers from widening countries return to their home country	Qualitative assessment of brain circulation, quantitative if data could be collected in future.	Brain gain/ drain is an important policy issue. Encouraging intra-EU researchers from widening countries to return to their home country at some point in their careers to ensure brain circulation - not one-way brain drain - is an important policy aim.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Job-to-job Mobility of Human Resources in Science and Technology	The movement of individuals between one job and another from one year to the next. It does not include inflows into the labour market from a situation of unemployment or inactivity.	Indicator from the EIS2021, could be a relevant indication for cross-sectoral mobility.	European Innovation Scoreboard 2021 from Eurostat	Annual
P1	d) Careers and mobility of researchers	No. of organisations that have endorsed the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers. Disaggregated data for 1) Universities and 2) other Research-Performing Organisations.	No. of research-performing organisations that have endorsed the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers	This could be an indicator at EU level to give insights into how far HEIs have signed up to open, transparent and merit-based recruitment practices.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	No. of researchers who completed intersectoral activities	No. of researchers who completed intersectoral activities, meaning that they undertook a placement in the private sector if working in academia, and in academia if working permanently in the private sector, of more than 1 calendar month	Intersectoral mobility is an increasingly important policy priority. However, inclusion of this indicator depends on how many indicators there are overall.	Quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	No. users of the ERA Talent Platform	No. users of the ERA Talent Platform per year	New platform which is expected to become part of the ERA4YOU portal which will emerge from the current EURAXESS Portal for researchers. Basic output indicator.	Qualitative/ quantitative assessment at national level	Data not currently collected
P1	d) Careers and mobility of researchers	Number of national funding instruments that support intersectoral mobility of researchers	Number of national funding instruments that support intersectoral mobility of researchers	Number of national funding instruments that support intersectoral mobility of researchers	Quantitative assessment at national level	Data not currently collected

P1	d) Careers and mobility of researchers	Share of doctoral students from outside the EU	The proportion of Non-EU doctoral students to the total number of doctoral students in a given country.	Already in the EMM and should be retained, as a key measure of international mobility. In the context of global engagement, Europe's attractiveness for researchers globally as a destination is a useful proxy.	Eurostat	Annual
P1	d) Careers and mobility of researchers	Share of doctoral students with a nationality from another EU country	This indicator is the proportion of doctoral candidates with a citizenship of another Member State to the total number of doctoral candidates in a given country.	Already in the EMM and should be retained. Whilst not a policy priority in all EU countries (some of whom have high numbers of EU researchers already), proxy for fostering the mobility of researchers, and also for assessing brain drain/ gain nexus. Weakness in data however is that not all MS collect data on intra-EU mobility (e.g. IE), as EU researchers are not differentiated from nationals.	Eurostat	Annual
P1	d) Careers and mobility of researchers	Share of doctorate holders employed outside academia, 3 (or 5, or 6) years after graduation	Share of doctorate holders employed outside academia and higher education, 3 (or 5, or 6) years after graduation	Proxy for the degree of to which researchers' skills are portable to other sectors and of their employment potential to use PhD qualifications in other sectors. Ideally the minimum for the indicator should be after 5 years, as a substantial number of PhD graduates do postdocs and typical surveys of PhD graduates show a large number in the academic sector. More and more doctorate holders are employed outside academia, simply because they can't get jobs in academia (increase in the supply of doctorates exceeds the number of academic positions available). Sometimes, researchers' skills are highly valued and PhDs are in strong demand in the private sector (example – AI, STEM subjects). The problem is that not all researchers can easily get jobs if their research and other skills are not fully valued by non-academic employers. Practical training and skills during the PhD (for both academic and non-academic careers) that are promoted to and recognised by employers could possibly help alleviate this situation	OECD CDH dataset	Every 3-5 years

P1	d) Careers and mobility of researchers	Share of researchers expressing satisfaction that the hiring procedures in their institution are open, transparent and merit-based	This indicator represents the proportion of researchers having answered positively to the three following questions from the MORE2 and MORE3 surveys: MORE2: "What is your opinion on the following issues: 1) Are you satisfied with the extent to which job vacancies are publicly advertised and made known by your institution? 2) Do you think that the recruitment process at your home institution is sufficiently transparent? 3) Do you think that recruitment at your home institution is sufficiently merit-based?", with answer categories "yes", "no" and "N/A / no opinion". MORE3: "What is your opinion on the following issues with respect to recruitment in your home institution: 1) Research job vacancies are sufficiently externally and publicly advertised and made known by the institution. 2) The recruitment process is sufficiently transparent. 3) Recruitment is sufficiently merit-based.", with answer categories "I agree", "I don't agree" and "N/A".	Already in the EMM and should be retained. Although perception-based, it could complement more fact-based data e.g. on how many HEIs have signed up to different EU initiatives to promote open, transparent and merit-based recruitment of researchers (e.g. the Charter and Code, the HRS4R award). Note - MORE Survey data only available once every 3 years as survey carried out on that periodicity.	MORE2 and MORE3 Survey	Annual
P1	d) Careers and mobility of researchers	Working conditions of researchers	The working environment and terms and conditions of employment for researchers	Same issues apply as above. Whilst this could be a potentially useful indicator with quantitative and qualitative aspects, it would need to be carefully aligned as universities and other employers of researchers are very heterogeneous and direct comparisons would need to be treated with caution. Working conditions could for example refer to proportion of researchers with permanent contracts and other criteria, which would help indicate the extent to which academic work is precarious.	Qualitative assessment at national level	Data not currently collected

P1	e) Knowledge Valorisation	Adjusted Research Excellence Indicator (AREI)	This indicator defines the research excellence of a country through a composite indicator integrating four components: share of top 10% most highly cited publications per total publications (data source: CWTS); PCT patent applications per population (OECD); European Research Council (ERC) grants per public R&D (DG-RTD, Eurostat, OECD) and participation in Marie Skłodowska-Curie fellowships (DG-EAC).	Continuity with previous EMM – only composite indicator kept so far. General feedback was that composite indicators should be avoided and that MS find it very difficult to understanding how their particular performance has been calculated, even though the JRC's methodology and the indicators used to calculate it are transparent.	Calculations by European Commission, Joint Research Centre, Competence Centre on Composite Indicators and Scoreboards (JRC-COIN)	Composite indicator, calculated based on data from Science-Metrix, OECD, World Bank, Eurostat, DG RTD, DG EAC
P1	e) Knowledge Valorisation	Availability of an Industrial Technology Roadmap	Existence of an Industrial Technology Roadmap at national level	Industrial Technology Roadmaps are considered key towards achieving the green and digital transformations, as they highlight the importance of research and innovation in providing the technological foundation to transform the industrial value chain. They also create synergies with between research & innovation and industry. Answer: Yes/ No	Qualitative assessment at national level	Data not currently collected
P1	e) Knowledge Valorisation	Business enterprise researchers as % of national, total	Business enterprise researchers as % of national, total	Indicator reflects the research size (in relative terms) within the business sector in relation to the researchers in the public sector.	Main Science and Technology Indicators, OECD	Annual
P1	e) Knowledge Valorisation	Business enterprise researchers in full-time equivalent per thousand employment in industry	Business enterprise researchers in full-time equivalent per thousand employment in industry	Indicator reflects the research size (in absolute terms) within the business sector in relation to the researchers in the public sector.	Main Science and Technology Indicators, OECD	Annual
P1	e) Knowledge Valorisation	Exports of medium and high technology products as a share of total product exports	This indicator is the ratio of the value of medium and high technology exports in national currency and in current prices to the value of total product export. The medium and high technology exports include products from the following SITC Rev3 category: 266, 267, 512, 513, 525, 533, 54, 553,	In existing EMM. However, highly contextual. The indicator measures the technological competitiveness of the EU, i.e. the ability to commercialise the results of research and development (R&D) and innovation in international markets. It also reflects product specialisation by country.	European Innovation Scoreboard, from Eurostat (ComExt) for Member States, UN ComTrade for non-EU countries	Annual

			554, 562, 57, 58, 591, 593, 597, 598, 629, 653, 671, 672, 679, 71, 72, 731, 733, 737, 74, 751, 752, 759, 76, 77, 78, 79, 812, 87, 88 and 891			
P1	e) Knowledge Valorisation	Number of investment projects to improve university research infrastructures	Number of investment projects to improve university research infrastructures (e.g. using ESIFs, EIB large loans)	Sub-indicators such as research infrastructure upgrading projects at national level in the university sector are of interest as they are part of the upgrading of R&I infrastructures beyond pan-European RIs funded through ESFRI.	Quantitative assessment at national level	Data not currently collected
P1	e) Knowledge Valorisation	Number of partnerships under Horizon Europe with industrial alliances and ecosystems	Number of partnerships under Horizon Europe with industrial alliances and ecosystems	The new ERA highlights the need to focus on ecosystems and the links between academia, industry and other sectors of the economy to boost competitiveness. The normalised number of partnerships could be indicative of the strength of such links	Qualitative assessment at national level	Data not currently collected
P1	e) Knowledge Valorisation	Number of patent applications to the EPO (disaggregated by sector/ technology area/ applicant type)	Number of patents by technology area: e.g. nanotechnology, ICT, biotechnology, health, environmental-related technologies), applicant type: Public Research Organisations, universities, etc.	Patent registration data is included in the EIS. It isn't perfect in terms of comparability between countries. Some countries tend to over-patent, whereas others may under-patent due to commercial confidentiality concerns and/ or cultural reasons. However, still a useful proxy for how innovative and applied is the research being conducted. Patent indicators are also available through centralised international databases, meaning that international data comparability could be achieved. In widening countries, this may be useful barometer of progress towards research excellence. Patent information is based on the priority year and is made available after the date of publication of the application. The time lag between these dates can be explained be the length of the patent procedures (for EPO data this time lag can be up to 30 months). Data	European Patent Organisation	Annual

				therefore need a long time to be considered as final (2012 data in 2016).		
P1	e) Knowledge Valorisation	Share of knowledge intensive sectors in the economy	Share of sectors undertaking RDI activities in the economy	Context indicator, but highly strategic in assessing R&I performance.	Quantitative assessment at national level	Data not currently collected
P1	e) Knowledge Valorisation	Share of knowledge-intensive services exports as % of total services exports	This indicator is the share of knowledge-intensive services exports in total service exports. The knowledge-intensive services exports are defined as the sum of credits from items SC1, SC2, SC3A, SF, SG, SH, SI, SJ and SK1 of the Extended Balance of Payments Services Classification (EBOPS) 2010.	In EMM 2015-20 (and EIS), if too many indicators, then knowledge-intensive services as an export is too far removed from the ERA and too contextual, with too many variables influencing outcome. Knowledge intensive activities are a proxy as enabler for firms and organisations to better innovate; they are sources and carriers of knowledge that influence the performance of individual organisations and industry clusters across sectors of the economy as stated by the OECD. However, this is a context indicator which means that its ability to capture impact by the ERA measures is limited.	European Innovation Scoreboard	Annual
P1	e) Knowledge Valorisation	Share of product and/or process innovative firms cooperating with higher education institutions or public/private research institutions	For performance (2014): the indicator is the proportion of product and/or process innovative firms co-operating with universities, other higher education institutions, Government, public or private research institutes to the total number of product and/or process innovative firms. For growth (2012–2014): ERA Monitoring Handbook, 2018, Page 21 (a) The indicator is the proportion of product and/or process innovative firms cooperating with universities or higher education institutes (HEIs) to the total number of product and/or process innovative firms. (b) The indicator is the proportion of	Indicator on the link of academia and industry in line with the focus on cooperation with other sectors	Eurostat	Annual

			product and/or process innovative firms cooperating with Government, public or private research institutes (PRIs) to the total number of product and/or process innovative firms.			
P1	e) Knowledge Valorisation	Share of public research financed by the private sector	The share of the total amount of research funds allocated to the public sector from all sources coming from the private sector.	Relevant to capture the link of public-private research. Continuity with former EMM 2015-2021 as included then.	Eurostat	Annual
P1	e) Knowledge Valorisation	Technology transfer - Commercialisation of technology and other research results through licensing	Number of licences granted	See above – commercialisation of technology could be a relevant proxy for innovation and transfer of results into the economy.	World Bank	Annual
P1	e) Knowledge Valorisation	Technology transfer - Commercialisation of technology and other research results through RDI collaborations with the private sector	Number of collaborations with the private sector resulting in the commercialisation of technology	RDI collaboration with the private sector is considered by the economists as a technology transfer tool per se, as it transfers also tacit knowledge and is often a condition for an eventual future licence	World Bank	n/a
P1	e) Knowledge Valorisation	Technology transfer - No. of spin-offs created from RPOs	Number of spin-offs created from RPOs	Spins-offs are one way in which universities contribute to the local and regional economy. This is a good way of generating new start-ups, often in R&D-intensive or innovation-focused sectors. However, any individual indicator has limitations. For instance, spin-offs are only one way in which universities research efforts pay off, others might include licensing and academics or universities corporately establishing relationships with private sector partners. A further challenge is that some countries are interested in entrepreneurship whereas others do not see spin-off creation as a priority.	World Bank	n/a

P1	e) Knowledge Valorisation	Technology transfer - Survival rates (%) of spin-offs from universities and RPOs (after 5 years)	Survival rates (%) of spin-offs from universities and RPOs (after 5 years)	See above – survival rates are crucial if start-ups are going to be monitored. Tracking number of spin-offs created and their survival rate after 5 years is a relevant indicator if looking at all spin-offs created by non-profit research performing organisations (incl. RTOs) and not only by universities	World Bank	n/a
P1	e) Knowledge Valorisation	Patent applications to the EPO with foreign co-inventors in percentage, by priority year	Co-inventions represent the international collaboration in the inventive process.	Patents co-registered with international researchers capture innovation and international cooperation in their contribution towards economic growth. It is a highly contextual indicator; it would be difficult to specify intra-EU co-invention which would be more ERA-related.	OECD Patents Statistics	Annual
P1	e) Knowledge Valorisation	Total business enterprise R&D personnel in full-time equivalent per thousand employment in industry	Number of business enterprise R&D personnel in full-time equivalent per thousand employment in industry	Indicator reflects the research size (in absolute terms) within the business sector including the total of personnel (researchers, administrative staff, etc.) in relation to that of the public sector.	Main Science and Technology Indicators, OECD	Annual
P1	e) Knowledge Valorisation	Number of high-tech patent application to the EPO by priority year per million inhabitants	The data refers to the ratio of patent applications made directly to the European Patent Office (EPO) or via the Patent Cooperation Treaty and designating the EPO (Euro-PCT), in the field of high-technology patents per million inhabitants of a country. The definition of high-technology patents uses specific subclasses of the International Patent Classification (IPC) as defined in the trilateral statistical report of the EPO, JPO and USPTO.	IP and patents play an important role in the creation, dissemination and use of knowledge and innovation in the economy. The break down by type of patent application showcases strength in a specific area of the economy, focus on high-tech captures technological dimension.	Eurostat, PATSTAT database (EPO); OECD	Annual

P1	e) Knowledge Valorisation	Availability of incentives for research performing organisations (incl. universities and RTOs) to efficiently disseminate and exploit their research results Europe-wide	Incentives for RPOS can include: patent filing, licensing, contribution to standard-setting activities, etc.	Indicator could provide insights on	Qualitative assessment at national level	Annual
P1	e) Knowledge Valorisation	No. of pre-commercial procurement projects	No. of pre-commercial procurement projects		Quantitative assessment at national level	Annual
P1	e) Knowledge Valorisation	No. of innovation procurement projects	No. of innovation procurement projects		Quantitative assessment at national level	Annual
P1	e) Knowledge Valorisation	Patent applications under PCT per million inhabitants	Number of patent applications filed under the PCT, at international phase, designating the European Patent Office (EPO). Patent counts are based on the priority date, the inventor's country of residence and fractional counts	IP and patents play an important role in the creation, dissemination and use of knowledge and innovation in the economy. Patents are especially relevant in the continuously changing IP systems as these seek to optimise the balance between private and social benefits towards economic growth.	OECD Patents Statistics	Annual
P1	e) Knowledge Valorisation	Development of environment-related technologies, percentage of all technologies	Number of environment-related inventions. The number of environment-related inventions is expressed as a percentage of all domestic inventions (in all technologies). Indicators of technology development are constructed by measuring inventive activity using patent data across a wide range of environment-related technological domains (ENVTECH5), including environmental management, water-related adaptation, and climate change mitigation technologies. The counts used include only higher-value	Innovation indicator linked to the green transition as captured in the OECD Green Growth Database, also included in the EIS 2021.	OECD Green Growth Database	Annual

			inventions (with patent family size ≥ 2).			
P1	f) Global engagement	Number of public–private co-publications per million population	Number of public-private co-authored research publications. The definition of the "private sector" excludes the private medical and health sector.	Relevant to capture public-private research. Represents a continuity element with former EMM as indicator already included.	European Innovation Scoreboard 2021 (from Scopus database, data calculated by Science-Metrix as part of a contract to the European Commission (DG RTD))	Annual
P1	f) Global engagement	Number of participations in Horizon Europe from outside the EU-27 and Associated Countries (by country)	Number of participations in Horizon Europe from outside the EU-27 and Associated Countries (by country)	Participations in Horizon Europe from outside the EU would be a proxy for Europe's openness to the world, and would help to assess the degree of internationalisation of research excellence.	Quantitative assessment at national level	Can be calculated using data collected annually
P1	f) Global engagement	International co-publications with ERA partners per 1,000 researchers in the public sector	This indicator measures, using fractional counting, the number of publications of an ERA country (or region within the ERA) involving at least one co-author from another ERA country. The number is presented relative to the given country's (or region's) researcher population size	Already in the EMM and should be retained. It is a good proxy to measure the outcomes resulting from the transnationally allocated research funding	WoS and Eurostat	Annual

P1	f) Global engagement	Share of publications with international collaborative authors	Share of publications with international collaborative authors	There is clear evidence that increased international research collaboration increases national research excellence	Quantitative assessment at national level	Data not currently collected

Different thematic aspects of the indicators provided in the previous table are now examined, including gender equality, research infrastructures, researcher careers, global engagement (covering internationalisation) etc.

Several observations regarding indicators relating to **gender equality** and **gender mainstreaming in research** can be made. The ERA Roadmap 2015-2020 placed gender equality on the agenda as it was one of the six thematic ERA priorities. It was given increased attention by most countries in 2015-2020, as confirmed by stakeholders interviewed, leading to a significant effort at national level. However, as pointed out in the 2018 ERA Progress Report, whilst some progress was made, gender inequality still exists in research and academia, and a glass ceiling for women persists in most countries.

Gender will continue to have some importance in the revitalised ERA. For instance, further progress is required to improve gender balance in research. Gender equality and equal opportunities are important themes in the new ERA, taking into account gender balance in research teams, in decision-making and the gender dimension in research content. However, there is a wider focus in the ERA Pact on issues beyond gender to include inclusiveness more generally, including equality and diversity. Diversity is considered in the broader sense, taking into account gender, ethnicity, social diversity including migrants, people with disabilities and tackling all forms of discrimination.

Some gender indicators were already included in the previous EMM, namely (1) the share of female PhD graduates, (2) the gender dimension in research content and (3) the share of women in grade A positions in HEIs. The latter, however, only covers positions in HEIs and does not provide information on the gender balance in other public research organisations or the business enterprise sectors. By introducing indicators counting the number of female R&D researchers in these sectors, not only would a better view of gender balance among these sectors be provided, but this would also enable international comparison, as they were developed by UNESCO UIS. This is the case for example of the female R&D researchers as percentage of total R&D researchers – Government/ Business enterprise / Higher education.

Additional quantitative data based on existing centralised data sources could be taken, for example, from the 'She Figures' publications, thereby minimising any extra data collection efforts for Member States. The 2018 'She Figures' report[52] (the 2021 report is due later this year) provides a range of indicators on gender equality in R&I at pan-European level. Released every three years, each edition aims to provide a better understanding of emerging issues by introducing additional indicators. For example, the 2018 edition provides insights on the early segregation in the education pathways chosen by young women and young men and their subsequent progress to the top education levels.

As noted by GENDERACTION, monitoring the progress of gender equality and mainstreaming under the ERA requires a more complex set of indicators than the one currently included in the EMM 2015-2020 based on, among others, the share of women in Grade A positions and could benefit from a qualitative assessment. Particularly in countries that are "weak innovators", where proportions of women in Grade A positions might be higher, quantitative indicators on their own can skew perceptions of progress as these proportions may be a result of lower spending on R&I,

[52] https://ec.europa.eu/info/publications/she-figures-2018_en

women working for lower pay and men not finding these positions attractive. GENDERACTION therefore recommends combining existing quantitative figures with qualitative indicators derived from NAPs and additionally information provided by Member States, such as the existence of a Gender Equality Plan.

Indeed, the inclusion of an indicator on Gender Equality Plans (GEPs) is particularly relevant for complementing quantitative statistics. Horizon Europe requires all participants to develop a GEP. GENDERACTION has found that GEP implementation varies across the EU, where the newer Member States do not tend to have a GEP requirement. As such, it is important that national authorities support Research Performing Organisations (RPOs) in the development of their GEPs and that there is a clear definition of GEPs at EU level. Coherence across the EU is important to enable comparisons to be made. Considering that GEPs are required for Horizon Europe, the relevance of this indicator would go beyond R&I organisations that apply and are successful under Horizon Europe. As the ERA is larger than the group of successful players that will need to comply with the GEP eligibility criterion for Horizon Europe, this indicator would provide relevant insights and address the importance given to gender equality in the ERA Communication and the ERA Forum for Transition.

However, the inclusion of an indicator on GEPs is not straight forward. If the "Number of GEPs in Horizon Europe projects" is included as an output indicator, this would not be that informative, as all projects are required to have such a plan. Qualitative assessment would be needed to analyse the quality of the GEPs, as the mere fact of developing a GEP does not mean that it has been successfully implemented. Moreover, if monitoring the existence of GEPs were to be expanded beyond reporting for Horizon Europe where GEPs are voluntary, for instance, to all universities, or to universities, research institutes and other research actors, such as national / regional government research bodies, this would raise an issue regarding who will collect such data.

To be effective, the approach might combine simple output data to assess which type of R&I actors have developed a GEP, but qualitative assessment of how effective the GEPs have been as a strategic planning document and during their implementation. This sort of assessment would lend itself to the Commission's DG RTD commissioning periodic studies on gender equality in the ERA (or through Horizon Europe implementation), rather than systematic and comprehensive monitoring and indicators, which might be difficult to provide, given the issue as to who would collect the data.

In terms of **Open Science (OS) and open access to data and scientific research results,** this was a sub-priority area within P5a in the ERA Roadmap 2015-2020. However, it will become much more important arguably in the new ERA and new EMM, as it is an area that has evolved significantly in terms of the level of policy attention and funding at EU and national levels, driven by societal challenges and the need for cross-disciplinary research.

Stakeholders at European and national level consider OS – including open access to data and scientific results practices - to be key to the future success of European R&I. However, this masks differing levels of interest in OS policy objectives at national level, in that some countries are already advanced in this area, whereas others lag behind, especially in the widening countries. There is a clear link between many areas of OS (Priority 1) in terms of the free circulation of knowledge and data. Additionally, the ESFRI White Paper addresses its role in facilitating access to high-quality, open research data by ensuring the networking of pan-EU RIs, and through the European Open Science Cloud (EOSC), linked to Priority 2. In developing indicators around Open Science, it is important to consider components such as Open Access to publications, FAIR and Open

data and open science practices in research as the most relevant indicators in combination or as standalone ones.

The EOSC is an environment for hosting and processing research data to support EU science and is developing quickly. Initiated in 2015, it aims to develop an environment to store, share, process and re-use research digital objects, such as publications, data and software following FAIR principles, based on **F**indability, **A**ccessibility, **I**nteroperability and **R**eusability.[53] Given the prominence of the FAIR principles, it could be relevant to select at least one FAIR data-related indicator. Two have been included in the table above, namely the number of FAIR publications shared to EOSC, and the percentage of the active data spaces that take up data management practices, including the FAIR data principles, and provide into the EOSC ecosystem. These are not perfect, and showcase only to a limited extent the nature of Open Science and EOSC; they could however serve as additional indicators to measure progress in this dimension. It should be noted that the EOSC Association Task Forces are currently developing a system to monitor EOSC readiness, underlining that FAIR indicators are at an early stage of development. FAIR data could also be assessed in terms of the four principles. Although the verification process can prove complex, there are a number of tools available to check to what extent data follows the FAIR principles. Such tools enable the user to answer simple questions regarding the four principles to assess how FAIR the data is and provide a score. However, it should be noted that these tools do not count on broad support. In this respect, expectations would need to be managed. If data availability and reliability in respect of FAIR data improves, then in future, related indicators could be considered for inclusion in the Scoreboard. However, for now, partly due the complexity in assessing FAIR data (with a need for several sub-indicators to reflect its four different dimensions), it would be necessary to develop a composite FAIR indicator to include in the Scoreboard. Otherwise, if multiple indicators on FAIR data were included, it would be disproportionate.

The former EMM included indicators on the share of papers in Open Access (OA) and open datasets. The 2018 Progress Report highlighted that there was an assortment of national approaches to open access to research data and progress has been slow. The indicators proposed in the table could therefore accelerate the transition to an open science environment. For instance, a qualitative assessment of OA policies in NAPs and other information sources could provide a deeper assessment of the steps taken to foster open science, supplementing a focus on the results. Additionally, the indicator on the number of RFOs requiring their research to be published in OA could encourage RFOs to make all publications available in OA.

The indicators included in the EMM 2015-2020 focused on Open Access rather than Open Science, which is a reflection of the rapid progress achieved on Open Science. Additional indicators could therefore cover aspects such as OS practices, datasets and publications, although the fast developments in the field will make it especially relevant to incorporate additional stakeholder feedback on the OS proposed longlist of indicators and review these for possibly new existing ones. Common agreement about the importance of open science for the EU research and innovation landscape among stakeholders strengthens the need to capture progress through meaningful indicators but might, at the same time, challenge agreement as to which indicators are the best possible ones. For example the European University Association (EUA) identified the following

[53] **https://digital-strategy.ec.europa.eu/en/policies/open-science-cloud**.

elements as key in the transition towards open science: ensuring open access to research publications; and supporting institutions and authors in retaining their rights and being able to openly share their research outputs without restrictions.

Lastly, there is an important policy issue regarding **reciprocity in the area of Open Science and Open Access to publications and data. Europe has made open science a key policy priority.** However, there is a question mark as to how open the EU should be, if other major competitors benefit from OS, but do not reciprocate by information sharing to the same extent (e.g. China). [54] A study report for DG RTD in 2020 "Towards a 2030 vision on the future of universities in the field of R&I in Europe" for instance stressed that EU policy should reflect the concerns of universities that a culture of openness should be fostered but based on reciprocity from third countries (e.g. through open science, open access and open data approaches in which Europe excels)[55]. The Commission has also noted that it will base its rules for international scientific cooperation in future on the principle of "open strategic autonomy." Consideration could therefore be given to the inclusion of an indicator on reciprocity. [56]

Fostering **career development and promoting researcher mobility** are important EU policy objectives stressed in both the ERA Communication and ERA Pact. There is a need in developing indicators in these policy domains to reflect broader issues, such as the imperative of skills development and training for researchers in the context of strengthening their employability and updating their skills set to meet the needs of the Digital Skills Agenda. Besides, monitoring the working and career conditions of researchers in relation to improving researcher precarity continues to be a priority at EU level. Research precarity is considered to have a negative impact not only on the motivation and well-being of researchers but also on their career prospects and the nature and quality of scientific outputs, especially for young researchers and women. Addressing issues of precarity is considered to contribute to the resilience of science systems. However, limitations to effectively monitor research precarity constitute a major barrier to following on developments in this area, as qualitative indicators would be needed and differences across systems would need to be taken into account[57].

There are already indicators from the EMM on some topics, such as **open, transparent and merit-based recruitment**. For example, data is available through the series of three-yearly MORE studies on the *"Share of researchers expressing satisfaction that the hiring procedures in their institution are open, transparent and merit-based"*. Although perception-based, this could complement more fact-based data e.g. on how many HEIs have actually signed up to different EU initiatives to promote open, transparent and merit-based of researchers (e.g. the Charter and Code, which is in the process of being considered for revision and updating as part of a separate study,

[54] https://sciencebusiness.net/news/paquet-china-needs-open-more-european-researchers

[55] Study report "Towards a 2030 vision on the future of universities in the field of R&I in Europe" - CSES for the European Commission's DG RTD - https://op.europa.eu/en/publication-detail/-/publication/a3cde934-12a0-11eb-9a54-01aa75ed71a1/language-en

[56] https://sciencebusiness.net/technology-strategy-board/news/eu-rewrites-rulebook-science-and-technology-cooperation-rest-world

[57] The OECD has been doing relevant work in the field of researcher careers and precarity, e.g. through the project on Reducing the Precarity of Research Careers, see https://www.oecd.org/sti/science-technology-innovation-outlook/research-precariat/

and the HRS4R award). However, as the data is not available annually, this type of indicator could be incorporated into the Dashboard longlist, but not in the ERA Scoreboard.

Arguably, a more neutral, fact-based indicator to assess progress towards open, transparent and merit-based recruitment would be to include data on researchers' salaries and working conditions. The Universities Unit within DG RTD has commissioned an ongoing study on Knowledge Ecosystems, which includes a number of workstreams, including an investigation as to whether relevant statistical bodies could collect data on salaries and working conditions. This could be an example of new indicators dependent on new data sources that could be useful to monitoring ERA implementation, but which are not yet available. As such, they could be included in the overall indicator system framework, and be reported on later during new ERA implementation once data becomes available. However, such indicators could not be included in the Scoreboard, as the criterion that there must already be high-quality, reliable and comparable data available has not yet been met.

There also likely to be new activity-specific indicators that could help to assess **the career development of researchers,** with many planned activities and new initiatives to build on the former ERA Priority 3. There is presently a study for the Commission's DG RTD to investigate the way forward for the ERA Priority 3 policy measures[58]. It will therefore be important to include some indicators to monitor their implementation.

One or two indicators relating to the **employment potential of excellent researchers** have been included. For instance, the *Share of researchers receiving skills and training during their PhD* could be a useful indicator shedding light on how far universities invest in formal skills training for their researchers to complement research-based learning and skills development opportunities. There could be a specific digital dimension to monitor whether researchers are being equipped with the necessary digital skills in the context of the Digital Skills Agenda. Here, there is a link to open science / open access, as researchers will need to upskill so that they can make publications and datasets available openly, and to be able to contribute uploads to the EOSC.

Post-PhD, a further indicator for possible inclusion is the *Share of doctorate holders employed outside academia*, which could be assessed several years after the completion of their doctoral studies. Firstly, there are not enough (secure) academic positions within academia to employ all researchers. Secondly, Excellent research skills can be translated into employment opportunities in many sectors outside academia. Such researchers have high-level skills that could be beneficial for the private sector / industry, government / the public sector and society. The extent to which PhD and post-doctoral researchers are in demand from different sectors and not only academia, and able to find high-skilled employment would be a useful proxy. This would monitor the employability of researchers outside academia (which could generate policy lessons in terms of how to ensure that they have appropriate training and skills development to equip them to work in non-academic sectors).

There are a number of **researcher careers initiatives** being planned at EU level in the academic R&I sphere that are important in an ERA context. There are some existing initiatives under review, which may be modernised and relaunched, and there are other planned new pan-European

[58] Taking stock, evaluating the achievements and identifying the way forward for the ERA Priority 3 policy measures

initiatives with transformative potential to promote particular objectives. For instance, the 'HR Excellence in Research Award' (HRS4R) rewards higher education institutions which make progress in aligning their human resources policies to the 40 principles of *The European Charter for Researchers* and the *Code of Conduct for the recruitment of researchers.* This requires participants to develop a customized action plan/HR strategy that adheres to the principles in the Charter and Code.

This can contribute significantly to implementing the principles of the transparent, merit-based and open recruitment of researchers under Priority 1 (ERA Pact). These could also support the objective of widening excellence in the context of Priority 3 (ERA Pact). Likewise, there is a new initiative to develop a European competence framework for R&I talents, which could help to codify researchers' competences. The uptake of this framework once developed and launched among universities could be monitored.

Examples of several indicators that could be used to monitor progress towards implementation in these activity-based areas are:

Number of organisations that have applied for / received / renewed the HRS4R award % Horizon Europe funds allocated to bodies with the **HRS4R award**.
% of top 100 and Horizon Europe beneficiary organisations holding the **HRS4R award**.
% Horizon Europe funds allocated to bodies using the **European competence framework for R&I talents.**
Number and % of universities that have adopted the European competence framework for R&I talents.
Number and % of universities and other research-performing organisations that have endorsed the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.

If a new generation of NAPs is required, the main concern is not whether there are suitable potential indicators in the area of researcher career (there are many, as with say open science), but the question of the manageability of indicators, as it would be difficult for MS to monitor and report on all these indicators. The use of the full set of researcher careers indicators could be made optional, so if a particular ERA participant country has strongly prioritised researcher careers, then they may wish to report on a wider range of indicators. Other countries could report on a smaller core set of indicators in this domain.

However, under Option 2, if there were to be no NAPs, then a wide range of such indicators could be included in the performance dashboard, provided that the Commission takes responsibility for populating the data, as the data would be of interest to national and EU R&I stakeholders, such as universities and EU R&I associations.

A further ERA policy objective is to foster greater **international researcher mobility** and the traditional focus has been on indicators to measure international researcher mobility. Until recently, **intersectoral researcher mobility received less policy attention**, and was not therefore previously monitored in the EMM. However, given the increased importance of intersectoral mobility both in improving researchers' employability outside academia and in strengthening the relationship between academia and other sectors in a knowledge ecosystems context, intersectoral mobility should be monitored in future.

Given the over-supply of PhD and post-doctoral researchers in the EU-27 and the lack of sufficient high-quality, secure-tenured academic jobs to provide career opportunities for all such researchers, it is essential to monitor how far PhD-level qualifications and post-doctoral research experience have enabled the researchers concerned to access broader career opportunities in industry, in the public and third sectors, not only to pursue academic careers. Performing excellent science not only delivers benefits in terms of strengthening Europe's science base (especially in fundamental research), but also enables researchers to develop skills that could be attractive to industrial research and to the private and public sectors more broadly.

A *Study on Fostering Industrial Talents* (2018)[59] examined the issue of intersectoral researcher mobility, including how far there was support for such mobility through existing EU R&I and education funding programmes. A key finding was that the prominence of intersectoral mobility has grown, at EU and national level. For instance, such mobility is in greater focus in H2020 than in FP7 in the MSCA (e.g. under the individual fellowships IF sub-programme)[60]. There is growing attention to intersectoral mobility in the ERDF and ESF (sometimes also linked to smart specialisation sectoral priorities).

Consideration could be given to the inclusion of indicators on intersectoral researcher mobility such as the *Number of researchers who completed intersectoral activities (in the past 5 years)* and the *Number of national funding instruments that support intersectoral mobility of researchers.* Whilst based on survey data, the MORE researcher studies include a question about intersectoral researcher mobility. This combined with programme level data from Horizon Europe (e.g. especially the MSCA) could help to generate data to qualitative and quantitative data to assess the degree of progress.

There may be **challenges in achieving a consensus as to which aspects of mobility should be monitored** and whether these constitute important policy objectives or not. For example, there is already a great deal of intra-EU researcher mobility in some countries, which whilst generally positive for the ERA (circulation of ideas and knowledge), could also exacerbate the problem of brain drain from widening countries. Therefore, a policy priority is not only fostering researcher mobility but **ensuring balanced brain circulation**. Whilst the continued inclusion of researcher mobility indicators is appropriate, there are different stakeholder views as to how useful such indicators are.

For example, **extra-EU mobility of researchers to the EU** could be viewed as an important proxy for the relative attractiveness of the European Research Area globally to maintain the EU's attractiveness as a research destination compared with other destinations, such as the U.S. Indeed, this is monitored already through the MORE Surveys of 10,000 researchers (which however has the disadvantage that the data is only available once every three years).

Regarding **intra-EU mobility** of researchers, whilst this is seen as a positive policy objective in some countries to support the achievement of research excellence, this may not even be measured or considered to be a priority in all ERA countries. For instance, this used to be the case in **Ireland,**

[59] Study on fostering industrial talents in research at European level (2018), Study for European Commission's DG RTD (CSES, EPRD, PPMI).
https://op.europa.eu/en/publication-detail/-/publication/a33eb97c-437d-11e8-a9f4-01aa75ed71a1
[60] https://h2020.org.tr/en/h2020/marie-sklodowska-curie-actions/if

where **no distinction was made in statistics between intra-EU and national researchers in the dataset** as they were considered to be part of the same cohort of researchers. Only data on extra-EU researchers used to be collated. This has now changed and the statistics produced are highly detailed with lots of infographics and interactive dashboards. This could provide a good example of how such monitoring could be performed at the ERA level, as not only the origin of researchers is reported on but also their gender. [61]A further initiative that could be monitored in future is the development of the new **ERA Talent Platform** to address existing barriers to unbalanced mobility patterns by supporting researchers in their career development within the ERA, connecting researchers and institutions, improving employability and talent absorption and mobility schemes. Simple output indicators could be monitored such as the *Number of users of the ERA Talent Platform,* and the role of the platform in promoting intersectoral researcher mobility could be assessed.

This new platform is expected to become part of the **ERA4YOU portal** which will emerge from the current EURAXESS Portal for researchers, which presently focuses mainly on international researcher mobility. This could be used at EU level for instance in the ERA Progress Reports as a proxy for the level of interest among researchers in intersectoral researcher mobility opportunities. However, ideally, it would need to be supplemented by data about actual levels of intersectoral researcher mobility.

There is broad agreement between stakeholders that **high-quality and modern research infrastructures** form part of the backbone of the European research and innovation system, and are a key resource for researchers and scientists in the Member States at both national and regional levels. It is therefore important to debate what should be monitored. In the previous EMM, the focus was on ESFRI (Priority 2b i.e. pan-European research infrastructures known as ESFRI landmark projects).

Several ESFRI-related indicators were included in the EMM in 2015-2020, mainly based around the development of national roadmaps on research infrastructures, and an assessment as to how far particular countries involved were participating in ESFRI landmark projects. ESFRI projects involve very significant expenditure. This indicator is therefore useful for both new ERA P1 and P2 i.e. the level of investments in pan-European RIs (P1) and also how far different countries contribute to these is a proxy for assessing access to research excellence (new P2). Both are of interest.

An immediate question is how far the three previous ESFRI indicators should be retained. Stakeholder feedback suggests that these remain relevant, even if there has over time been a transition in the priorities of ESFRI and national stakeholders involved in ESFRI projects from the identification and planning of major investment in such RIs to them being built and set up and becoming fully functioning. This raises the question as to 'what to measure' as once ESFRI landmarks become operational, there are new goals and challenges which influence what should be measured.

[61] See for example https://hea.ie/statistics/graduate-outcomes-data-and-reports/graduate-outcomes-all-years/ For details on country see https://hea.ie/statistics/data-for-download-and-visualisations/data-for-download/2018-graduates-from-irish-higher-education-by-domicile-group-course-level-gender-domicile-of-origin-and-county/

Issues in this area are: the numbers of users of pan-EU RIs, how to maximise take-up of pan-EU RIs in terms of ensuring wide access to such high-quality RIs by different types of researchers, including the private sector and SMEs, fostering partnerships between pan-EU landmark ESFRI RIs and their global counterparts. In other words, attention will need to switch to monitoring the usage and extent of added value and utility of such RIs. Issues such as whether such RIs are embracing open science and open data to allow virtual access could also be monitored.

As for updating the EMM indicators on P2B/ ESFRI, it was not possible back in 2015 to measure how much national investment in pan-European RIs was being made as the data was not comparable. However, interview feedback found that it is now possible to generate such data at national level on a fully comparative basis. Therefore, the investment of millions of EUR in ESFRI pan-European research infrastructures could be ascertained which would shed light both on investments in RIs contributing to European integration and on which countries are contributing that need to strengthen their access to excellence.

However, there are also broader issues. Whilst major pan-European RIs developed through ESFRI are the most visible aspects of the ERA in the area of research infrastructures as they involve RIs of a transnational nature, the landscape of RIs across Europe is richer and also involves small-scale RIs. For instance, some universities have invested significantly in upgrading their research infrastructures, including through the use of Structural Funds (ESIFs) and where ESIFs are not available due to GDP levels in the region concerned, have taken out large EIB loans to invest in modernising and upgrading their research infrastructures. As these are part of the overall landscape of RIs in Europe, it raises the question as to whether the focus should continue to be on transnational, pan-European RIs or also on assessing the state of play in terms of the quality of national and regional RIs used by R&I actors within the ERA (e.g. universities, research institutes, translational research centres) that collectively influence Europe's competitive position in the R&I field. However, a constraint in this regard could be that there are many heterogeneous RIs across the EU, with limited comparability (e.g. national investment data) and it may therefore be too difficult.

Knowledge valorisation, a further sub-priority, relates to the importance of **capitalising on research results for the benefit of the economy and society.** It could potentially be captured by a range of indicators concerned with (1) strengthening cooperation with other sectors, (2) knowledge-transfer related indicators, such as IPR, spin-off creation, etc.

A first aspect to consider is the need to **strengthen cooperation with industry and, beyond that, also with other aspects of the economy**. Stakeholders welcomed the wider inclusion of industry in the new ERA and highlighted the need to strengthen cooperation across sectors for meaningful, inclusive progress towards the ERA. Indicators to capture this link could range from partnerships across sectors, estimation of funding for mobility across sectors or the number of public-private publications. The existence -or lack thereof – of an Industrial Technology Roadmap (mentioned in the ERA Communication list of 14 Actions), indicating the importance of research and innovation in providing the technological foundation to transform the industrial value chain, would further showcase the synergies between research & innovation and industry. This would, however, require national stakeholder involvement and qualitative considerations, as currently available indicators through international centralised databases are generally limited to R&D public-private expenditure. Thus, a trade-off is needed between available indicators and others, possibly most relevant to measuring progress towards P3 that would nevertheless require additional efforts to collect data at national level.

Secondly, linked to cross-sectoral cooperation, **knowledge transfer** relates to the **transfer of knowledge into the economy and the societal impacts generated**, for example, in terms of social innovation research measured as the number of publications on social innovation per capita. In the previous ERA priorities, P5a focused on knowledge circulation, however, there is a need to go beyond this to a higher level of ambition to include the transformation of R&I results into economic and societal benefits.

The outcomes from knowledge and technology transfer are difficult to measure, as these are complex with potentially a wide array of indicators that could be used. There are many different proxies for assessing knowledge and technology transfer contribution from R&I results from across the EU. The precise indicators will depend on various factors such as how detailed is it necessary to be, which R&I actors' performance should be measured (e.g. universities, industrial and applied research institutes?).

Examples are the number of patents applications registered and other forms of IPR, the number of patents and other types of IPR exploited, revenue generated by Technology Transfer Offices (TTOs), the number of innovation disclosures, the number of licenses signed, revenue generated through licensing (annually) and the number of start-ups and spin-offs created and their survival rates after 5 years. However, whilst such data exists, it is often very dependent on localised data collection e.g. by a university, by a regional authority or innovation body. There is currently no comprehensive EU level data covering all these aspects. However, there is better data available at EU level in some areas, such as patents than in others, where the data is non-existent e.g. number of university spin-offs and start-ups at an aggregate EU level.

Knowledge transfer takes place in many different ways, for instance through the development of publications and their dissemination, making datasets and research results available, setting up a start-up or spin-off from a university and by establishing a partnership with businesses in the locality or the region.

The impacts of knowledge transfer are difficult to quantify accurately even at a relatively local or regional level. For instance, such activities may generate new employment, revenue and taxes locally, with innovation and knowledge spillovers in the wider regional and sometimes national economy. However, the challenge is that monitoring impacts is easier to perform through studies that focus on a specific type of research result e.g. publications, citations, patents and IPR, etc. Therefore, monitoring the contribution of knowledge transfer to the economy and society is easier to carry out with a specific unit of analysis in mind e.g. the economic and societal impacts of knowledge transfer from a university to its wider region. It would be difficult to assess impacts at the EU level, other than by falling back on proxies such as patents data, where data is collected more systematically across all countries, and on a comparable basis.

Measuring the impacts of knowledge transfer to the economy and society comes with some challenges, as pointed out in the European Innovation Scoreboard (EIS) revised methodology 2021, which reviewed the possibility of measuring social innovation in future EIS and considered different ways of doing so. It concluded however that the complexity of measuring such innovation would require a common definition of social innovation in the first place and there is currently no consensus on this point, and would then need to build on commonly agreed indicators that would capture the different dimensions: "Social innovation involves a multiplicity of actors and roles, and has an impact on several levels of innovation.

This complexity and the fact that there is not yet a consensus on the definition of social innovation, creates obstacles to finding comprehensive indicators."[62] In the contest of the EIS, it was decided that six possible social innovation indicators could be tested as additional context indicators on the impact of structural differences between countries, yet further work is needed before these can be added to the EIS given the difference between social innovation and other forms of innovation measured in the EIS. An alternative suggestion points to the development of a separate scoreboard for social innovation, which would target only social innovation through a set of different indicators on an annual basis. Stakeholder feedback and further analysis is needed to define how to best possibly measure this social innovation dimension in the context of the ERA and identify the best possible indicators that would allow for cross-country comparison given the very different national contexts.

This example from the EIS demonstrates that whilst it may be desirable to strengthen monitoring of the societal impacts of the ERA, in the same way as there have been attempts to integrate social innovation into the EIS, such a development would need to face the challenges in comparability and identifying suitable indicators and data sources.

There are also reasons to accommodate a small number of **innovation-oriented indicators**, since innovation is given somewhat more prominence in the new ERA Pact than in the old ERA. Indeed, stakeholders taking part in Workshop 2 pointed out that the new ERA should give adequate attention to Research and Development and Innovation (R&D&I), and not over-prioritise academic R&I (even if the latter remains important in building Europe's longer-term scientific base).

There is an argument in favour of the inclusion of more innovation-oriented indicators in the new EMM, including some indicators from the European Innovation Scoreboard (EIS). Four indicators were already taken from the EIS in 2015-2020. However, a balance needs to be struck to ensure branding differentiation between the EIS and ERA Scoreboard / wider monitoring system. However, although more innovation indicators could be included, not all existing indicators are seen as that relevant to the ERA.

For example, the Share of total knowledge-intensive goods exports as a % of total goods and the share of knowledge-intensive services exports as % of total services exports are important innovation-related trade indicators. They are reported on in the EIS. However, it is questionable how much value it adds repeating them in the ERA indicators, as this is a very indirect proxy for the level of innovation and role of EU and national R&I in contributing to the ERA.

In terms of specific indicators that could be considered, patent application figures are for instance, a useful proxy for the level of innovation and applicability of the research conducted in the country, and benefit from already existing data through centralised sources such as the European Patent Office at EU level or the OECD Patent Database at international level. The advantages of such indicators are that international data is normalised and therefore comparable, and that datasets are broken down also by type of patent, thereby allowing for more granular indicators for example focusing on environment-related technologies, which could serve as link to the green transition. On the disadvantages side, patent data are only proxy indicators and limited as such, especially due to cultural context or commercial confidentiality concerns in some countries, where other countries tend to over-patent, creating comparability issues in actually capturing research outputs and

[62] European Innovation Scoreboard, Social innovation methodological report

innovation levels. Should stakeholders consider patent data to be a relevant proxy for innovation, a decision would be needed in terms of which specific indicator or indicators related to patents is best suited. Some examples are included in the table above.

In addition, innovation metrics suggested in the longlist aim to capture other aspects such as *innovative SMEs collaborating with others as percentage of SMEs*. This indicator is included in the European Innovation Scoreboard, which indeed focuses on innovation and from which the ERA EMM 2015-2020 already borrowed some indicators as relevant for the monitoring mechanism too. Given the increased focus on innovation, a larger number of EIS indicators are relevant in the context of the revitalised ERA priorities, thereby calling for reflection on which and how many EIS indicators should be included in the ERA EMM. EIS indicators are well established and generally rely on centralised and already existent databases, but incorporating too many EIS indicators into the ERA monitoring mechanism and Scoreboard could possibly diminish its strategic position as a standalone tool and lead it to be regarded as partially duplicating already existing information. This has been highlighted by stakeholders throughout the consultation programme and would benefit from additional consideration in the final decision-making around specific indicators to be included into the new EMM.

Lastly, and very much linked to innovation and the ever-changing IP national and EU systems, an adequate management of **intellectual property rights (IP) is at the core of open science (OS).** Digital objects that have persistent identifiers (PIDs) and are FAIR (Findable, Accessible, Interoperable, and Reusable), increase the protection of researchers' rights. Suggested indicators under the new P3 include for example Number of FAIR and open digital objects shared in the framework of EOSC. This is only partially a reflection of the value and role of EOSC, as it provides a limited picture of open science. It could, however, serve as a proxy, together with an additional qualitative assessment, of the open science progress made at country level.

3.3.7.2 Priority 2 – Taking up together the challenges posed by the twin green and digital transition, and increasing society's participation in the ERA

Priority 2 of the new ERA focuses on the crucial role played by EU and national R&I funding programmes and initiatives in contributing to the green and digital transition, plus the question of increasing society's participation in the ERA. More specifically, the new P2 addresses challenge-based ERA actions, synergies between research and innovation policy, education and the EU Skills Agenda, synergies between research and innovation policy, education and the EU Skills Agenda and more active citizen and societal engagement in research and innovation in all its dimensions, amplifying access to research and innovation excellence across the Union, advancing R&I investments and reforms.

A key feature of these areas is that whilst they have an increased prominence in EU policy frameworks, they are new and important elements of the ERA looking ahead. A longlist of indicators is provided on the following page:

Table 3-178 Longlist of indicators – ERA Pact Priority 2 (Challenges for the twin green and digital transition, and increasing society's participation in the ERA)

ERA Pact priorities	ERA Pact sub-priorities	Indicator	Definition	Rationale for inclusion	Source	Frequency of data collection
P2	g) Challenge-based ERA actions	**Sub-indicator on GERD** – Environmentally related government R&D budget, % total government R&D	The data refer to government budget appropriations or outlays for R&D, expressed as a percentage of total R&D expenditure	Budget allocated through EU R&I expenditure to environmentally-oriented R&I is of importance in assessing the ERA (and FP) contributions to the Green Deal and environmental sustainability. As developed by the OECD, indicator would be internationally comparable. However, the inclusion of Green Growth indicators may add to the overall no. of indicators and proportionality is an issue. GERD part of OECD S&T indicators.	Green Growth Indicators Database, OECD	Annual
P2	g) Challenge-based ERA actions	**Sub-indicator on GERD** – Environmentally related R&D expenditure, % GDP	The data refer to government budget appropriations or outlays for R&D, expressed as a percentage of total R&D expenditure	As above (except relating to actual expenditure on green growth)	Green Growth Indicators Database, OECD	Annual
P2	g) Challenge-based ERA actions	EU R&D expenditure of importance to green growth	R&D expenditure in public and business sector of importance to green growth in energy- and environment-related technologies, expressed in % of all-purpose R&D expenditures.	Green growth is crucial for the Green Deal and to assess the contribution of EU R&I in this regard. However, there could be risks in having too many expenditure-related indicators.	Green Growth Indicators Database, OECD	Annual
P2	g) Challenge-based ERA actions	R&I investments in green transition (million EUR) (e.g. Horizon Europe, R&I expenditure through ESIFs).	Estimate of R&I investment at national level to deliver the clean energy transition in line with the European Green Deal	Would be dependent on EU committing to commissioning periodic studies to analyse the contributions to the green transition through EU R&I.	Estimate at national level	Data not currently collected

P2	g) Challenge-based ERA actions	R&I investments in digital transition (million EUR) (e.g. Horizon Europe, R&I expenditure through ESIFs, Digital Europe Programme).	Estimate of R&I investment at national level to deliver the digital transition in line with European priorities.	Would be dependent on EU committing to commissioning periodic studies to analyse the contributions to the digital transition through EU R&I.	Estimate at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	% of top 100 and Horizon Europe beneficiary organisations holding the HRS4R award.	% of top 100 and Horizon Europe beneficiary organisations holding the HRS4R award.	Would link to research excellence by checking how many of the leading universities and Horizon Europe beneficiary organisations hold the HRS4R award. However, a disadvantage is that perhaps not all leading universities may wish to participate and they may use other mechanisms to ensure that they are delivering transparent, merit-based and open recruitment of researchers.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	Synergies between the European Education Area and the ERA in the area of Research excellence (qualitative)	Synergies, interaction and cooperation between the European Education Area and the ERA in the area of Research excellence (qualitative)	Qualitative assessment at EU and national level of the extent of synergies between the EEA and the ERA	Qualitative assessment at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	% Horizon Europe funds allocated to bodies using the European competence framework for R&I talents	% Horizon Europe funds allocated to bodies using the European competence framework for R&I talents	A useful measure for assessing the level of take-up of the European competence framework for R&I talents.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	No. of organisations that have applied for / received / renewed the HRS4R award (linked to compliance with Horizon 2020 and Horizon Europe requirements to access research grants). Disaggregated data for 1) Universities and 2) other Research-Performing Organisations.	No. of research-performing organisations that have applied for / received / renewed the HRS4R award (linked to compliance with Horizon Europe requirements to access research grants)[1]	This could be an indicator at EU level to give insights into how far HEIs have signed up to the HRS4R award. However, caution is that all H2020 and Horizon Europe applicants have to demonstrate they meet requirements in terms of open, transparent and merit-based recruitment practices. Therefore, if all HEIs taking part in the FPs are required to have the award, may not shed much light on extent of progress towards open, transparent and merit-based recruitment practices.	Qualitative/ quantitative assessment at national level	Data not currently collected

P2	h) Synergies R&I/ education/ EU Skills Agenda	Compliance of national policies with the EU-level principles relating to research careers	Compliance and alignment of national policies with the EU-level principles relating to research careers	Qualitative indicator.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	% international research grants (UMULTIRANK)	% research grants for international collaboration	International research grants likely attract international researchers and stimulate cross-border collaborations and mobility	Quantitative assessment at national level	Annual
P2	h) Synergies R&I/ education/ EU Skills Agenda	Existence of recruiting and assessment guidelines aimed at broadening the selection criteria beyond traditional metrics and specifically taking into account a) knowledge transfer, b) science communication, c) citizen science approaches, d) reaching sustainability goals, etc.		Recruiting and assessment guidelines which mirror the diversity of HEI's mission are THE instrument to set incentives for activities beyond research and teaching; they are a necessary condition for (especially younger) individuals to set priorities in their daily work. The existence of comprehensive recruiting and assessment guidelines can thus be seen as a necessary proxy for a system setting the "right" incentives.	Qualitative assessment at national level	Annual
P2	h) Synergies R&I/ education/ EU Skills Agenda	Existence of explicit action plans at HEI level to improve HR management in research (independently from HR Excellence Award)	Existence of explicit action plans at HEI level to improve HR management in research (independently from HR Excellence Award)	To identify needs of researchers, a bottom-up structured process can assist university leadership to identify "pain points". These pain points can then be taken up in other fora (e.g. with HE policy makers) to work/improve on them. They also need to be included in action plans which are instrumental in dealing with brain drain and keeping talented researcher	Qualitative assessment at national level	Annual
P2	h) Synergies R&I/ education/ EU Skills Agenda	Intensity of partnerships between research institutes/ HEIs in the EU and their international counterparts	Intensity of partnerships between research institutes/ HEIs in the EU and their international counterparts (qualitative)	Proxy only for international cooperation. International cooperation has less prominence in new ERA, but aligns with the 'open to the world' concept. May be difficult to measure and to ensure comparability.	Qualitative/ quantitative assessment at national level	Data not currently collected

P2	h) Synergies R&I/ education/ EU Skills Agenda	No. of partnerships between research institutes/ HEIs in the EU and their international counterparts	No. of partnerships with international research institutes/ HEIs	Proxy only for international cooperation. International cooperation has less prominence in new ERA, but aligns with the 'open to the world' concept. Absolute numbers will not be representative nor comparable.	Qualitative assessment at national level	Data not currently collected
P2	h) Synergies R&I/ education/ EU Skills Agenda	Share of researchers receiving skills training during PhD	Share of researchers receiving skills training during PhD	Whereas some universities provide skills training to their researchers during the PhD, many others provide no formal training. This could help to shed light on the extent of training for doctoral researchers. *Only drawback is the proportionality in the no. of indicators overall.*	MORE survey	Every 2 years
P2	i) Synergies research/ innovation/ industrial policy	Use of tax incentives for investment in R&I (million EUR)	Value of tax incentives for investment in R&I (million EUR)	As developed by OECD, would be internationally comparable.	OECD R&D tax incentives database	Every 2 years
P2	i) Synergies research/ innovation/ industrial policy	Indirect government support through R&D tax incentives as percentage of GDP	The tax subsidy rate is defined as 1 minus the B-index, a measure of the before-tax income needed by a "representative" firm to break even on USD 1 of R&D outlays (Warda, 2001). As tax component of the user cost of R&D, the B-Index is directly linked to measures of effective marginal tax rates. Measures of tax subsidy rates such as those based on the B-index provide a convenient proxy for examining the implications of tax relief provisions. These provide a synthetic representation of the generosity of a tax system from the perspective of a generic or model type of firm for the marginal unit of R&D expenditure. For general and country-specific notes on the time-series estimates of implied marginal tax subsidy rates on R&D expenditures (based on the B-index), see http://www.oecd.org/sti/rd-tax-stats-	As developed by OECD, would be internationally comparable.	OECD R&D tax incentives database	Every 2 years

			bindex-notes.pdf.			
P2	i) Synergies research/ innovation/ industrial policy	Indirect government support through subnational R&D tax incentives	The tax subsidy rate is defined as 1 minus the B-index, a measure of the before-tax income needed by a "representative" firm to break even on USD 1 of R&D outlays (Warda, 2001). As tax component of the user cost of R&D, the B-Index is directly linked to measures of effective marginal tax rates. Measures of tax subsidy rates such as those based on the B-index provide a convenient proxy for examining the implications of tax relief provisions. These provide a synthetic representation of the generosity of a tax system from the perspective of a generic or model type of firm for the marginal unit of R&D expenditure. For general and country-specific notes on the time-series estimates of implied marginal tax subsidy rates on R&D expenditures (based on the B-index), see http://www.oecd.org/sti/rd-tax-stats-bindex-notes.pdf.	As developed by OECD, would be internationally comparable.	OECD R&D tax incentives database	Every 2 years
P2	i) Synergies research/ innovation/ industrial policy	Integration of R&I and researchers into smart specialisation strategies in cooperation with other sectors (qualitative assessment)	Integration of R&I strategic considerations and provisions for researchers and researchers' careers into smart specialization strategies in cooperation with industry	Whilst only a qualitative assessment would be possible, the importance to developing synergies and ensuring effective coordination between the ERA and NAPs planning and smart specialization strategies was stressed by some stakeholders.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	Employment created in RPOs' spin-offs after 5 years	Number of staff in spin-offs after 5 years	Tracking the number of start-ups and their survival rate can be a relevant indicator but many start-ups issued from public research organisations even when they survive after 5 years, never exceed 10 employees. A goal of ERA could be to create start-ups that grow significantly and attract private equity. One	Quantitative assessment at national level	Data not currently collected

				start-up having created 50 jobs after 5 years should have the same weight than 5 start-ups having created 10 jobs after 5 years or 25 start-ups having created 2 jobs after 5 years		
P2	i) Synergies research/ innovation/ industrial policy	Leverage of private venture capital by these RPOs' spin-offs after 5 years	Leverage of private venture capital by these RPOs' spin-offs after 5 years (Million EUR)	Not recommended given limited data availability	Quantitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	Availability of national IPRs and technology transfer strategy, methodologies and practices	Existence of national IPRs and technology transfer strategy, methodologies and practices	Not recommended given limited data availability	Qualitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	Incentives for technology transfer including patent filing, involvement in standardisation practices, etc.	Number of incentives for technology transfer including patent filing, involvement in standardisation practices, etc.	Not recommended given limited data availability	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	Number of RFOs that integrate IPRs and technology transfer methodologies and practices in research assessment	Number of RFOs that integrate IPRs and technology transfer methodologies and practices in research assessment	Not recommended given limited data availability	Quantitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	European Innovation Scoreboard Summary Innovation Index (SII)	The Summary Innovation Index (SII) is composite indicator produced every year by the European Commission as part of the European Innovation Scoreboard (DG Internal Market, Industry, Entrepreneurship and SMEs, 2018). It is used to benchmark MS/AC, accounting for a wide spectrum of innovation indicators.	EIS SII is part of the European Innovation Scoreboard and computes a set of indicators together. Although relevant as innovation indicator, strategic considerations are needed to distinguish the ERA Scoreboard from the EIS	European Innovation Scoreboard	Annual

P2	i) Synergies research/ innovation/ industrial policy	High-tech imports, % total trade	High-tech imports, % total trade	Too contextual? Very difficult to establish attribution. High-technology imports are a proxy for innovation as they refer to technical products with a high intensity of R&D (as classified by Eurostat and OECD). Commodities belong to the following sectors: aerospace; computers & office machines; electronics, telecommunications; pharmacy; scientific instruments; electrical machinery; chemistry; nonelectrical machinery; and armament	WIPO	Annual
P2	i) Synergies research/ innovation/ industrial policy	Trade balance, % GDP	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	About half of MS have a positive trade balance (exports – imports). about half of MS have a negative trade balance. For high income and high salaries countries, a negative trade balance is certainly a measure of the weakness of the innovation system: - number of low-tech exports is low because salaries, and therefore prices, are too high. - number of high-tech exports is too low because the countries innovation system is weak	World Bank	Annual
P2	i) Synergies research/ innovation/ industrial policy	Innovative SMEs collaborating with others (percentage of SMEs)	Number of small and medium sized enterprises with innovation co-operation activities, i.e. those firms that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years of the survey period.	Innovation indicator with a focus on small and medium enterprises collaborating, thereby creating linkages with other businesses. If this could be collaborating with SMEs in other EU MSs, this would be a powerful ERA indicator.	European Innovation Scoreboard, from Eurostat (Community Innovation Survey)	Biannual
P2	i) Synergies research/ innovation/ industrial policy	Availability of national roadmaps with identified ESFRI projects setting out investment needs	Availability of a national roadmap with identified ESFRI projects setting out investment needs	As ESFRI projects involve very significant expenditure, how far different countries have prepared national roadmaps continues to be a proxy for assessing access to research excellence esp. in widening countries (new P2).	Qualitative assessment at national level	Data not currently collected

P2	i) Synergies research/ innovation/ industrial policy	Availability of national roadmaps with identified investment needs for the creation/upgrade/maintenance of Technology Infrastructures	Availability of national roadmaps with identified investment needs for the creation/upgrade/maintenance of Technology Infrastructures	Although all MS/ ACs produce national roadmaps, Technology Infrastructures is newly mentioned in the new ERA and could therefore be monitored within roadmaps.	Qualitative assessment at national level	Data not currently collected
P2	i) Synergies research/ innovation/ industrial policy	Availability of national public funding schemes to (co-)finance the creation/upgrade of Technology Infrastructures	Availability of national public funding schemes to (co-)finance the creation/upgrade of Technology Infrastructures	Although all MS/ ACs produce national roadmaps, Technology Infrastructures is newly mentioned in the new ERA and could therefore be monitored in terms of funding.	Qualitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	No. and proportion of countries/regions where research agenda/roadmaps/projects/ policies are co-design with citizens, civil society and end-users (e.g. through dedicated co-design meetings, citizen consultations)	No. and proportion of countries/ regions in which R&I initiatives involve citizens in the design phase.	An important means of ensuring the relevance of the ERA, and alignment with societal concerns, is co-design activities with citizens and/or societal actors such as civil society organisations.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	No. of countries and/or regions where there are citizen and civil society co-creation (e.g. citizen science) strategies at national and regional level with adequate targets/monitoring and/or funding mechanisms.		An important means of increasing the quality, relevance and trust in science.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	Research on Social Innovation	Number of publications developed on social innovation per total population. [Number of publications in EU OpenAIRE can be identified using keywords such as social innovation or social entrepreneurship]	Indicator which aims to capture the contribution also from the business R&I towards solving societal problems. However, perception based through survey data collection as opposed to stakeholder preference for factual indicators.	EU OpenAIRE	Annual

P2	j) Societal engagement in R&I	Businesses that aim to solve social problems, as % of total	Number of people that agree/disagree with often seeing businesses that primarily aim to solve social problems.	Indicator looking into the societal contribution of the ERA towards the Sustainable Development Goals through Horizon Europe funds	Global Entrepreneurship Monitor	Annual
P2	j) Societal engagement in R&I	No. and proportion of countries/regions having procedures for citizen involvement and the extent to which citizens are involved in decision-making	No. and proportion of countries/regions having procedures for citizen involvement and the extent to which citizens are involved in decision-making (e.g. through R&I roadmaps, agendas and policies)	This indicator aims to measure the extent to which R&I roadmaps, agenda, and policies are co-shaped and co-designed with citizens and society. It is important for assessing the responsiveness of R&I to societal needs and expectations. An important means of increasing the quality, relevance and trust in science.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	No. of countries and/or regions where there are citizen and civil society co-creation (e.g., citizen science) strategies at national and regional level with adequate targets/monitoring and/or funding mechanisms	No. of countries and/or regions where there are citizen and civil society co-creation (e.g., citizen science) strategies at national and regional level with adequate targets/monitoring and/or funding mechanisms	This indicator looks at the degree to which citizen and civil society involvement is promoted in the actual conduct of research. For instance, it should capture citizen science-type activities, but also more broadly other forms of participatory practice that go under different names and labels in different disciplinary contexts. While it may seem tempting to look at the % of funding allocated, or the % of projects, due to difficulties defining and delimiting, given the lack of such strategies in most member states and regions it seems more sensible to monitor developments in how prevalence (and potentially how ambitious and broad) such strategies are.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	No. and proportion of countries/regions where research agenda/roadmaps/policies are co-design with citizens, civil society and end-users (e.g. through dedicated co-design meetings, citizen consultations)	No. and proportion of countries/regions where research agenda/roadmaps/policies are co-design with citizens, civil society and end-users (e.g. through dedicated co-design meetings, citizen consultations)	An important means of ensuring the relevance of the ERA, and alignment with societal concerns, is co-design activities with citizens and/or societal actors such as civil society organisations.	Qualitative/ quantitative assessment at national level	Data not currently collected

P2	j) Societal engagement in R&I	No. of research publications involving citizen science	No. of research publications involving citizen science	This indicator is a proxy for citizens' interest and engagement with research and innovation. Puts the focus on the general public itself. In a Eurobarometer exercise, which has the advantage of having a robust methodology, weighted sample, and for some question units time-series data stretching back several decades. There could alternatively be indicators to monitor both passive and active engagement in research).	Quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	% of Horizon Europe funds estimated to have contributed to the SDGs	Estimation (in %) of the total Horizon Europe funds received in the country contributing to the SDGs, either as main goal of the project or as subgoal	Content specific indicator with a focus on research conducted on social innovation, as included in the EIS 2021.	Qualitative/ quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	Number of publications co-authored with non-academics.	Number of publications co-authored with non-academics.	This goes beyond citizen science but gives insight in collaboration beyond academia.	Quantitative assessment at national level	Data not currently collected
P2	j) Societal engagement in R&I	Citizens' interest and engagement with research and innovation	The levels of citizens' interest and engagement with research and innovation	"The engagement of citizens, local communities and civil society will be at the core of the new ERA to achieve greater societal impact and increased trust in science." - ERA Communication. This would however be very challenging to measure, possibly would need to be done through surveys.	Qualitative/ quantitative assessment at national level	Data not currently collected

A key consideration for the indicator system is how far cross-cutting, broader **linkages between the ERA and other EU policy areas,** such as the **digital and green transitions should be pursued**. On the one hand, in the context of the Communication on a European Green Deal[63] and the Communication on A Europe fit for the digital age[64], these areas are central planks in the EU's strategic policy agenda. However, there are practical manageability issues as the ERA is already very broad in focus and indicators cannot be included to assess each and every aspect of its implementation.

There can be challenges in integrating indicators relating to broader EU policy areas e.g. digitalisation and the green transition. For instance, at the workshop on monitoring and indicators in June 2021 for this study, it was explained that whilst there are some expenditure-related indicators on green R&I and digital R&I, Eurostat does not yet have comprehensive EU-level data, and only partial data is available in some MS. Whilst indicators can be developed to monitor these aspects, data will not be easily available. This would instead require additional work that might, however, be considered necessary as stakeholders expressed the need to strengthen and accelerate the work on indicators related to the green transition. Potentially, in the same way that the cross-cutting issues within H2020 will be subject to an evaluation study, to include a financial assessment of EU funding invested across different areas, projections could be made as to how far EU R&I funding has supported these priorities.

For instance, an indicator such as *"R&I investments in green transition (million EUR)"* which would need to cover not only Horizon Europe, but also R&I expenditure through ESIFs. Such data would be useful for policy makers, but it is not feasible to generate such data without additional work e.g. analysing expenditure thematically through a project portfolio analysis. For complex indicators, including those requiring the development of quantitative estimates based on data analysis and evaluative judgement, consultants would be required to produce estimates. It would be unlikely to be realistic to ask ERA participant countries to generate such data, or report on such data as part of NAP monitoring at national level. There could however be new data sources already planned.

In other cases, monitoring data theoretically exists, such as the amount of R&I expenditure through the RTD Framework Programmes (e.g. Horizon 2020, Horizon Europe) that contributes to digital transition and green transition. However, such data has to be extracted and a political decision made that the Commission will analyse such data and invest the necessary resources to do so. An alternative could be to only assess such indicators as part of thematic evaluations carried out by external consultants.

There are potential R&I indicators linked to the green transition and circular economy that could be considered. For example, the DESI index contains green indicators and the Circular Economy Action Plan is supported by a monitoring and indicators framework. [65] However, the scope to include indicators may be limited. The Communication notes that *"Monitoring progress towards a circular economy is a challenging task. The transition towards a circular economy is not limited to certain materials or sectors. It is a systemic change that affects the entire economy and involves all products and services".*

[63] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[64] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age_en
[65] Monitoring framework for the circular economy COM/2018/029 final and https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516190041541&uri=COM:2018:29:FIN

Regarding the sub-objective of **increasing society's participation in the ERA,** this covers issues such as citizen science. However, there are challenges in terms of including sensible indicators for such priority areas. Theoretically, the percentage of EU-funded research projects that involve a **citizen science dimension** could for instance be measured. However, if the aim was to measure citizen science engagement in R&I across the ERA as a whole, more systematic new data collection would be required, as such data does not yet exist. It would also be quite complex, as there are many different national and regional R&I actors, and several different categories of research activities (e.g. applied research, fundamental research, etc.). The question as to who would collect such data, and from which types of actors (e.g. EU Executive Agencies in relation to Horizon Europe project only, or Ministries, universities and applied research institutes, etc.).

3.3.7.3 Priority 3 - Amplifying access to research and innovation excellence across the Union

Regarding **access to research and innovation excellence,** the focus in the ERA Pact is on widening access to excellence. Whilst recognising this is an important priority, a useful means of structuring this Priority in terms of indicators is that first and foremost, the ERA is seeking to achieve Research Excellence and the goal of widening access to excellence (e.g. in less strongly performing R&I countries) is a crucial sub-priority. Whilst some indicators could focus on widening excellence, these would only be applicable to widening countries, so it would be preferable to include some more inclusive indicators covering research excellence across all 40+ ERA participant countries. This would help to ensure continuity with the former ERA, in that excellence is a longstanding underlying principle of the ERA.

This concept relates to the idea of lifting the performance of those that are currently lagging behind to a point where they can demonstrate the conduct excellent science. Achieving the objectives linked to this priority will be challenging, as fostering wider research and scientific excellence is a long-term endeavour.

Whilst excellent science can be measured and assessed, it is worth recalling that it is a multi-faceted issue. The theme of widening access to research excellence includes a diverse range of issues, ranging from monitoring levels of international and intersectoral researcher mobility (including brain drain / gain implications), through to the extent to which particular widening countries take part in landmark ESFRI projects, which are a proxy for excellent science.

A further priority within P3 is advancing EU and national R&I investments and reforms. Whilst investments are an important cross-cutting priority in the ERA Pact, these are given a particularly strong emphasis in P3. As such, indicators on R&I Investment as well as those addressing each of the three sub-priorities are included in the table below.

Table 3-189 Longlist of indicators – ERA Pact Priority 3 (Amplifying access to research and innovation excellence across the Union)

ERA Pact priorities	ERA Pact sub-priorities	Indicator	Definition	Rationale for inclusion	Source	Frequency of data collection
P3	k) Investments and reforms in countries with lower R&I performance	Share of Horizon 2020 funding to Widening Member States	Share of Horizon 2020 funding to Widening Countries	Widening participation in excellence is a key EU policy priority.	Qualitative/ quantitative assessment at national level	Can be calculated using data collected annually
P3	k) Investments and reforms in countries with lower R&I performance	National investment into pan-European RI projects (m EUR)	National investment devoted to pan-European R&I projects in a given year, as percentage of GDP	In the previous EMM, it was not possible to measure how much investment was being made as data was not comparable. Such data is now available, although data on national and regional RIs is not available on a comparative basis.	Qualitative/ quantitative assessment at national level	Data not currently collected
P3	l) Synergies Union/ national/ regional funding programmes	No. of ERA countries that fund Seal of Excellence awards	Number of EU countries that fund projects labelled as Seal of Excellence. The Seal of Excellence is a quality label awarded to project proposals submitted to Horizon Europe, which were judged to deserve funding but did not get it due to budget limits, receive the Seal of Excellence.	Proxy for excellence and degree of commitment by national authorities to invest in excellence.	Qualitative assessment at national level	Data not currently collected
P3	l) Synergies Union/ national/ regional funding programmes	Leverage effect (ratio between EU R&I funding and leveraging of national R&I funding e.g. through joint programmes, thematic partnerships and Seal of Excellence).	Ratio between EU R&I funding and leveraging of national R&I funding e.g. through joint programmes, thematic partnerships and Seal of Excellence	The extent to which EU R&I funding is able to generate leverage through increased national and regional R&I funding, including through joint programming and follow-up approaches in Horizon Europe is an important issue. This is a proxy for how well aligned EU and national R&I funding are.	Qualitative/ quantitative assessment at national level	Data not currently collected

P3	l) Synergies Union/ national/ regional funding programmes	% funds within Horizon Europe devoted to actions supporting research careers	% funds within Horizon Europe devoted to actions supporting research careers at national level	EU investment into developing researcher careers complementing national resources dedicated to the improvement of researcher careers.	Qualitative/ quantitative assessment at national level	Can be calculated using data collected annually
P3	l) Synergies Union/ national/ regional funding programmes	EU funding and national support (million EUR) for the European Charter and Code, HRS4R, ERA Talent Platform, ERA4YOU initiative, European competence framework for R&I talents	EU funding and national support (million EUR) for the European Charter and Code, HRS4R, ERA Talent Platform, ERA4YOU initiative, European competence framework for R&I talents	Proxy for coordination and synergies of funding between national and EU funding in the specific area of excellence in R&I and in support to researcher careers and research quality. Could also be expressed as % of GFDP for better comparability.	Qualitative/ quantitative assessment at national level	Data not currently collected
P3	l) Synergies Union/ national/ regional funding programmes	Total value of participations in million EUR of Horizon Europe (disaggregated by country)	Horizon Europe funds allocated to countries (Million EUR)	Proxy for development of efficient and effective national research capacity and for research excellence.	Qualitative/ quantitative assessment at national level	Can be calculated using data collected annually
P3	l) Synergies Union/ national/ regional funding programmes	Amount of national funding supporting mobility between industry & academia	National funding (in EUR) dedicated to supporting mobility between industry & academia		Qualitative/ quantitative assessment at national level	Data not currently collected
P3	l) Synergies Union/ national/ regional funding programmes	Amount of funding of Seal of Excellence awards at national level in million EUR	Value of funding for projects with Seal of Excellence at national level (Million EUR)	Proxy for national investment in R&I excellence.	Quantitative assessment at national level	Data not currently collected
P3	l) Synergies Union/ national/ regional funding programmes	Leverage effect of Horizon Europe through Seal of Excellence Awards	Aggregate funding leveraged across all ERA participant countries (by encouraging MS to fund national R&I applications that narrowly missed out on EU Framework Programme funding).	Proxy for national investment in R&I excellence.	Qualitative/ quantitative assessment at national level	Data not currently collected
P3	m) Collaborative links across RPOs in	Number of peer reviews in	As per indicator.	Peer reviews foster collaborative links and networking in widening countries and help to	Quantitative assessment at	Data not currently

	Europe	widening countries		foster excellence. They could be measured in widening countries.	national level	collected
P3	m) Collaborative links across RPOs in Europe	Number and share of open peer reviews	As per indicator.	Peer reviews foster collaborative links and networking and are a means of fostering excellence. However, the indicator would only be meaningful if supported by qualitative assessment.	Quantitative assessment at national level	Data not currently collected
P3	m) Collaborative links across RPOs in Europe	Participation rate (in %) of total participants of RPOs from countries with lower research and innovation performance into European scientific networks	As per indicator.	Indicator only a proxy of the change in participation in European scientific networks by RPOs from less mature R&I systems. Indicator relevant at EU level and for widening countries	Quantitative assessment at national level	Data not currently collected
P3	m) Collaborative links across RPOs in Europe	Share of developing ESFRI Projects and operational ESFRI Landmarks in which a widening country is a partner	Share of developing ESFRI Projects and operational ESFRI Landmarks in which a widening country is a partner	ESFRI projects involve very significant expenditure. This indicator is therefore useful for both new ERA P1 and P4 i.e. deepening the ERA with the development of research infrastructure (P1) and advancing R&I investment and reforms (P4).	Quantitative assessment at national level	Data not currently collected
P3	m) Collaborative links across RPOs in Europe	Number of new links created between European scientific networks and RPOs from countries with lower research and innovation performance	As per indicator.	Indicator only a proxy of progress towards increasing links between RPOs in stronger and less mature R&I systems. Indicator relevant at EU level and in widening countries.	Quantitative assessment at national level	Data not currently collected
P3	m) Collaborative links across RPOs in Europe	Type and quality of new links created between RPOs from countries with lower research and innovation performance into European scientific networks	Qualitative assessment of types and quality of new links and collaborations between RPOs from countries with lower research and innovation performance into European scientific networks. Indicator relevant at EU level and for widening countries	An assessment of links between RPOs in widening countries and European scientific networks could shed light on progress towards objectives.	Qualitative/ quantitative assessment at national level	Data not currently collected

P3	R&I investments	GBARD (EUR) allocated to Europewide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector	This indicator is the government budget allocations for R&D (GBARD) allocated to transnational cooperation normalised by the number of researchers from the public sector. [66]	GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals. The transnational element is important to assess the degree of transnational cooperation (former P2a).	Eurostat	Annual
P3	R&I investments	GBARD allocated to Europe-wide transnational, bilateral or multilateral, public R&D programmes per FTE researcher in the public sector	This indicator is the government budget allocations for R&D (GBARD) allocated to transnational cooperation normalised by the number of researchers from the public sector.	GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals.	Eurostat	Annual
P3	R&I investments	GBARD allocated to transnational cooperation per researcher in the public sector	The government budget allocations for R&D (GBARD) allocated to transnational cooperation normalised by the number of researchers from the public sector. [67]	GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals. The transnational element is important to assess the degree of transnational cooperation (former P2a).	Eurostat	Annual

[66] Transnational coordinated R&D contains GBARD allocated to Europe-wide, bilateral or multilateral transnational public R&D programmes and GBARD allocated to transnational public R&D performers. However, for this indicator, only the GBARD allocated to Europe-wide transnational public R&D programmes and the GBARD allocated to bilateral or multilateral public R&D programmes are taken into account. The latter two address cooperation through programmes, while the third sub-category (GBARD allocated to transnational public R&D performers) does not involve joint programming and therefore does not contribute to ERA sub-priority 2a (implementing joint research agendas).

[67] Transnational coordinated R&D contains GBARD allocated to Europe-wide, bilateral or multilateral transnational public R&D programmes and GBARD allocated to transnational public R&D performers. However, for this indicator, only the GBARD allocated to Europe-wide transnational public R&D programmes and the GBARD allocated to bilateral or multilateral public R&D programmes are taken into account. This is because these latter two components address cooperation through programmes, while the third sub-category (GBARD allocated to transnational public R&D performers) does not involve joint programming and therefore does not contribute to ERA sub-priority 2a (implementing joint research agendas).

In the new ERA, the ERA Pact stresses the importance of achieving funding synergies **between EU, national and regional R&I funding programmes**.

There was broad stakeholder consensus (e.g. interviews, workshop 2) that there should be an effort to facilitate the integration of R&I and to strengthen the role of researchers in smart specialisation strategies. The extent to which the research community has been involved in cooperation with other sectors could be assessed qualitatively, as the need to strengthen synergies and to ensure effective coordination between the ERA and NAPs and the planning and development of smart specialization strategies was stressed by some stakeholders in interviews. However, a potential weakness is that in some countries, leading universities may not agree with the priorities identified at regional level in smart specialisation strategies. Qualitative indicators could also be included to assess cooperation with other sectors, including in respect of **funding synergies between centralised and decentralised EU programmes, as well as national and regional R&I funding programmes.**

There is a much greater focus on investments and on the role of investments in providing "directionality" or strategic direction through EU R&I expenditure and policy-making. However, it also covers aspects of the ERA 2015-2020 Priority 1 (strengthening the effectiveness of national R&I systems). Therefore, it is also necessary to include indicators relating to national level reforms of different types e.g. of R&I policies, systems, structures institutional and administrative arrangements etc. However, it may be easier to assess reforms mainly qualitatively. The focus is on securing investments in longer-term, fundamental research and on the coordination of such investments at an EU, national and regional level (possibly involving transnational investments where thematic expertise is concentrated across several countries.

As noted in the introductory cross-cutting explanation of the role of investments in the new ERA, there is agreement through the ERA Forum for Transition and in the ERA Pact on the importance of increasing R&I investments and exploring the scope more often for joint R&I investments. Accordingly, voluntary targets for R&D&I expenditure have been agreed (see section 3.3.4.2 - Prioritising Investments and Reforms (cross-cutting).

One of the ERA priorities under ERA Pact, P3 is **research excellence.** A barometer of progress towards research excellence at country level would be to measure the *Number of participations in Horizon Europe* and the *Total value of participations in million EUR of Horizon Europe.* This data was readily available disaggregated by country in Horizon 2020 and ought to be likewise in Horizon Europe. This data is useful as a proxy for research excellence, including in a widening context, as participating the EU RTD Framework Programmes is highly competitive. This would serve as a proxy for research excellence as often, only some 5-10% of applicants are successful.

Many countries already closely follow how well their R&I stakeholders are performing in the FPs, as the EU R&I funding programmes are the largest transnational R&I funding programmes globally.

Evidence from the national level suggests that these indicators are already taken seriously. For example, the Research Council of Norway commissioned a study to examine how well their R&I stakeholders were performing in terms of their average participation rate, and sought to identify any measures that could be taken to improve their competitive performance, recognising the participation rate as being an international proxy for research excellence.

Further indicators relating to research excellence include the level of Member State and/ or Associated Country investment in **funding high-quality R&I projects under the Seal of**

Excellence Awards. This is a proxy for excellence at national level as it reflects the level of commitment by national authorities to invest in excellence domestically. Examples of potential indicators are: the Number of ERA countries that fund Seal of Excellence awards, the Amount of funding of Seal of Excellence awards at national level in million EUR and the Leverage effect from Horizon Europe funds (by encouraging MS to fund national R&I applications through the Seal of Excellence Awards).

There are also more complex means of assessing Research Excellence at national level, such as the **Adjusted Research Excellence Indicator (AREI),** which is the **only composite indicator** presently in the EMM. This has the advantage of being methodologically robust, as it was developed by the JRC, is supported by a methodological document, and country progress is assessed based on four indicators. The problem with this indicator, however, is that many Ministries interviewed were sceptical about the value added of composite indicators generally and specifically in respect of the AREI, found it difficult to understand how it was computed and what the final score meant in real terms in terms of their country's performance, and progression over time.

Further suggestions were received on research excellence from EU R&I stakeholders, including monitoring the amount of block funding to publicly funded universities and research institutes and of competitive national funding for fundamental research. Furthermore, we suggest an indicator should be added that qualitatively measures progress on the freedom of research (a value in the Pact for R&I).

The intention in the ERA Pact is to widen access to research excellence. In terms of how this might happen in practice, there are a number of different areas in which progress towards the widening objective could be monitored. As mentioned earlier, H2020 and Horizon Europe participation data is already available and provides a direct indicator of how successful R&I actors have been over time in winning competitive research projects, a proxy for their progress in research excellence. Indeed, previous evaluations have identified that several widening countries – e.g. Estonia, Cyprus – have been performing strongly, relative to their country size compared with 'old' Member States.

Furthermore, the intention in the ERA Pact is to widen participation through networking and collaboration between R&I actors in better and weaker performing R&I countries within the ERA. This is expected to be achieved by fostering collaborative links across Research Performing Organisations (RPOs) in Europe, including in stronger R&I countries and their widening counterparts. There are many different possible indicators to measure collaboration of this nature, as per the earlier table.

3.3.7.4 Priority 4 – Advancing concerted research and innovation investments and reforms

Finally, Priority 4 of the ERA Pact focuses on strengthening and advancing research and innovation investments and reforms. It does so by focusing on two dimensions: on the one hand, the **prioritisation** of long-term research and innovation investments and policy reforms at all governance levels (Union, national and regional), and on the other **coordination** of research and innovation investments: by supporting the identification and implementation of potential for coordinated investments and reforms in order to strengthen the ERA dimension across all governance levels in the Union and maximise its impact for the benefit of Union's science and innovation systems.

As such, several R&I investment indicators are included under this priority, despite being a cross-sectoral aspect of the ERA Pact. They provide a relevant indication of the prioritisation of R&I in the

form of investment and can help monitor the investment in R&I, of special relevance in countries with less mature R&I systems.

The following table provides a longlist of indicators.

Table 3-20 – Longlist of indicators – ERA Pact Priority 4 (Advancing concerted research and innovation investments and reforms)

ERA Pact priorities	ERA Pact sub-priorities	Indicator	Definition	Rationale for inclusion	Source	Frequency of data collection
P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	Gross National Expenditure on R&D (GNERD) as percentage of GDP	The total expenditure on R&D financed by a country's institutions regardless of where the R&D is performed. As such, it includes R&D performed in the "rest of the world" that is financed by national institutions or residents; it excludes R&D performed within a country that is funded from institutions outside of the national territory (that is, from institutions that are part of the "rest of the world"). GNERD is constructed by adding the domestically financed intramural expenditures of each performing sector plus the R&D performed in the "rest of the world" that is financed by domestic funding sectors.	Important to include this as for some countries GDP is distorted by foreign direct investment (e.g. multinational Pharma, ICT and Medical Devices a significant component of GDP in Ireland).	Eurostat	Annual
P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	Extent of block funding to public research organisations	Block funding as a percentage of total funding to national performers.	Proxy indicator to the prioritisation of R&I in the public sector, especially when considered in terms of change as compared to previous years.	OECD	Annual
P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	Private co-funding of public R&D expenditure (as percentage of GDP)	All R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD) financed by the business sector	The extent to which the private sector is willing to co-fund R&I projects may be a proxy for various issues, such as how closely the private sector works with public sector universities, PROs and RTOs. It could also help to assess the willingness of the private sector to invest in projects that are close to the market.	European Innovation Scoreboard, Eurostat, OECD	Annual

P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	Number of long-term reforms implemented at national level	Quantitative review of number of 1) administrative / institutional reforms and 2) structural and/ or policy reforms have taken place	Simple output, not meaningful in itself, but more a starting point before assessing progress qualitatively (see next row).	Qualitative/ quantitative assessment at national level	Data not currently collected
P4	n) Prioritise long-term R&I investments and policy reforms at all governance levels	Types of R&I reforms implemented at national level (disaggregated between 1) administrative / institutional reforms and 2) structural reforms	Qualitative assessment as to whether 1) administrative / institutional reforms and 2) structural and/ or policy reforms have taken place	Qualitative indicator as not possible to assess quantitatively easily.	Qualitative/ quantitative assessment at national level	Data not currently collected
P4	o) Coordination of R&I investment	Existence of a common R&I strategy/agenda (with external stakeholders)	As per indicator.	This indicator could provide an indication of the synergies in R&I between different actors in the form of a common strategy or agenda. Specificities of the indicator would need to be defined.	Qualitative assessment at national level	Data not currently collected
P4	o) Coordination of R&I investment	Existence of a common R&I strategy/agenda (with other HEIs)	As per indicator.	There are several previous examples of joint action between universities in different countries on particular research topics. This could be interesting to monitor as coordination of investment may help contribute to research excellence in particular disciplines/ thematic areas.	Qualitative assessment at national level	Data not currently collected
P4	o) Coordination of R&I investment	Existence of intra-ministerial dialogues on R&I for coordinated investment at all government levels	Intra-ministerial dialogues on R&I refer to formal and informal structures in place at national level aimed at coordinating R&I investment	Proxy indicator based on the existence of coordination on research and innovation investment mechanisms at national level.	Qualitative assessment at national level	Data not currently collected
P4	o) Coordination of R&I investment	Qualitative assessment of the coordination on research and innovation investment across the levels of government	Qualitative assessment of the coordination efforts undertaken at national level and with other levels of government on R&I	Assessment of the coordination mechanisms available across the different levels of government, ministries and sectors.	Qualitative assessment at national level	Data not currently collected

P4	R&I investments	Gross Domestic Expenditure on R&D (GERD) as percentage of GDP	The total intramural expenditure on R&D performed in the national territory during a specific reference period.	GERD is strategic and contextual and a crucial measure of progress in level of investments towards ERA goals. As a priority is to use public funds to boost private R&I investment, this should be reported on or only GBARD as in EMM 2015-20.	Eurostat	Annual
P4	R&I investments	**Sub-indicator on GERD** - Government Budget Allocation for R&D (GBARD) as percentage of GDP	The government budget allocations for R&D (GBARD) divided by the gross domestic product (GDP) of a given country. GBARD represents budget provisions and not actual spending	GBARD is strategic and contextual, but remains a crucial measure of progress in level of R&I investments towards ERA goals.	Eurostat	Annual
P4	R&I investments	**Sub-indicator on GERD -** Business Enterprise expenditure on R&D (BERD) as percentage of GDP	All R&D expenditures in the business sector (BERD)	Private sector R&D is a crucial component of total GERD. Private sector contribution towards R&D constitutes a major element towards further developing R&I systems, especially challenging in countries in which R&I is not of high strategic relevance.	Eurostat	Annual

Advancing research and innovation investments and reforms, as outlined in the ERA Pact, requires an adequate policy and regulatory framework that maximises its impact. Conducting reforms leading to such transformation, however, at the same time calls for the mobilization of resources including funding and human resources among others. Therefore, Priority 4 focuses on supporting the prioritisation and coordination of the funding of R&I and its reform, as outlined in the ERA Pact.

The prioritisation of long-term research and innovation investments and reforms can to some extent be monitored through quantitative indicators such on R&I investment. *Gross Domestic Expenditure on R&D (GERD) as percentage of GDP*, for example, was included in the previous EMM and could be retained to provide not only continuity but also relevant information on potentially increasing investment in widening countries, as recommended by the ERA Pact. Sub-indicators such as *Government Budget Allocation for R&D (GBARD) as percentage of GDP* or *Gross National Expenditure on R&D (GNERD) as percentage of GDP* could provide additional granular information and allow for a more accurate picture of actual investment (GNERD for example is important to include as for some countries GDP is distorted by foreign direct investment e.g. multinational Pharma, ICT and Medical Devices).

As for coordination and the contribution from the private sector, examples such as *Private co-funding of public R&D expenditure (as percentage of GDP)* and *R&D expenditure in the private sector (BERD) as a percentage of GDP* could be relevant indicators to analyse the role of the private sector. Although these indicators are only proxies for the prioritisation of R&I, they can be useful, when taken together with some qualitative indicators that assess the types of reforms conducted at national level.

In order to assess the quality and type of reforms, a qualitative assessment by national authorities is needed. Suggested indicators include the number of long-term reforms at country level, and types of reforms broken down in different categories such as administrative and structural reforms. The existence of a joint R&I strategy is suggested as an additional indicator, as it could be an indication of efforts to push for coordinated reforms. Smart specialisation strategies and their inclusion of an R&I dimension could serve as a further indication of prioritisation and strategic relevance given to R&I. However stakeholders questioned whether such strategies are the best suited indicator in the ERA context as some universities did not necessarily agree with the areas highlighted by them.

Coordination across all levels of government in R&I funding is crucial for the advancement of the ERA. Findings from this study suggest that involving senior professionals from the different Ministries and authorities relevant to the ERA would help coordinate and strengthen efforts, while also strengthening accountability. Although multilevel governance is also addressed under Priority 3, Priority 4 reflects the aim to further strategically prioritise it in a coordinated way across sectors and levels of government, possibly using indicators such as the *existence of intra-ministerial R&I meetings or working groups* and the *quality of existing coordination mechanisms.* Although only a proxy and requiring a qualitative assessment, these aspects could shed light on the work done at national level to increase coordination in R&I.

The areas of **transnational cooperation** (meaning intra-EU) and **international cooperation** (meaning between the EU and ERA participants countries and third countries) were both supported in the former ERA under Priority 2b and Priority 6 respectively. In the new ERA, it is important that at least some continuity is ensured in pursuing these aims. Consideration should therefore be given to indicators such as GBARD allocated to Europe-wide transnational, bilateral or multilateral, public

R&D programmes per FTE researcher in the public sector. GBARD was already in the previous EMM, and collecting data on transnational expenditure on R&I could be useful in that transnational cooperation contributes to the ERA in different ways, e.g. through researcher mobility, fostering research excellence, etc.

Consideration is also needed regarding the **potential inclusion of bibliometrics indicators,** a couple of which were in the EMM. In the new ERA, it could be worth retaining the indicator '*International co-publications with ERA partners per 1,000 researchers in the public sector',* as this is a **proxy for research excellence through international cooperation** that measures the outcomes resulting from transnationally-allocated research funding.

However, the extent to which different countries perceive this indicator as being important depends on how internationalised their research system already is. In some countries, such as Ireland, Germany, etc. there are already many European and international researchers and therefore, international co-publications is not necessarily seen as a highly relevant indicators. Conversely, in ERA countries with less well-developed R&I systems, such as Lithuania, the Ministry of Education, Science and Sport mentioned that this is a very important indicator as there is a need to encourage Lithuanian researchers to collaborate more internationally to strengthen the visibility of their national research output. A further publications-related indicator is the *'Share of publications with international collaborative authors'.* This is important, not only to increase the visibility of researchers' work, but also because there is clear evidence that increased international collaboration increases national research excellence.

However, there are weaknesses in an over-reliance on bibliometric indicators. Recent debates have focused on the utility of conventional metrics as indicators to assess research quality. There is a concern that such indicators can be manipulated depending on how much funding a particular university, research institution or individual researcher has at their disposal to get their research into top journals. In recent, years, concerns have been expressed by some EU R&I associations regarding the over-focus on Journal Impact Factor as a measure of success. There is a growing trend among institutions to explore more accurate, transparent and responsible approaches to research evaluation. For instance, the San Francisco Declaration on Research Assessment (DORA) recommends not using journal-based metrics to measure the quality of individual research articles. While conventional metrics measure research outputs, mainly journal publications, there are additional areas of impact not covered by bibliometrics or usage metrics. Some of these are being explored by Altmetrics.

Altmetrics have become a means for measuring the broader societal impacts of scientific research. Open Science and Altmetrics rely heavily on (open) web-based platforms, encouraging users to contribute (via likes, shares, comments etc.). Altmetrics, then, are both drivers and outcomes of open science practices. More specifically, Altmetrics can stimulate the adoption of open science principles, i.e., collaboration, sharing, networking. Since Altmetrics include the views of all stakeholders and not only other scholars, they have the potential to assess the impact of scientific results on society as a whole.

Whilst Altmetrics are being explored, most metrics experts agree that they should complement and not replace current procedures and methods used in research evaluation. As such, both bibliometrics and Altmetrics should be taken into consideration when devising the new indicators.

3.3.8 Should quantitative (voluntary) targets be set?

A further question is whether quantitative (voluntary) targets should be set in the new ERA monitoring and indicator system at EU level that the Member States – and other EU R&I stakeholders where appropriate – will contribute towards.

In the EMM (2015-2020), no quantitative targets were included as decided by the Ad hoc Working Group on Monitoring in 2014. The rationale for this was that the implementation through national level ERA Roadmaps involves quite different types of actions and that there are very different baseline positions across different countries. The comparability of performance in some areas, especially P1, strengthening the effectiveness of national R&I systems, was seen as being limited.

Nonetheless, in the new ERA, some interview feedback suggested that there may be scope to introduce new quantitative indicators, supported by targets, for instance under the new Priority 1, linked to investments and reforms.

Moreover, the 14 Actions set out in the new ERA Communication of September 2020 include several actions that also include quantitative targets (see Annex 4). Some are recognised as being highly ambitious and aspirational rather than realistic. Nonetheless, they may still be important in cementing political commitment to achieving the new ERA's objectives. For instance, Action 1 suggested a reaffirmation of the 3% target of GDP expenditure on public and private funding for R&I at an EU aggregate level. This was originally agreed in the European Council conclusions from Lisbon (March 2000) and Barcelona (March 2002).

Some stakeholders have argued that political recommitment to the 3% target, and increasing the public R&I funding percentage from 1% to 1.25% of GDP by 2030 is essential to leverage and incentivise private investments, and to support a higher level of ambition for the ERA. Others have however pointed out that the 3% target has been around since the early stages of the ERA and has still not been achieved after 20 years. This means that a debate involving all stakeholders is necessary as to whether there would be added value in setting targets in the new ERA Scoreboard.

Advantages of target setting are that it is helpful to have quantified objectives relating to investments to encourage national high-level political commitment to the new ERA. It is also easier to measure progress when baselines and targets are established from the outset. Another potential advantage of setting targets is that countries might then have a fixed goal to reach. An interviewee mentioned that NAPs were only helpful to some extent as countries tended to be rather conservative in their measures and objectives so as to be able to say they had reached them (eventually). Targets could perhaps contribute to finding the right balance between being ambitious and making realistic efforts such as might be expected at national level, given resource constraints, varying degree of political commitment, etc.

It might also be worthwhile to examine the symbolic and social value of indicators and explain why there may be scope for country-specific targets in some cases. One possible way forward would be, when there is a situation that stakeholders within a country set a target but they do not meet this (e.g. as a result of lack of investments by national government, low level of implementation by universities). In this case, they will need to provide an explanation to the Commission as to why (in a voluntary manner and without sanction). Equally importantly, they would need to do so within their own stakeholder community. This could provide some leveraging power for R&I stakeholders, such as universities when negotiating with their national government, and could lead to

parliamentary questions to strengthen accountability, etc. A risk of this approach could be that if national targets for some indicators were set, it could lead to an overly-cautious approach in target setting by countries reluctant to be seen not to have met targets. This could undermine the high level of ambition of the new ERA.

Further **disadvantages of target-setting** are that it may be difficult to set targets at levels all stakeholders agree are realistic, targets may not be achieved, and under-performance or conversely over-performance against a particular target could be misinterpreted by politicians and wider stakeholders unless EU-level and national-specific contextual factors are considered in interpreting the data. To some extent, such concerns can partly be mitigated through data normalisation, taking into account the divergent baseline situation in different countries, and through qualitative interpretation of national data and of the EU aggregate position. Alternatively, recognising the different baseline scenarios by setting different targets for different countries or groups of countries might reinforce the role of realistic and achievable targets.

Taking an example of the need to interpret performance, rather than rely on the data alone: the 3% GDP expenditure on R&D target was not achieved, but the global economic and financial crisis, and its aftermath in terms of the effects on national and European R&I budgets limited the scope to achieve the target for a significant period beyond the 2008-2010 crisis. Some countries continued to experience financial constraints for much of the following decade.

In addition, any unexpected events, such as the COVID-19 pandemic and its medium to longer term economic effects - need to be considered when assessing progress towards targets.

If targets were to be adopted, a consideration is whether targets should be set at an EU aggregate level, as was the case for the earlier-mentioned 3% GDP expenditure on R&D set in the early 2000s, or should be country-specific. The advantage of such targets is that it may not be feasible for every single ERA participant country to reach the target, but viable for the EU-27 as a whole. At least for politically-visible strategic indicators that need to be agreed between the Commission and EU-27 MS, it could be simpler to set EU-level targets than to assess countries' individual performance against targets, which would otherwise add additional complexity. Country performance can still be compared against the EU average benchmark against the target, although as noted earlier, some countries, such as Germany significantly influence the EU average, so benchmarking against the EU-27 average may be considered very useful in some countries, but not in others.

3.3.9 Data sources for the new ERA Scoreboard and broader monitoring system

Annex 1 lists the current set of EU data sources used to support the EMM indicators. These include a combination of Eurostat and other EU data sources, and survey data, which is often, but not always perception-based. Among the issues relating to data sources are whether the existing data sources (linked to indicators defined in the EMM) will continue to be available to serve ERA monitoring and with the same frequency of reporting as previously, or with longer time lags. Secondly, the question as to whether any new data sources are likely to become available needs consideration.

Regarding **existing data sources** (see Annex 2), the expectation is that most data sources used in the EMM will continue to be available, if stakeholders decide that some of these indicators should

continue to be used in the new ERA Scoreboard. There are one or two exceptions, such as data on transnational cooperation in ERA-Learn in Priority 2a.

Interviewees highlighted the evolving nature of data and indicators used in the science and innovation field so far and pointed at the **potential emergence of new data sources** in future for the measurement of the ERA priorities. Examples are:

- New data being piloted by **Eurostat** in the field of R&I expenditure;
- New data being developed by the OECD Working Party of National Experts on Science & Technology Indicators (NESTI);
- New data being developed by the **OECD on industrial researchers and applied research**, which will allow existing data to be disaggregated at a more detailed level of granularity;
- New data becoming available through European and nationally funded initiatives, e.g., Open Science Observatory[68], **European Open Science Cloud (EOSC)** and the Academic Freedom Index[69];
- Data that already existed but which was not previously comparable, but which could be made so in future (e.g. national investments in pan-European research infrastructures).
- The **European Innovation Scoreboard 2021** (methodological innovation and experimentation to develop new indicators using new data sources e.g. in areas such as environmental aspects of innovation and social innovation).

Eurostat is a key source of data for the EMM in 2015-2020 and is expected to continue to be so in the new ERA. The extent to which new data sources may be available that would allow scope to include new indicators was explored through interviews. Eurostat mentioned that in addition to continuing to produce existing data, they are carrying out pilot projects on indicators linked to R&D expenditure and also to researchers in the higher education sector, some of which are expected to be continued. These types of indicators are relevant as headline, contextual data that could be included in the ERA Scoreboard. These are:

Table 3-21 - Examples of pilot studies for new R&D indicators by Eurostat's R&D Task Force

Pilot studies (new voluntary data collection on R&D)	
Pilot 01	Number of R&D performing institutional units by institutional sector and size class
Pilot 02	GERD by sector of performance, type and source of funds (breakdown internal/external)[70] GERD by sector of performance, type and source of funds (breakdown transfer/exchange)
Pilot 03_1	GOVERD by main activity of R&D performer (high level NACE)

[68] https://osobservatory.openaire.eu/home
[69] https://www.gppi.net/2021/03/11/free-universities
[70] Pilot 2 is classed as Level 2. This foresees regular voluntary data transmission, with dissemination in Eurobase unless the data are flagged confidential.

Pilot 03_2	HERD by main activity of R&D performer (high level NACE)
Pilot 03_3	PNPERD by main activity of R&D performer (high level NACE)
Pilot 04	**Concentration of R&D expenditure and personnel in BES**
Pilot 05	**GERD by sector of performance and type of institution**
Pilot 06	**GERD by sector of performance and type of costs**
Pilot 07	Total, female R&D personnel by sector and employment status – breakdown Doctoral and Master students
Pilot 07	Total, female R&D personnel by sector and employment status – breakdown internal/external
Pilot 08	**Researchers in the Higher Education sector by seniority level**

Source: Eurostat, R&D Task Force, 2019.

A feature of these indicators is that they will rely on "voluntary" data collection by EU-27 MS. The four highlighted in bold, i.e. pilots 4, 5, 6 and 8, are those that are likely to be continued in that the recommendation made by the Eurostat R&D Task Force is that there should be regular data transmission on a voluntary basis, aiming for full dissemination in Eurobase. The second pilot could potentially be useful, as GERD by sector would provide an additional layer of detail beyond the current Government budget allocations for R&D (GBARD) in the current EMM.

A stakeholder interviewed participating in the OECD Working Party of National Experts on Science & Technology Indicators (NESTI) mentioned the ongoing debate and effort among OECD and national experts on developing new indicators that would allow science and innovation to be measured in a more timely and effective manner. There are likely to be "new forms of measuring science we cannot imagine yet" in the future. The stakeholder thought that measuring R&I in terms of the percentage of GDP expenditure was outdated and there is a need to make room for new and imaginative indicators to capture aspects of the ERA that have not previously been measured.

A different interviewee indicated that national statistical offices often already collect and have additional data over and above the data sets that are presently used and presented e.g. there are dozens of different indicators used in the OECD innovation and science scoreboards, many of which draw on data available across the EU and in OECD countries (which captures most but not all of the ERA participant countries). This data is, however, not used to its fullest potential in the context of the ERA Roadmap and presented only in aggregate format. For example, in the case of Research and technology organisations (RTOs), data is collected at national level, however they are not presented in a disaggregated manner and their turnover is instead included under private and government spending, despite the large number of researchers included under some of the major RTOs, e.g. Fraunhofer with 60,000 researchers. Current work is being done in cooperation with the OECD to explore how RTO data can be maximised and its use improved.

An example of how new indicators may need to be considered relates to the area of open science and open data. Conventional bibliometric indicators such as the Journal Impact Factor (JIF) and the number of publications and / or citations are commonly integrated into metrics systems to measure 'excellence'. However, some stakeholders, including some of the leading EU R&I associations of universities have expressed concerns about whether such indicators are neutral and genuinely measure scientific excellence, in that the outcome can be influenced by the financial resources a particular research institute, academic institution/ university has that enable it to publish in leading journals. It should also be stressed that current European Open Science policy is opposed to the exclusive use of such metrics as true indicators of excellence[71].

In order to promote open science, some stakeholders have expressed support for the idea of using Altmetrics as either a complement, or an alternative to the use of conventional indicators of scientific excellence. The use of such metrics would involve not only selecting new indicators but also require the use of new data sources.

Examples of different additional data sources that could feed in to the development of the new ERA Scoreboard beyond existing data sources in the EMM are:

Box 3-5 - Examples of additional data sources

Datasets across sources:

- UN Database on SDG indicators
- WIPO and WIPO IP Statistical Data Center
- European Patent Office
- EU Gender equality in research and innovation
- European Labour Force Survey: additional indicators linking PhD degrees with career outcomes, gender, sector of employment, etc.[72]

OECD datasets:

- Main Science Technology and Innovation (MSTI) Datasets Archive 2020
- OECD R&D tax incentives database
- OECD STI Scoreboard
- OECD Patent Quality Indicators Database (series of indicators capturing the technological and economic value of EPO and USPTO patents)
- OECD Triadic Patent Families Database (set of patents jointly filed at EPO, JPO and USPTO)
- OECD REGPAT Database (EPO and PCT patents by regions)
- OECD Citations Database (references to patent and non-patent literature cited in EPO, USPTO or PCT patents)
- OECD HAN database (harmonised patent applicants' names)

UNESCO UIS - Science, technology and innovation

- GERD by type of R&D activity: http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS

Open Science monitoring information:

- EOSC Strategic Research and Innovation agenda https://eosc.eu/sites/default/files/EOSC-SRIA-V1.0_15Feb2021.pdf
- EOSC EB wraps up activities by releasing key documents for the European Open Science Cloud https://www.eoscsecretariat.eu/news-opinion/eosc-eb-wraps-activities-releasing-key-documents-european-open-

[71] **https://www.openscience.eu/open-science-policy-platform-final-report/**
[72] **https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey**

science-cloud
- Landscape of EOSC-related infrastructures and initiatives https://www.eoscsecretariat.eu/news-opinion/country-sheets-analysis-eosc-related-infrastructures-initiatives
- The OpenAIRE Monitor with in particular their subpage that regards the EC.

Data sources for new indicators

New indicators to be considered in the new monitoring mechanism could be retrieved from a combination of existing and new data sources.

Table 3-192 – Data sources for new indicators by ERA Pact priority

Priority	New indicator	Source	Comment(s)
1. Deepening a truly functioning internal market for knowledge	• Share of R&I organisations which have a Gender Action Plan (GAP), at EU and national levels, and per type of legal entity	• Quantitative/ Qualitative assessment at national level	• As new eligibility criteria to get access to Horizon Europe funding, public bodies, ROs and HEIs will need to have a Gender Equality Plan (GEP) in place.[73] • Gender equality and broader inclusion continues to be a strong focus of ERA in future
	• Number of FAIR and open digital objects shared with EOSC (EU and national data).	• European Open Science Cloud (EOSC)	• Starting point to measure open science at national level in the form of FAIR and open digital objects shared with EOSC, however considered to only partially capture the value of EOSC.
	• Share of doctorate holders employed outside academia, 3 (or 5, or 6) years after graduation	• OECD CDH dataset	• Proxy for the degree of to which researchers' skills are portable to other sectors and of their employment potential to use PhD qualifications in other sectors.
	• Patent applications under PCT per million inhabitants	• OECD Patents Statistics	• IP and patents play an important role in the creation, dissemination and use of knowledge and innovation in the economy.
2. Broadening ERA and relevance - twin transition and society's participation	• R&I investments in green/ digital transition (million EUR) (e.g. Horizon Europe, R&I expenditure through ESIFs).	• Estimate/ assessment at national level	• Given their relevance, data on green and digital transitions are expected to increase in future.
	• Employment created in RPOs' spin-offs after 5 years	• Quantitative/ Qualitative assessment at national level	• Tracking the number of start-ups and their survival rate can be a relevant indicator in the long-term.
	• Indirect government support through R&D tax incentives as percentage of GDP	• OECD R&D tax incentives database	• Contextual indicator which would serve as proxy to indicate level of tax support to R&D

[73] https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/c0b30b4b-6ce2-11eb-aeb5-01aa75ed71a1

	• Synergies with the European Education Area through Research excellence, EU[74]	• European Commission, DG Joint Research Centre	• Synergies between the ERA and the EU Skills Agenda is highlighted as a priority in the ERA Pact
3. Amplifying access to excellence	• Share of Horizon 2020 funding to Widening Member States	• DG Research & Innovation, Corda database	• Improving access to excellence in countries with less mature R&I systems is a priority in the ERA Pact
	• Integration of R&I and researchers into smart specialization strategies in cooperation with industry	• Qualitative assessment of national/ regional smart specialization strategy	• Researcher integration into the smart specialization strategy stressed in the ERA Communication[75]
4. Advancing R&I investments and reforms	• Types of R&I reforms implemented at national level (disaggregated between 1) administrative / institutional reforms and 2) structural reforms	• Quantitative/ Qualitative assessment at national level	• Common understanding of reform would be needed to assess progress made at national level. • Qualitative indicator as not possible to assess quantitatively easily.
	• Qualitative assessment of the coordination on research and innovation investment across the levels of government	• Qualitative assessment at national level	• Assessment of the coordination mechanisms available across the different levels of government, ministries and sectors

Looking ahead, there are a number of issues relating to new data sources for the new indicator system:

- How far do potential new indicators require new data sources?
- Are any new data sources likely to become available in the near future?
- If new data sources are required, what should be the process of collecting/disclosing data?
- To what extent would MS and ACs be willing to collect any new data? Have Eurostat and national statistical services been informed and what role should they play?
- How can Member States be incentivised to gather relevant data that may vary in complexity from country to country?
- How far could an international comparative benchmarking dimension be built in (e.g. through coordination and negotiation with the OECD to integrate datasets?

[74] European Commission, DG Joint Research Centre
[75] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020SC0214&from=EN

3.3.10 Benchmarking of relevant Scoreboards and data visualisation approaches

The purpose of this sub-section is to consider whether inspiration can be drawn from other relevant scoreboards through a benchmarking exercise. This could help to identify good practices useful for the design of the ERA Scoreboard.

There are a variety of Scoreboards at EU and international level that present country level performance in a visually interesting, user-friendly and interactive way. Based on a specific set of indicators, these Scoreboards allow users to navigate the data to better understand the progress made by individual countries and across countries, thereby enabling a deeper level of engagement with the data, and maximising its utility for users. Examples of well-established scoreboards are reviewed in more detail below.

Table 3-23 - Overview of different scoreboards

Scoreboard	Best practices relevant to the ERA Scoreboard
European Innovation Scoreboard (EIS)	The visually attractive and user-friendly interactive tool could serve as model for the future ERA scoreboard in its highly-customizable format whereby the user can select e.g. country, year and individual indicators and also compare specific geographies on individual indicators. Especially given the heterogeneity of R&I systems in ERA countries, this indicator-based comparison could be replicated at ERA priority level to guide countries to identify best practices and learn from each other. Methodological innovation is a hallmark of the EIS. For instance, in the 2021 EIS, there are new pilot methodologies to generate new data in areas such as environmental and social innovation.
European Industrial R&D Investment Scoreboard	Presented as slightly interactive set of dashboards, the benefit of this scoreboard is the visual presentation of key findings at different levels in an easy-to-read format. This serves as guidance for the user to navigate the underlying data, which can be downloaded both for EU+UK top companies and for the world top companies separately. A similar combination of interactive, visually attractive scoreboard and downloadable data could be relevant for the ERA scoreboard, potentially also contributing to an increased visibility of the ERA more broadly.
OECD Science, Technology and Innovation (STI) Scoreboard	Although limited to one specific out of many indicator at a time, the different display options of the STI allow the user to for example look at trends over time or compare country performance in different type of charts for the best visual representation. With easy to download data in Excel format, this tool brings together data from various areas and sources and could serve as inspiration for the ERA scoreboard to do a similar effort to present data available in the R&I ecosystem in a comprehensive way.
OECD Services Trade Restrictiveness Index	Composite STRI indices allow to measure and quantify restrictions on different aspects, thereby converting qualitative aspects into comparable quantitative indicators. A similar approach could be relevant for the ERA roadmap as a means to measure the qualitative progress made by countries in certain priorities with limited relevant quantitative indicators and convert it into a numerical value.

Future Scoreboard on the Sustainable Development Goals (SDGs)	DG Research and Innovation in collaboration with the Joint Research Centre (JRC) have been engaged in the development of 3 indicators dashboards on Planet, People and Prosperity. Consideration is being given to the finalisation of these three dashboards through a study to be undertaken in 2022 on SDG indicators across these three areas. The objective will be to measure the contribution of R&I in each of the SDGs and into the wider SDGs areas of implementation, i.e. at a higher level of aggregation. Eurostat has already been working on SDG indicators based on a common framework developed by the UN. [76] There is an agreed set of SDG indicators used to measure progress. This provides a good example of the wide range of indicators available and the need for selectivity as several indicators have been selected per goal. There are some areas of common interest, for instance, gender equality, industry and innovation are part of the SDGs. However, the specific focus is different as the SDGs often have a developing country orientation. Nonetheless, there are areas of interest e.g. gender equality[77]. There is an objective of promoting inclusive and sustainable industrialisation and fostering innovation. This includes indicators on R&I, such as Gross Domestic Expenditure on R&D (long-term trend in last 15 years) and short-term trends (in past 5 years), and patent applications to the European Patent Office (EPO).

Some general trends and best practice can be derived from existing scoreboards that could inform the development of the ERA Scoreboard:

- **Data visualization**: one of the main values of a scoreboard comes from an effective visualization of the data, which results in a visually easy to follow format that simplifies the reading for a wider audience and allows the user to make sense of the main findings in an intuitive way, often by using a world map, a colour coding system and different charts and graphs to showcase performance by country.
- **Interactivity**: dropdown menus, selection of individual indicators or themes for comparison across countries and display of additional details when e.g. clicking on a certain country are examples of integrated interactivity with the tool that allow additional customization, thereby allowing a more in-depth analysis of the data by the end user. This is a main feature of a scoreboard, especially if the customized charts can also be downloaded in different formats.
- **User experience:** a user-friendly interface and an intuitive navigation are key elements for a strong uptake of any scoreboard. So is also the continuous update of data for most timely information and the display of definitions of indicators and technical terms used for an inclusive experience. Accompanying the main scoreboard with downloadable data in Excel format for additional manipulation offline as well as issuing a periodic report on e.g. an annual basis containing also qualitative considerations would further strengthen the user experience as a whole.

Additional details regarding the findings from the benchmarking are included in Annex 7.

Of special relevance is the European Innovation Scoreboard (EIS), given its close link with the ERA and the relevance of the innovation dimension in the ERA Roadmap process overall. The 2021 EIS edition of the EIS is not only relevant in terms of the existing indicator selection and its well

[76] Sustainable development in the European Union Monitoring report on progress towards the SDGs in an EU context, 2021 edition, Eurostat

[77] The SDG on GE focuses on some common aspects e.g. persistent employment gaps and gender pay gaps, closing these gaps and promoting equality between women and men in decision-making.

positioned scoreboard but also in regard to its innovative measurement framework that captures policy developments in the area. Consideration is given to measuring environmental innovation and social innovation, two aspects that are highly relevant when developing the ERA Monitoring mechanism in the present study.

4 CONCLUSIONS AND RECOMMENDATIONS

This section sets out conclusions and recommendations drawing on the evidence base gathered throughout the study.

4.1 CONCLUSIONS

4.1.1 ERA Roadmap process, ERA governance and ERA policy framework

As the ERA Roadmap was agreed voluntarily between the Commission, the Member States and the ERA Partnership, ERA participant countries could implement the roadmap and develop NAPs in a flexible way as appropriate to their national R&I situation. This had advantages. Flexibility was appreciated as reflecting the heterogeneity of R&I systems across the ERA's diverse landscape, but it led to a wide variation in the NAPs in terms of their ambition and level of detail. While the PSF Peer Reviews were meant to support this process by analysing the R&I system and providing recommendations for national reforms, these came too late in the process to help develop and update the NAPs.

The lack of synchronisation in the timing of the development of national R&I strategies and the ERA NAPs prevented the NAPs from achieving as much value added as they might otherwise have done. Some countries were constrained by pre-existing national R&I strategies already agreed and so had to modify whatever already exited in their NAPs to ensure alignment, whilst other NAPs had to be developed before national R&I strategies had been updated.

The debates in ERAC and the ERA-related SWGs have been the main platform for joint agenda-setting in relation to the ERA priorities and ERA Roadmap. It was generally considered positive that while the roadmap provided a skeleton for actions to be taken at national level, there was sufficient room for flexibility to translate this into the specific national context and to reflect differences between countries in baseline performance. This voluntary aspect was mostly considered as being the only viable way to build the ERA around a partnership-based model. Apart from the legal situation that national R&I policies remain the competence of the Member States, a number of interviewees suggested that a non-voluntary approach could become counter-productive and lead to 'box-ticking', rather than provide a genuine platform for reform based on common objectives. Notwithstanding, there was an openness to having a more common approach to structuring the NAPs in terms of the broad template to follow, provided that flexibility in approaching the development of actions and solutions to problems identified by priority was retained.

Stakeholder feedback pointed to a lack of guidance in the ERA Roadmap in terms of the operational implementation of high-level objectives at national level. A gap was identified between the high-level ERA Roadmap objectives and their translation into specific objectives, actions and targets at national level. This was particularly the case for countries that faced challenges in terms of the

need for structural, institutional and / or administrative reform and / or that needed to catch up with better-performing R&I countries across ERA participant MS and ACs.

The feedback on the ERA-related ERAC Working Groups was quite diverse across the ERA Priorities. While some were reported to work well, and were perceived as having created added value with specific reports, guidelines and an active role in the EMM process, others were considered by interviewees to have run out of steam early on, with a simple repetition of the annual work programme for some activities. Some interviewees mentioned a general pattern of a limited number of MS representatives being very active, while most others took a more passive role. One reason suggested for the lack of productivity of the SWGs was the absence of a secretariat and dedicated resources for the WG to carry out research, or to produce reports or studies or to collect specific data. Nevertheless, a small number of SWGs did manage to produce outputs based on MS surveys, collated and analysed by WG members. A good practice emerging was the development of a simple monitoring framework to keep track of activities committed to in NAPs at the Priority level by Member States (see case study on the Joint Programming Committee/ Priority 2b in Section 2.4).

The SWGs that were reported to have been most effective were those that focused on ERA (sub)priorities with a relatively narrow and clear set of common objectives (e.g. gender equality and ESFRI/ the common research infrastructure roadmaps). Strong leadership (mostly by the Chair) was also mentioned as a key factor determining the effectiveness in developing a joint policy agenda. The importance of considering the regional dimension in the new ERA, in the context of embedding a multi-level governance approach, was also raised by some stakeholders. This was arguably a major deficiency in the previous ERA Roadmap process at the NAP development level, in that regional stakeholders were rarely involved.

The majority of ERA-related governance structures typically were found to be led by representatives from the Ministries of Education and Science. This meant that representatives of Ministries and agencies responsible for applied and industrial research and innovation were less informed about and involved in the ERA policies. Feedback from members of the ERA Forum for Transition has emphasised the importance of a multi-level governance approach to ERA implementation, and as part of this, stakeholder engagement in smart specialisation strategies could be seen as a good practice that could be considered as a model to be adapted in the future ERA.

Overall, the ERA process needed closer alignment and engagement with high-level policy decision makers in many countries, especially Ministers responsible for R&I. Some suggested that the Competitiveness Council was not the right setting for a discussion of ERA as there are often too many topics on the agenda besides the ERA. In the past, it has been attempted to hold an annual Ministers Conferences on strategic considerations for the ERA, but this has not led to a sustainable discussion forum. The reasons put forward for this were a low level of political interest in ERA topics, and a lack of a stimulating and challenging meeting agendas that could attract Ministerial attention.

The feedback on the 'old' ERA governance processes highlighted a number of challenges that the future ERA needs to address. The study also shows the complexity of a situation that brings up a number of dilemmas and dichotomies.

Regarding **joint agenda setting,** the key messages are:

- Strengthen the linkages to high-level decision-making processes to build a stronger strategic programming process leading to the development of an overarching set of objectives for ERA;
- There is a need for a longer time horizon to allow strategical planning for ERA advancement and at the same time, the ERA process should be reactive and able to respond to upcoming new themes;
- Maintain some form of thematic SWGs which would allow more opportunity for in-depth exchange on specific R&I topics and policy learning;
- The old ERA has led to the disengagement of stakeholders from industry and industry-oriented research and innovation. The new ERA should strengthen stakeholder involvement to become more inclusive, involving a broad spectrum of R&I stakeholders including regional and local actors. This requires more flexible and topic-related forms of stakeholder involvement combining comprehensive representation to discuss the overall ERA objectives and more focused representation of stakeholders engaged in specific topics and actions; and
- Broaden the policy alignment discussion to other EU policy areas where the ERA and the RTD Framework Programmes more generally have a strong potential to contribute, such as the Green Deal and Digitalisation and Cohesion Policy (ensuring coherence with ESIFs and smart specialisation strategies), whilst at the same time keeping the focus on R&I policies.
- Regarding **policy learning and incentivising:**
- Policy learning is an added value of the ERA governance process which was highly welcomed by national stakeholders;
- The linkage between the ERA process and priorities (or in the future actions) and the PSF could be strengthened and made more explicit;
- The European Commission can play an important role as a facilitator in the process and through policy dialogues. In addition, the Commission could reflect upon different ways of providing incentives, such as making changes to EU funding rules in order to stimulate wider take-up of particular initiatives (e.g. the Charter and Code for Researchers, the HRS4R).
- The Commission could also consider various regulatory initiatives to help deepen cooperation and to allow for more sustainable forms of transnational cooperation through the ERA, such as supporting the potential development of a European Legal Statute for universities wishing to make their university alliances more sustainable through the European Universities Initiative.
- In addition, the Member States could reinforce efforts to eliminate barriers to researchers' mobility within the EU and wider ERA participants countries, including legal barriers;

Regarding the translation of the common agenda into **national implementation,** it was found that:

- More efforts should be made to support and guide countries to translate high-level common objectives into national policy objectives at a strategic and operational level. The current ERAC governance processes are not geared towards this;
- A future NAP-type process could provide more strategic direction and guidance as to how to translate ERA objectives into national policy objectives, but at the same time the

flexibility to adapt common objectives to the particular context of the individual MS/ACs should not be lost;

- The coordination between all Ministries and agencies involved in the national and regional R&I eco-system needs to be strengthened at MS/AC level, with a view to broadening ERA actions beyond policies on public and academic research institutions and careers; and
- Good practice examples of stakeholder involvement at MS/AC level could serve as inspiration for all ERA countries to engage and involve actors in discussions on the development and implementation of NAPs and of specific measures. Furthermore, good practice examples of effective practice in the coordination of the NAPs at national level were identified. Rolling these out more widely across ERA participant countries is necessary to ensure stronger coordination both at a Ministry level and in the context of multi-level governance.

Regarding **monitoring and evaluation** aspects and the EMM, important dilemmas were revealed:

- On the one hand, national Ministries would value more direct involvement in monitoring and reporting activities to allow for greater engagement and accuracy in the data, especially in helping to interpret monitoring data and to contextualise the evolution in national performance. Indeed, there were concerns that without appropriate interpretation, data could be misinterpreted by politicians and wider stakeholders; and
- On the other hand, some MS reported a lack of human and financial resources to be actively involved in monitoring activities across so many thematic areas.

The **process of accountability** has a particular set of complexities:

- The partnership model relies on voluntary processes inspired by the Open Method of Coordination, - in which there is reporting on progress made on the common ERA objectives. This is seen by most stakeholders as an essential element of the ERA governance process.
- However, the current way that this was implemented in the 'old' ERA framework is regarded as unsatisfactory by many R&I stakeholders due to the lack of high-level policy ownership.
- Clearer guidance on translating concrete ERA actions into a national agenda of reforms and measures is needed, for instance with support through the Policy Support Facility (PSF) in countries that request it, and/ or through a rolling series of ERA-dedicated dialogues between the Commission and relevant national and regional R&I stakeholders on a country-specific basis. Even though this would be a non-binding process, it would help to review the extent of progress in ERA implementation, identify policy priorities and opportunities to identify synergies with other EU policies and EU programmes (e.g. ESIFs/ smart specialisation, Recovery Facility Fund).

4.1.2 ERA Monitoring Mechanism and indicators

The revitalised ERA priorities, the Council conclusions and feedback from stakeholders suggest the ERA Monitoring mechanism needs to be updated to incorporate developments in the R&I space and better capture progress made towards individual ERA priorities. The restructuring of the indicator system will also need to take into account which indicators in the EMM remain relevant and the strategic role of the new ERA Scoreboard.

The main conclusions relating to the design of the new monitoring mechanism are now outlined.

Firstly, some indicators from the previous EMM should be **retained in the new indicator system to ensure continuity**. However, several indicators should be excluded as they have become less relevant over time (see supporting Excel sheet and Section 3.3.6 setting out a proposed longlist of indicators). Moreover, some indicators could be reclassified, with a better characterisation of the type of indicator they are defined as. [78]

Secondly, a category of indicator in the previous EMM was "outcome/ impact". This could be separated into two different types of indicator, **a results indicator to assess the intermediate outcome, and an impact indicator to assess the longer-term outcome**. The rationale is that outcomes materialise over different timeframes. Moreover, whereas results can often be quantified, impacts are often less easily measurable, and may require qualitative assessment.

Thirdly, it will be necessary to **distinguish between different types of performance indicators** and to specify their category (e.g. output, results or impact, headline, context) and whether these relate directly or indirectly to activities being supported through the ERA at EU and national levels. The indicator system will need to incorporate headline and context indicators which provide insights into strategic progress at national and European level, but which are often not directly linked to ERA-related activities (or only indirectly linked, which makes it difficult to assess attribution). [79] Nonetheless, the online survey found that stakeholders are strongly in favour of some kind of strategic monitoring and reporting system to assess overall ERA progress, not only operational and more direct monitoring.

Fourthly, there should be **reliance on European centralised data sources** (**and international where possible),** to minimise additional reporting and monitoring efforts that need to be conducted at national and EU levels. The use of existing international data further facilitates comparisons between countries and offers the scope to include international benchmarking in selected third countries that make suitable comparators.

Fifthly, greater use should be made of **indicators in the European Innovation Scoreboard (EIS).** Whilst four indicators in the 2015-2020 EMM came from the EIS, given the focus through the new Priority 3 on translating R&I results into the economy, some additional indicators could be considered. However, not too many should be incorporated into the new ERA monitoring mechanism, as a clear distinction between the ERA Scoreboard and the EIS needs to be retained to ensure the new Scoreboard adds value and doesn't duplicate.

Sixthly, **EU and national stakeholders in monitoring and reporting efforts should be engaged** to strengthen links between monitoring and reporting activities and policy development. Increased coordination with defined roles is needed, promoting the integration of monitoring data into EU and national policymaking cycles, such that ERA Progress Reports could become a useful tool for making policy adjustments. If the new ERA is implemented over say a 10-year timeframe,

[78] For instance, the composition indicator on research excellence developed by the JRC (AREI) is described as an "input" indicator in the EMM and JRC's AREI methodology report 2020. However, the four individual indicators used to calculate the composite, such as international co-publications, high-value patents registered and participation in excellence programmes, such as the ERC grants and MSCA appear to be more like results indicators than inputs.

[79] Attribution may be difficult to evaluate, as other factors influence the trajectory as to how indicators evolve over time e.g. macro-economic situation, political changes in government, any changes in national funding policies or arrangements.

this would allow greater scope to make periodic reviews of progress using monitoring data, which could then be used to update the NAPs.

Further observations are that the ERA priorities in the revitalised ERA Communication as well as in the ERA Pact are very broad, and include several sub-priorities. This raises the issue as to how best to integrate some of the former ERA priorities, as most of these have strong ongoing resonance. However, a debate is needed as to what should be measured. It should be considered whether all priorities, sub-priorities and objectives are equally important, or whether prioritisation is necessary.

The proposed new indicator system structure builds on the four new ERA Pact priorities, and the identified thematic sub-priorities within each Priority. This is especially the case in Priority 1of the ERA Pact (Deepening the ERA), which is broad in scope and incorporates many of the former ERA priorities. Therefore, having indicators for each of the sub priorities would make it easier to follow what is being monitored and how it fits in with each new ERA Pact Priority. However, it may not always be possible to devise specific and suitable indicators for all sub-objectives, either due to measurement difficulties or because the inclusion of such indicators at too detailed a level would result in too many indicators being put forward in the new indicator system.

The EMM did not include indicators relating to the societal impacts of European R&I. In the new ERA, societal aspects have become more important priorities e.g. under the new Priority 2 (Common approaches to the win digital and green transition and increasing society's participation in the ERA). The digital and green transitions now receive increasing attention in the ERA Pact compared to before, also under Pact Priority 2.

Regarding **indicator selection**:

A good balance is needed between headline and context indicators, to measure strategic progress, and more operational progress.

- **A challenge is that not all indicators are perceived as relevant in all countries.** An example is that monitoring the number of intra-EU mobile researchers is of minimal if any interest to advanced R&I countries that are already successful in attracting researchers from elsewhere in the EU and around the world. No one size fits all approach is possible nor effective, so it might be necessary to have a core set of indicators, supported by optional indicators.
- The indicators used at input and output, results and impacts levels should be inter-connected to help demonstrate causal chains. For example, GBARD at the input level incentivises private sector R&I investments which can be measured through BERD, which could be an impact indicator, albeit a contextual one, as other factors may influence BERD beyond GBARD.
- The need to ensure adequate syner**gies and coordination between national ERA measures and actions identified in NAPs and other EU-funded initiatives** with a strong national implementation dimension has been highlighted. Examples are links between the ERA NAPs and the place-based Smart Specialisation strategies, and with ESIF planning, as Structural Funds provide more funding support for R&I at national level than Horizon 2020 and Horizon Europe excellence funding. This needs to be considered in defining indicators.

Regarding **data sources:**

- The EU RTD Framework Programmes (specifically Horizon Europe) are a key EU funding source to contribute towards ERA implementation but also offer scope to generate significant new

data. The ability for this data to be used to help with ERA monitoring should be investigated, including the focus on cross-cutting themes within the new ERA, such as on gender equality. The possible inclusion of some data generated through the Framework Programmes in the new monitoring system could be considered, such as the level of researcher participation in mobility programmes, national performance in sub-programmes focused on scientific excellence (e.g. the ERC grants scheme and MSCA).

- New data sources provide an opportunity to integrate new indicators, and to complement existing indicators with further granularity. This applies both to direct indicators to assess ERA implementation and indirect context indicators. Data sources to be considered are OECD databases, Eurostat data and new data collected through EU initiatives.

Regarding **monitoring responsibilities**:

Coordination of reporting and monitoring at EU and national level is key to strengthening the link to policy-making and for R&I decision-making to be data and evidence-based.

- **Long-term ERA objectives are monitored by the EU** and this has been done through the ERA Progress report on a bi-annual basis. Should it be continued, national stakeholders could be involved with a minor role as observers or be consulted on the progress made at national level to increase their ownership and strengthen the incentive to revise and adjust ERA measures based on conclusions from the progress report.
- **Monitoring at national level** with a focus on monitoring of the Roadmaps was done by ERAC Standing Working Groups and considered very useful for national stakeholders. A similar effort could be replicated in the future to complement the EU level monitoring.
- **Limited capacity at national level, both in terms of human as well as financial resources,** suggests it would be best to strike a balance in the involvement of EU and national level stakeholders in monitoring, so as to maximise accountability and ownership on both sides without creating too much of a burden that countries cannot meet.
- The commitment to the creation of an **ERA Scoreboard** is an opportunity to present findings more visually. This will be a major change to the reporting so far through the ERA progress report and will need to be accompanied by consideration of data collection responsibilities.

Potential additional reporting efforts as outlined in section 3.3.1, e.g. in the form of a **Performance Dashboard** replacing the EMM, and/ or a centralized **Policy Online Platform** where ERA countries upload information on ERA relevant activities, strategies and general actions would also need to be considered in relation to data collection responsibility and accountability. Regarding the **monitoring and reporting processes and the frequency of these**:

- Stakeholders consider a **combination of EU and national monitoring** would be complementary and representative of actions taken, as not all EU indicators are relevant to all countries. With EU level monitoring linked to the indicators selected, and national monitoring linked to the development and implementation of the ERA Roadmap, synergies and coordination efforts are needed to bring together findings from both sides to provide a comprehensive picture of progress towards the ERA objectives.
- With the **introduction of the new ERA Scoreboard**, consideration should be given to how this affects the broader monitoring mechanism and what the process should be in future. If the

ERA Scoreboard is to focus on strategic high-level indicators, these could be integrated into a broader set of indicators monitoring other dimensions through more operational and activity-based indicators, as presented in the options analysis in section 3.3.1.

- Whereas annual reporting frequency was accepted for the ERA Scoreboard, stakeholders' preferred option regarding the frequency of monitoring and reporting for the broader monitoring system was that this should continue to be biennial. The present system whereby there is a biennial ERA Progress Report providing an overview of progress towards ERA implementation at the EU level overall, with supporting country fiches to assess national performance data and to track the evolution in performance was considered proportionate. Changing the monitoring of ERA implementation at national level to annual monitoring was considered as too great an administrative burden that most countries could not take on. In addition, stakeholders consider that for progress to become visible, more time is needed for actions to have an effect.

4.2 RECOMMENDATIONS

This section sets out recommendations, drawing on the key findings, conclusions and lessons learned. The lessons learned provide the context for the recommendations outlined.

4.2.1 ERA Roadmap process, ERA governance and ERA policy framework

A number of lessons learned can be highlighted in respect of the ERA Roadmap process, ERA governance and ERA policy framework. These are:

1. The need to increase the high-level political buy in / engagement to the ERA process.
2. The need for a strategic planning process.
3. The need to involve a wider set of stakeholders to address the ambitions of the new ERA, while keeping them engaged in the process.
4. The need to address the limited/unbalanced implementation of ERA measures across EU Member States.

In the following subsections, the associated challenges are discussed, together with possible solutions that the key ERA stakeholders should explore.

Recommendation 1 – Ensure that high-level political buy-in and engagement with the ERA process is secured at national Ministerial levels (with a corresponding level of seniority from the European Commission).

As stressed in the conclusions of the ERA 2015 – 2020 assessment (section 2), there is a need for increased ownership and commitment at higher levels of decision-making in the Member States to implement national ERA measures, to include structural, institutional and administrative reforms where relevant. A more systematic high-level engagement amongst MS/AC and between MS/AC and the Commission would also be required, regarding the definition of the common ERA objectives and key actions, the respective strategies and the expression of political willingness to remove barriers to the implementation of new ERA-relevant policies at national level.

Strengthening the linkages of the different governance functions to high-level decision-making processes can be achieved by involving:

- the Competitiveness Council in the approval of the common ERA objectives, the proposed strategies and roadmaps and the follow-up of their implementation, which will raise awareness of the significance of the ERA in an EU policy context;
- high-level policy representatives of the MS/AC in policy design and coordination in ERA bodies such as the ERA Forum, as a means of ensuring that agreements in the ERA bodies are translated into national policy decisions; and
- engaged policy makers, preferably with leadership qualities in the coordination of dedicated task groups – in many cases involving multiple Ministries – with proximity to high-level decision makers in charge of implementing national actions related to the ERA policy agenda.

Ministerial Conferences

Several informal meetings of Ministers for Competitiveness (Research) have been held on key priority topics relating to the new ERA, linked to the current 6-month rotating trio of Presidencies.[80]. These Ministerial Conferences were seen to be useful in strengthening political attention to the ERA during the ERA Communication development process and the lead-up to its publication.

Building on this momentum, regular ERA Ministerial Conferences could become an important element in the ERA governance framework, as suggested in very recent Council conclusions[81]. With Research and Innovation being considered as important components of economic and social development, a political interest that is much higher-than-previously should be expected in ERA topics in order to justify specific Ministerial attention.

Recommendation 1.1 - ERA Ministerial Conferences should be organised on a bi-annual basis to address broader strategic issues, including the degree to which high-level objectives are being attained and/or guidance for the development of new strategic directions and pilot projects.[82]

ERA Ministerial Conferences could moreover allow attention to be directed to particular topics where progress needs to be made within the ERA. At the same time, ERA progress could be brought to the **European Semester Agenda, with a focus on operational aspects of the ERA policy**

[80] One conference was held as part of the Croatian Presidency (February 2020) which covered the brain drain. A second informal Ministerial Meeting on Competitiveness (Research) was held in July 2020. In October 2020, under the Germany Presidency, a Ministerial Conference on the European Research Area was organised to contribute to an ambitious reorganisation of the ERA. A recent (May 2021) meeting during the Portuguese Presidency focused on the framework conditions for the career development of researchers.

[81] The December 2020 Council conclusions call for "ERA Ministerial Conferences" at least once in two years with the aim of shaping further actions for the implementation of the ERA policy agenda and to take stock of the development and the achievements of the current ERA actions. The September 2021 draft Council conclusions invite future Council Presidencies to consider within their planning of Competitiveness Council agendas an item for reporting on the progress of ERA implementation at national levels and organising an ERA ministerial conference to guide the evolution of the ERA

[82] The agenda of these meetings could be prepared by the ERA Forum for Transition and then by the Permanent Forum, mentioned in the December 2020 Council Conclusions on the new ERA.

agenda. This would enable the Ministerial Conferences to have a more frequent follow-up on progress with regards to planned reforms and other actions in the national ERA roadmaps.

Governance and coordination at EU level

In the 2015 – 2020 period, responsibility for the policy coordination of ERA was given to ERAC, in its capacity as the EU's strategic policy advisory committee. As already mentioned in section 2, ERAC provided advice on the identification and design of strategic priorities related the development of the ERA, whereas ERA-related (Standing Working) Groups undertook the implementation of a designated Priority.

In the September 2021 draft Council Conclusions, ERAC keeps its advisory role, while a new body, the ERA Forum will be in charge of coordination and reinforced implementation of the new ERA. The new governance architecture allows for the creation of time-limited and objectives-bound sub-groups of the ERA Forum for the implementation of ERA Actions. Also, Standing Working Groups can be formed for the governance of individual ERA Actions or priorities for providing advice on the entire policy cycle. A clear division of mandate between ERAC and the ERA Forum will need to be elaborated to avoid the duplication of similar policy debates. For instance, ERAC could focus on the long-term strategic aims of ERA and its objectives at European level, while the Forum focusses on the implementation of the ERA Policy Agenda.

This new governance architecture would be relevant in the three options of the options analysis.

While the design of operational mechanisms[83] could be envisaged as coming at a later stage, it would be important to stress that the ERA Forum should be composed of **senior representatives** of the Member States that have close links with national decision-making processes in **Research and Innovation** policy matters (for example, persons endorsed to represent Ministries in charge of research, economic development and competitiveness).

Recommendation 1.2 – the ERA Forum should have increased technical capacity and ability to deliver operational results that support EU and national ERA implementation. It should be supported by allocating some EU funding, such that its effectiveness could surpass that of the SWGs in 2015-2020.

Recommendation 1.3 - the Standing Working Groups (SWGs) should be potentially supported by setting up flexible and temporary WGs with a limited duration. The objective of these temporary WGs would be to address newly emerging topics whose relevance needs to be addressed in a dynamic way to produce concrete conclusions for the ERA Forum.

The setting up of *ad hoc* Working Groups (WGs) on particular topics has been the practice for some time. For instance, in 2013 an **ad-hoc group on ERA monitoring** was established solely to discuss the indicators and how to monitor. Subsequently, in the ERAC report (ERAC 1209/18), the

[83] A crucial mechanism refers to coordination of the agendas of the WGs with each other and with the Council Presidency priorities. The ERAC review points to the role of the Commission to ensure consistent, efficient participation across groups and an increased coordination between Council Presidency priorities and the agendas of the ERA-related groups. This could be achieved through earlier involvement of Council Presidencies in the Steering Board.

ERAC ad-hoc WG on Partnerships was promoted as a good example of building trust-based cooperation between the Member States/ Associated Countries and the European Commission in an effective and efficient manner. Similar WGs could be commissioned to produce the thematic reports suggested in option 2 of the options analysis. The configuration of the Standing Working Groups should be decided on the basis of the strategic directions of the ERA agenda and the finalisation of the ERA prioritization at EU level.

Governance and coordination at national level

Recommendation 1.4 – Governance arrangements at national level need to be efficient, effective and rigorous. Specifically, strong coordination is needed by whichever Ministry (or designated body) is responsible for implementing coordination nationally.

Recommendation 1.5 – If there were to be a new generation of National Action Plans (option 1), this should build not only on the previous set of NAPs but also incorporate good practices and stakeholder engagement techniques already used to develop other national strategies and initiatives supported by EU funding. Examples are the strategies and plans for planning national ESIFs (including the S3 smart specialisation strategies, as well as for the RRF).

Recommendation 1.6 – A multi-level governance approach should be adopted to ensure that regional representation is also included.

Findings indicate that the degree of political ownership of the ERA roadmap and national R&I agenda played a key role in determining whether measures went ahead, or not. The extent of involvement at national level of the different Ministries influenced the extent to which there was a sense of shared ownership, which in turn influenced progress towards national ERA implementation across different ERA priorities. Key to political ownership was the perception of the value added of the ERA's agenda at a national level that was very often related to the strategic value placed by the country on the R&I sector as a whole. In the future, it would be critical for central players in national R&I policy implementation and in funding to be closely involved, so as to increase the visibility of national ERA implementation.

Building on examples of successful implementation of the ERA Roadmap (e.g. in DE, SE, AT and SI), national governance should involve improved coordination between all relevant Ministries responsible for different ERA priorities, e.g. those in charge of education and science, research, innovation and economic development. The alignment of the ERA national agendas with other national policies is increasingly important in the new ERA, given stronger links between ERA and national policies related to the digital and green transition and the orientations outlined in the new EU industrial policy[84]. The **internal governance models to be used should build on current schemes used for the development of national strategies and initiatives**. Such schemes

[84] European industrial strategy | Internal Market, Industry, Entrepreneurship and SMEs (europa.eu)

have been developed in most MS for elaborating strategies and plans for national ESIFs and for the S3 strategies, as well as for RRF, in which regional/local authorities and actors have been among the contributing parties.[85] Ideally, similar intergovernmental structures could be used for developing and managing the development, implementation and monitoring of the national ERA strategies so as to identify and exploit synergies among the different policies and ERA actions.

The regional dimension in the new ERA, in the context of embedding a multi-level governance approach, should be considered, since in the previous ERA Roadmap process regional stakeholders were rarely involved in the NAP development. Good practice examples in terms of the importance of regional consultation with key R&I and knowledge ecosystem actors such as in the development of smart specialisation strategies could be replicated.

Recommendation 2 – Put in place an effective strategic planning process to support the ERA to ensure that the process is more systemic and co-designed jointly between the Commission and Member States (but including other R&I stakeholders in consultation processes).

Vision and policy orientation

The New ERA, as set out in the Commission Communication, defined four broad strategic priorities, further developed in the **Pact for Research and Innovation** in the form of priority areas for joint actions. These included (1) Deepening a truly functioning internal market for knowledge, (2) Taking up together the challenges posed by the twin green and digital transition, and increasing society's participation in the ERA, (3) Amplifying access to research and innovation excellence across the Union and (4) Advancing concerted research and innovation investments and reforms.

For all these priority areas, it is important to a set **a vision and clear policy orientations for the future of ERA** for the years to come in order for it to become effective and impactful in the definition of EU and national priorities, implementation strategies and progress monitoring towards the realisation of the set objectives. Guidance on the vision and policy orientations should be given by the Council, based on position papers prepared by the Forum for Transition. Such an elaboration of the broad strategic priorities needs to be agreed on, in order to set out what Europe wants to commonly achieve. The Council Conclusions of 28 May 2021 have achieved this for one aspect of the four broad strategic topics: providing researchers with attractive and sustainable careers and working conditions and making brain circulation a reality. The ERA Pact adds some insights on the basis of shared values and principles. However, further agreement and guidance is needed to avoid the same gap between the broad level strategic objectives and operational objectives.

ERA policy agenda

The **ERA policy agenda** is a new instrument that emerged following the Council Conclusions of December 2020. The Council Conclusions also referred to the potential of launching ERA pilot

[85] Most of the countries for which ESIF has a minor contribution to their development strategies have robust R&I systems that efficiently interact with relevant authorities for the implementation of R&I strategies. So existing intergovernmental mechanisms can be used for the coordination of national ERA actions

actions in 2021 that have a broad political support and are jointly implemented by a critical mass of Member States and the Commission in order to maintain the political momentum in priority fields of action, such as the **European Open Science Cloud (EOSC);**the evolution of EURAXESS into an **ERA Talent Platform** addressing existing mobility barriers and improving employability and talent absorption; the implementation of a **Europe-wide networking programme for science managers** to address the growing need for the professionalization of science management at research performing and funding organisations; and the development and implementation of the "plastic pirates" **citizen science campaign** to raise awareness among (young) citizens of the impact and benefits of R&I in their daily lives.

While each of these topics are highly relevant, they are operational proposals for common actions. The ERA Pact was a step in the strategic direction of the ERA policy agenda, further developing these strategic goals will be needed to ensure a common understanding at all levels of governance. The ERA policy agenda should then be understood as the translation of the ERA vision and policy orientations into strategic objectives and coherent lines of action. The ERA policy agenda and actions should also be the basis for developing and following-up the national strategies and roadmaps for the new ERA.

Co-design approach for the ERA policy agenda

As for the process to be used for the development of the ERA policy agenda, currently the ERA Forum for Transition is in charge. The December 20202 Council conclusions on the new ERA call on the MS and the Commission to jointly develop the ERA policy agenda. For this purpose, a **co-design approach** could be implemented, along the lines of the one used for the development of Horizon Europe[86].

The first phase of the co-design process should involve the development of strategic objectives for the four priorities of the new ERA (Table 3-1). This has taken place in the form of the ERA Communication and the ERA Pact so far, among other arrangements. A second revision of the ERA Pact should take place as a process of co-design with MS/AC and stakeholder organisations aiming to identify the broad lines of action for each strategic objective and to determine the governance requirements. This stage should, therefore, lead to the definition of the strategic objectives of the ERA policy agenda, the corresponding lines of action and the configuration of bodies that are similar to the current SWGs. These SWGs should have representatives of the appropriate Ministries and agencies that match the topic, including education and science but also the ones in charge of competitiveness, regional development, climate change and digitisation.

A third level of the co-design process should address the development of the ERA actions, requiring coordination at EU level, like the ones referred to in section 3. The co-design could for this stage be organised at the level of the SWGs. The consultations should enable ERA actions to be defined, by specifying i) the scope, objectives, actors, resources and timing of the initiative; ii) the resources to be used; iii) the organisation of work among the different actors; iv) the governance scheme, specifying roles and responsibilities, decision making processes, allocation of work and methods for monitoring and reporting; and v) the criteria to assess progress and successful implementation.

Time horizon of the ERA policy agenda

[86] European Commission (2021). Horizon Europe Strategic Plan 2021 – 2024

Recommendation 3 – Consideration should be given to assigning a longer duration to the new ERA, such as a 10-year implementation period. This would allow sufficient time for a more strategic approach to be pursued, and avoid having to rush consultation during NAP development with national and regional R&I stakeholders beyond the Ministries.

Recommendation 3.1 – A longer period of implementation would also allow for periodic reviews of the extent of progress towards ERA objectives at national and EU levels.

- At EU level, the extent to which any changes are needed for particular priorities and sub-priorities could be assessed.
- At national level, the extent to which monitoring and reporting information and data provided in the biennial ERA Progress Reports/ country fiches require revisions to the NAPs and / or policy dialogues to debate what is action needed, could be debated.

An equally important dimension is the time horizon of the ERA policy agenda. An analogy with the previous reporting period is the ERA Roadmap for 2015-2020 that covered a period of five years, but was based on priority areas already defined in 2012. Since the new governance model needs to be stable and provide the necessary continuity, the new ERA policy agenda should cover a period that is at least equal to the duration of the current programming period, that is until 2027. Periodic evaluation exercises, for example, once every 3 or 4 years could be used to assess its relevance, efficiency and effectiveness and propose changes that may also relate to new challenges. Since creating synergies with other policy programmes is key, the alignment with the current programming period allows an integration of ERA objectives into other EU policy instruments as well.

Other possibilities would be to consider a 10-year horizon, in accordance with other longer-term objectives set for 2030, like the ones for energy and climate. This, however, risks momentum being lost in the later stages and a loss of co-ordination with changes in other major policies and programmes. Alternatively, the duration of the policy agenda could be linked to the terms of the Commission political leadership and/or the European Parliament, as these are milestones for the formulation of broader development policies and objectives. As ERA is a co-designed process, matching it only to the Commission leadership seems less appropriate.

The need to involve a wider set of stakeholders to address the ambitions of the new ERA

Recommendation 4 – A wider set of stakeholders should be involved in the new ERA governance and in regular stakeholder consultation arrangements. This would serve several aims, including strengthening the ERA's visibility at national and regional level, harnessing the collective knowledge and expertise of EU, national and regional R&I stakeholders, and ensuring that all relevant types of stakeholders covering academic and applied research, and innovation (including its industrial dimension) are represented.

Recommendation 4.1 - Give a more central role to the ERA Stakeholder Platform in consultations related to the design of the ERA policy agenda and reviews of its effectiveness. The Platform could also be involved in helping to identify conclusions and

lessons learned from the different processes used to monitor and evaluate progress of the ERA policy agenda implementation.

In the multi-level governance scheme of the new ERA policy framework, a large variety of new stakeholders have to be adequately represented. These include University/scientific, business organisations, and the different associations grouping innovation actors and stakeholders of regional / local development and citizens.

Industry generally, and industrial researchers in particular, should be closely involved in ERA governance and in stakeholder consultations, becoming more firmly embedded in governance structures and in specific initiatives. Indeed, findings point to the need for ERA to adopt more of an **ecosystem-based approach**, recognising the full spectrum of research and innovation actors that contribute to the ERA, including the valuable role played by academic R&I associations at EU level, but also the potential role of representative organisations of industrial researchers in the private sector and of RTOs, and regional R&I associations. Industrial groups heavily involved in commissioning and/or exploiting research, such as cluster management organisations and venture capital firms that already operate transnationally, could make particularly useful contributions. Indeed, the ecosystem-based approach aligns with the idea of enhanced inclusiveness that is stressed in the Commission Communication and the Council Conclusions on the new ERA.

A first step in this direction could be appointing members to the ERA Forum that represent national ministries in charge of research, economic development, digitalisation and competitiveness (already discussed in section 5.1). Policy coordination needs to take place both at national and at trans-national levels. As such, there is also a need to involve in the SWGs (or Permanent Forum), new actors at the MS/ AC level that have a leading role in the implementation of other EU strategies that are closely related to the ERA, such as the EU's Green Deal, Digital Transition, or new Industrial Strategy. The same applies to national governing bodies involved in the financing instruments of R&I, the ESIFs related to Smart Specialisation Strategies and the Resilience and Recovery Plans. This, in turn, increases the need to involve regional and local authorities, as well as innovation-support actors in the SWGs, as discussed above. ERA is geared to ministerial representation in its main bodies, however across EU countries the division of labour between ministries and agencies in developing and implementing R&I policies is quite diverse. This could at least be addressed by inviting umbrella organisations such as Science Europe and TAFTIE to stakeholder platforms.

A more central role would need to be given to the **ERA Stakeholder Platform** in consultations related to the design of the ERA policy agenda and its reviews and to conclusions and lessons learned from the different means used to monitor and evaluate progress of the ERA policy agenda implementation. The ERA Stakeholder Platform could be organised to mirror the SWG structure, meaning that consultations and other types of events organised in each case would be more focused on stakeholder groups that are more directly related to the objectives and actions of a specific SWG.

The new system would need to find a modus of 'smart engagement' with an umbrella type of Stakeholder Platform having wide and inclusive participation, while on specific ERA topics the most relevant and interested representatives should take part. This will be beneficial for their engagement in the process and also reduces the time burden on representatives.

The need to address the limited/unbalanced implementation of ERA measures across EU Member States

As in the 2015 – 2020 period, the National Strategies and development of a new generation of National Action Plans (NAPs) should be considered as the main mechanism to guide the effort required for the design and implementation of the ERA policy agendas for the MS/AC. Should this be the case for (option 1), with the inter-ministerial coordination structures discussed in previous sections providing a forum for determining priority-specific matters at national level and developing the national strategies and roadmaps. Having discussed the issue of political ownership and multi-level governance, attention is now turned to the elaboration of the National Strategies and NAPs, or their equivalent that will be applied in the new ERA.

Recommendation 5 - - Establish closer links between the development and implementation of NAPs or their successors and other national strategies and priorities, such as the Smart Specialisation strategies.

If as per the options analysis, there is to be a new generation of NAPs (Option 1), this recommendation would be applicable. However, if instead, national R&I strategies and action plans are shared among ERA participant countries via an Online Policy Platform Portal (Option 2), then instead, national R&I strategies and action plans should be aligned with Smart Specialisation strategies.

The policy cycle for the Cohesion Policy and the Recovery and Resilience Facility (RRF) may offer useful insights for the design of the national ERA policy framework. In fact, a common feature for the two former ones (section 3) is that, based on a framework defining general objectives that is decided at the level of the Council, each Member State has to develop National Strategic Documents. The corresponding roadmaps are then used to monitor physical and financial progress in the implementation of the programmes. There should be interactions in the development of these documents and the ones relating to the national ERA agendas.

The potential for funding synergies and strategic links between Smart Specialisation strategies – in regions and countries where this is relevant - and the development of a new generation of NAPs, contributing to the objectives of the new ERA, should also be highlighted. For example, many Smart Specialisation strategies prioritise knowledge transfer, innovation and partnership working through an ecosystem-based approach, which could be highly relevant to Priority 3 of the new ERA. Moreover, S3 strategies also incorporate actions necessary to improve national or regional research and innovation systems, which could contribute to Priority 1 of the new ERA by helping to strengthen the effectiveness of R&I systems and by bringing the necessary R&I actors together. A further good practice aspect of the S3 strategies is that they are stakeholder-driven and involve extensive consultation, including new actors not previously involved in the development of R&I strategies.

Such joint developments could lead to improved national ERA Action Plans in the many cases examined in the ERA assessment where it was shown that NAPs were often developed in a relatively short time-frame and mainly involved national Ministries, with limited scope, policy outreach and time for consultation with a wider set of relevant R&I actors.

More targeted guidance for the development of national ERA strategies and action plans

Recommendation 6 - Develop more targeted guidance for the development of national ERA Action Plans (NAPs) in the form of improved ERA Roadmap guidance, supported by good practice examples.

Recommendation 6.1 – Whilst retaining flexibility within the template to allow ERA participant countries to develop a NAP that reflects their needs and priorities, introduce common elements such that the NAPs are more comparable in the second generation.

Recommendation 6.2 - Maximise the use of existing mechanisms, such as the Policy Support Facility (PSF) and the Structural Reform Support Service (SRSS) to support Member States in reviewing their national R&I systems and in the identification of suitable national reforms.

It should be noted that the following recommendations would only be applicable if a political decision is taken to develop a new generation of NAPs. If instead ERA participant countries share information via an online portal, the ERA Roadmap guidance and NAP template would not be needed.

The Policy Support Facility (PSF) could be used to encourage Member States to improve their R&I policies. The Structural Reform Support Service (SRSS) also helps EU countries to design and carry out structural reforms as part of their efforts to support job creation and sustainable growth. These policy support structures could be used to assist bilateral policy dialogues on the NAPs between the Commission and individual countries.

If NAPs are continued (option 1), the guidance should specify what the ERA is seeking to achieve overall and provide practical case study examples of good practice to national authorities providing clearer illustrations as to how particular actions or measures might be implemented in practice. More generally, taking inspiration from S3 where a more elaborate process is implemented involving many stakeholders, the guidance should provide policy learning options at an early stage, with bilateral dialogues (EU-MS) to translate ERA objectives into national actions. These should also take into account other relevant national initiatives and synergies with S3 and/or RRF actions. Technical Assistance planned for ESIF implementation could be allocated for this purpose, noting that starting in the programming period 2021 – 27, ESIF funding may be used to cover national contributions to ERA related actions, e.g. European Partnerships.

If NAPs were to be continued (option 1), detailed guidelines and commonly-agreed templates for NAPs would be useful[87] to promote a better coordinated approach, and to facilitate the formulation of national ERA roadmaps by the Member States with comparable objectives. This could be achieved in a way that still respects the need for flexibility to adjust ERA objectives to the national context if needed

Stronger interaction of monitoring and implementation

[87] A similar approach has been adopted in terms of common structure and content to S3 strategies and RRF plans at national level, despite wide variations in the strategies and RRF plans themselves.

Recommendation 7 – Monitoring data generated through both the new ERA Scoreboard and the revised and upgraded EMM should be used to influence EU and national R&I policy making. The interlinkage between monitoring and policy-making in R&I needs to be strengthened, and lead to follow-up actions, such as revising and improving the NAPs.

The Council explicitly requested that there should be an evidence-informed approach to ERA implementation. An in-depth analysis was provided in Section 3.3 of recommendations for the development of a streamlined monitoring and indicator system. Based on findings, there is a need to ensure that the monitoring system and indicators, and development of the ERA Progress Report and country fiches based on monitoring data, facilitate a process that initiates a policy learning and reprogramming process both at the national level and at EU level.

The evidence from the 2015-2020 ERA Roadmap process was that whilst the monitoring data generated and reviewed at a Priority and country level was considered to have been useful, it has not been used to make changes to improve and revise the NAPs so far. Therefore, regular follow-up of NAP implementation through monitoring and reporting activities in future would enable monitoring to serve as a strategic tool to identify policy lessons that can be derived from monitoring activities and that would feed into the national and EU ERA policy development and implementation lifecycle. In particular, strategies, targets and roadmaps should be adjusted to reflect lessons learned through monitoring, and should be based on the extent of progress made, and the distance still to be travelled. This would increase the likelihood of attaining the objectives related to the development and fine-tuning of the new ERA policy framework and joint policy agenda and improve the quality of its subsequent implementation.

4.2.2 Indicator and Monitoring system

The new ERA Scoreboard

Recommendation 8 – A new ERA Scoreboard should be developed consisting of 15-20 quantitative indicators to assess strategic progress in ERA implementation. This will help the Scoreboard and the new ERA implementation to maintain strong political visibility across ERA participant countries.

Recommendation 8.1 – The ERA Scoreboard should be designed in a way that ensures that there is a clear differentiation with the European Innovation Scoreboard. Although a small number of selected indicators may be useful for the ERA monitoring system more broadly, the ERA covers a much broader range of policy objectives and areas of activity so should be distinguishable.

Recommendation 8.2 – The indicator system should be streamlined to distinguish between the ERA Scoreboard and a broader monitoring framework consisting of a performance dashboard.

If NAPs are *continued*, there should be a three-tier system consisting of 1) the ERA Scoreboard 2) monitoring indicators for the NAPs and 3) broader ERA indicators at EU level moving beyond the minimum core set of indicators in NAPs.

If NAPs are *discontinued*, streamlining would still be needed, such as to distinguish between the ERA Scoreboard and Performance Dashboard mentioned above.

The selection of indicators

Recommendation 8.3 – Some indicators in the previous EMM should be retained, as they continue to be relevant and some degree of longitudinal continuity is needed.

Recommendation 8.4 – Additionally, some new indicators should be included (provided that there are new data sources to support these).

Recommendation 8.5 – The finalisation of the selection of quantitative indicators for the ERA Scoreboard should be selected based on reliable and comparable data being available.

Recommendation 8.6 – Where promising new indicators have been identified, but data is not as yet being collected/ or it does not presently exist, the Commission, Eurostat, the OECD and national Ministries should debate which indicators merit prioritisation in collecting new monitoring data. This will require institutional commitments and human and financial resources.

Recommendation 8.6 – Distinguish between a minimum set of indicators required in NAPs for reporting purposes to ensure comparability and additional optional indicators for countries interested in monitoring their performance in particular thematic areas of the ERA in further detail (Option 1 only).

Continuation of the biennial ERA Progress Reports?

Recommendation 8.7 – Under Option 1, the biennial ERA Progress Report exercise should be continued and country fiches developed. However, national authorities should be consulted before country fiches are signed off to strengthen ownership and quality assurance through fact-checking.

Recommendation 8.8 – Alternatively, under Option 2, the biennial ERA Progress Report could be continued but on a slimmed-down basis, with less focus on inter-country comparisons, and greater scope to focus on thematic areas of progress in particular editions of the Report. For example, in 2022, there could be a focus on say research infrastructures and researcher careers, in 2024, the focus could shift to open science, open access and open data.

Regarding the role of national Ministries in supporting the quality assurance and sign-off of national monitoring data, see Recommendation 10.1

It should be noted that the recommendations were adjusted to reflect the ongoing debate regarding the optimal structuring of the ERA policy framework and indicator system. Reference should be made to the options analysis presented in key issues in designing a new monitoring and indicator system (Table 3.6).

Stakeholder feedback from this study confirmed that no monitoring mechanism will be perfect and that a compromise needs to be found among the stakeholders involved. The ERAC Ad hoc

Monitoring Working Group in 2014 agreed on a monitoring mechanism that was considered to be a good starting point for following developments related to the ERA. Similarly, the revised monitoring mechanism will be a continuation of that effort so that stakeholders and interested parties can be provided with relevant insights, valuable data and actionable information. The final indicator selection will need further consultation and validation with stakeholders from a wide range of areas including EU and national stakeholders, R&I associations, academia and industry. Only with stakeholder support will the monitoring mechanism maximise the potential of the ERA and the monitoring be actioned.

The complexity of the ERA process, which aims to develop the ERA on the basis of shared priorities on a voluntary basis requires an updated monitoring mechanism in line with the new joint priorities agreed in the ERA Pact.

The role and involvement of different types of stakeholders in the new monitoring mechanism is a further aspect analysed. There is a need to ensure that where relevant, different types of R&I stakeholders at EU, national and even regional levels are able to contribute to the ERA monitoring. This could be achieved in different ways, for instance, involving the ERA Forum members (future Permanent Forum), Stakeholder Forum and the ERAC national experts in interpreting monitoring data, for instance, commenting on how much progress has been made across the four strategic objectives and 15 thematic priorities in the ERA.

The knowledge and expertise of these stakeholders could provide invaluable insights to interpret and analyse monitoring data, e.g. when flash reports are being produced on specific topics e.g. researcher careers, open science, internationalisation of research etc. Stronger links between the different levels of ERA governance and monitoring are needed to ensure that monitoring data informs policy-making and influences the ongoing process of alignment of national R&I policies/ strategic research and innovation agendas, programmes, systems and structures. For instance, if NAPs are continued, monitoring data should inform the regular review and updating of NAPs. Even if there are no NAPs, monitoring data from the Scoreboard and Dashboard will be presented both at an aggregate EU level and on a disaggregated basis, and could therefore be used to review national / regional progress against the ERA objectives and priorities in the ERA Pact. More strategically, the different governance bodies at EU level could review monitoring data and analysis produced through the Scoreboard and Dashboard and ensure that this feeds directly into evidence-based policy and decision-making in future.

Recommendation 9 – The knowledge and experience of the ERA Forum (and any eventual successor), ERAC members and Stakeholder Platform members should be leveraged as they could help to play a crucial role in the monitoring system, given links between monitoring and evaluation. These stakeholders could help to analyse and interpret monitoring data, provide contextualisation, commentary on what has been achieved in terms of progress towards the 4 strategic objectives and 15 thematic priorities.

Recommendation 9.1 - National Ministries and other national and regional R&I stakeholders should add value by helping the Commission and consultants preparing EU-level progress reports in ERA/ biennial progress reports (if continued). They could provide interpretation of the factors underlying country-specific changes in performance over time. Otherwise, there is a risk that national context-specific factors are overlooked and lead to

data being misinterpreted.

Other Scoreboards, such as the EIS and DESI, use **data visualisation and interactive data** in order to make the monitoring data more dynamic, user-friendly and exportable/ downloadable, and to ensure it is available in as close to real-time as possible. Good practices in respect of similar EU Scoreboards set up by the Commission and other international organisations e.g. the OECD, were analysed (see Annex 7). These could inform the way forward for the ERA Scoreboard.

Recommendation 10 – The ERA Scoreboard should adopt a good practice approach to data visualisation and design. For example, data could be provided in a visual format online supported by infographics, and be made downloadable in Excel and other open-source formats.

4.2.3 Follow-up to the study to finalise ERA policy framework and governance and monitoring and indicator system

Ongoing discussions at EU level on the future of the ERA will very much impact the strategic decision-making about the most suitable governance structure and the required monitoring and indicator system. The latest Council Conclusions to date highlight progress in the view of the governance structure and way forward, however a shared understanding of the specific priorities, the resulting actions and the way these will be monitored is still to be determined. Member States and Associated Countries will need to further discuss and align shared priorities beyond the high-level ones defined in the ERA Communication, the ERA Pact and the latest Council Conclusions to ensure a shared understanding of each of the core thematic areas and individual as well as joint action towards a stronger European Research Area.

Recommendation 11 – There is a need for a follow up debate on the core thematic areas to improve data collection and ensue the policy objectives, actions and monitoring are aligned and supportive of a successful ERA for the future.

Such shared understanding and defined priorities within each ERA thematic priority would also ensure alignment in new data collection efforts at national level going forward. Green and digital transitions, for example, are key areas in which new indicators will need to be developed, with the EU level relying on national efforts.

Annex 1: Supporting material on indicators

Matrix of EMM indicators

Priority	Headline indicator	Input Indicator	Output Indicator	Outcome/Impact Indicator
Priority 1: More effective national research systems	JRC Research Excellence (2013-2016)	GBARD as a percentage of GDP (Eurostat)[88]	Adjusted Research Excellence Indicator (REI) (source: JRC)	European Innovation Scoreboard Summary Innovation Index (SII) (source: EIS)
Sub-priority 2a: Optimal transnational cooperation	GBARD transnational (2014-2016)	Member States participation in public-to-public collaborations per FTE researcher in the public sector (Eurostat and ERA-Learn 2020 report on P2P)	GBARD allocated to Europe-wide transnational, as well as bilateral or multilateral, public R&D programmes per FTE researcher in the public sector (Eurostat)	International co-publications with ERA partners per 1000 researchers in the public sector (WoS and Eurostat)
Sub-priority 2b: European Strategy Forum on Research Infrastructures (ESFRI)	None	Share of developing ESFRI Projects in which a Member State or an Associated Country participates (ESFRI)	Availability of national roadmaps with identified ESFRI projects and corresponding investment needs (ESFRI)	Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner (ESFRI)
Priority 3: Open Labour Market for Researchers	EURAXESS job postings (2014-2016)	Share of doctoral candidates with a citizenship of another EU Member State	Researchers' posts advertised through the EURAXESS job portal per 1 000 researchers in the public sector (EURAXESS and Eurostat)	Share of researchers expressing satisfaction that the hiring procedures in their institution are open, transparent and merit-based (MORE2 and MORE3 Survey)
Priority 4: Gender equality and gender mainstreaming in research	Women Grade A (2014-2016)	Share of female PhD graduates (Eurostat)	Gender dimension in research content (WoS)	Share of women in grade A positions in HES (WiS—Women in Science database)
Sub-priority 5a: Knowledge circulation	Innovative firms cooperation with universities (2012-2014) Innovative firms cooperation with research institutions (2012-	Share of product and/or process innovative firms cooperating with higher education institutions or public/private research institutions (Eurostat)	Share of public research financed by the private sector (Eurostat)	Number of public–private co-publications per million population (EIS)

88 Government budget appropriations or outlays on R&D (GBARD)

	2014)			
Sub-priority 5b: Open access	None	RFOs providing funds to cover costs of OA publishing and share of RFOs' publications available in OA* Share of life sciences papers to which a country contributed and that have at least one open dataset in Figshare*	Share of publications available in open access (green and gold) (1findr and WoS)	Qualitative assessment of OA policies in NAPs and other information sources*
Priority 6: International cooperation	Non-ERA publications per 1000 researchers (2014-2016)	International co-publications with non-ERA partners per 1 000 researchers in the public sector (WoS and Eurostat)	Non-EU doctorate students as a share of all doctorate students (Eurostat)	Exports of medium and high technology products as a share of total product exports* and Knowledge-intensive services exports as percentage of total services exports* (EIS)

Source: ERA Progress Report, 2018. Note - assembled by Science-Metrix from ERAC documentation. ERA Monitoring Handbook

Data sources in the EMM for ERA Roadmap implementation 2015-2020

Data sources:	ERA Priority	Indicators
ESFRI	• Priority 2 B - research infrastructures	• Headline indicator – Availability of national roadmaps with identified ESFRI projects and corresponding investment needs • P2b – EMM indicator – Share of developing ESFRI Projects in which a Member State or an Associated Country participates • P2b – EMM indicator – Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner • P2b – EMM indicator – Share of developing ESFRI project and operational ESFRI Landmarks in which a Member State or an Associated Country is a partner
EURAXESS PORTAL	• Priority 3 - An open labour market for researchers	• Headline indicator – Number of researcher postings advertised through the EURAXESS job portal, per 1 000 FTE researchers in the public sector (2012-2016)
EUROPEAN COMMISSION, JOINT RESEARCH CENTRE, COMPETENCE CENTRE ON COMPOSITE INDICATORS AND SCOREBOARDS (JRC-COIN)	• Priority 1 - More effective national research (and innovation) systems	• P1 – Headline indicator – Adjusted Research Excellence Indicator (AREI).
EUROPEAN INNOVATION	• Priority 1 - More	• P1 – EMM indicator – European Innovation Scoreboard

SCOREBOARD (EIS) *Data is drawn from the Community Innovation Survey.* [89]	effective national research (and innovation) systems	Summary Innovation Index (SII) • P5a – EMM indicator – Number of public-private co-publications per million population • P6 – EMM indicator – Exports of medium and high technology products as a share of total product exports • P6 – EMM indicator – Knowledge-intensive services exports as % of total services exports
EUROSTAT	• All priorities	• P1 – EMM indicator – GBARD as a percentage of GDP • P2a – Headline indicator – GBARD allocated to transnational cooperation per researcher in the public sector. • P3 – EMM indicator – Share of doctoral candidates with a citizenship of another EU Member State • P4 – EMM indicator – Share of female PhD graduates • P5a – Headline indicator – Share of product and/or process innovative firms cooperating with higher education institutions or public/private research institutions • P5a –EMM indicator – Share of public research financed by the private sector • P6 – EMM indicator – Non-EU doctorate students as a share of all doctorate students
THIRD ERA-LEARN 2020 ANNUAL REPORT ON P2P PARTNERSHIPS	• Priority 2 - Optimal transnational cooperation and competition	• P2a – EMM indicator – Member States participation in Public-to-public partnerships per researcher in the public sector
MORE2, MORE3 and MORE 4 SURVEYS (once every 3 years)	• Priority 3 - An open labour market for researchers;	• P3 – EMM indicator – Share of researchers expressing satisfaction that the hiring procedures in their institution are open, transparent and merit-based.
SHE FIGURES (once every 3 years)	• Priority 4 - Gender equality and gender mainstreaming in research	• P4 – Headline indicator – Share of women in grade A positions in HES
WEB OF SCIENCETM (WOS TM). **Google scholar** **Scopus (Elsevier)** **Databases on citations –**	• Priority 2 - Optimal transnational cooperation and competition • Priority 5 - Optimal circulation, access to and transfer of scientific knowledge including via knowledge circulation, open access	• P2a – EMM indicator – International co-publications with ERA partners per 1 000 researchers in the public sector • P4 – EMM indicator – Gender dimension in research content • P5b – Headline indicator – Share of publications available in open access • P5b – EMM indicator – Share RFOs' (i.e. members of Science Europe or other important sources of national funding) publications available in OA

[89] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210115-2

bibliometrics/ scientometrics…. **Journal Impact Factor (JIF)** **Altmetrix** **No. of citations.**	and a digital ERA • Priority 6 - International cooperation	• P5b – EMM indicator – Share of life sciences papers to which a country contributed and that have at least one open dataset in Figshare • P6 – Headline indicator – International co-publications with non-ERA partners per 1 000 researchers in the public sector.
DIRECTORY AND REGISTRY OF OPEN ACCESS POLICIES (MELIBEA & ROARMAP)	• Priority 5b - Knowledge circulation, open access and a digital ERA	• P5b – EMM indicator – RFOs (i.e. members of Science Europe or other important sources of national funding) providing funds to cover costs of OA publishing as of August 2018.

Source: ERA Progress Report, 2018

SMART and RACER criteria as applied to ERA monitoring and indicators

The importance of designing the indicators in a way that is compatible with the SMART and RACER criteria is stressed in the report. In this annex, we examine key issues relating to these criteria in further detail. Reflections will need to be given as to how these important principles could be mainstreamed into the development of a new and upgraded EMM.

SMART criteria – and their relevance to the future EMM

SMART criteria – generic explanation	Questions relevant to the ERA and EMM
Specific: Is it sufficiently clear what is being measured? Has the appropriate level of disaggregation been specified?	• Does the proposed set of ERA indicators capture the essence of the desired results? • Are the proposed indicators sufficiently specific to the ERA priorities and sub-priorities?
Measurable: The indicator has the capacity to be counted, observed, analysed, tested, or challenged.	• How far does the existing set of 24 indicators in the EMM consist of measurable indicators relevant to national ERA implementation? • Are some proposed indicators only indirect measures of progress? If yes, how effective are they as suitable proxies?
Achievable and attributable: The system [monitoring and evaluation system and related indicators] identifies what changes are anticipated as a result of the intervention and whether the results are realistic. Attribution requires that changes can be directly linked to the interventions.	• Are the quantitative indicators put forwards likely to lead to meaningful outcomes without further qualitative interpretation? • Are there clear attribution effects, or do these require evaluative interpretation e.g. through case study-based and qualitative analysis?
Relevant: An indicator should be pertinent in terms of measuring the results/outcomes linked to the activities / policy interventions being supported.	• Have there been any changes to the relevance of 1) headline and 2) operational indicators since the EMM was adopted in 2015? • Are additional indicators also now relevant, e.g. due to the evolution in the ERA's priorities in the new ERA Communication?

Timely, Trackable, and Targeted: Indicators must be timely in several aspects. First, they must be timely in terms of the time spent in data collection. Second, indicators must reflect the timing of collection. The monitoring and evaluation system and related indicators should allow progress to be tracked in a cost-effective manner at the desired frequency for a set period, with the clear identification of which stakeholder group(s) will be affected.	• To what extent is the data likely to be generated through the future EMM and current indicator system up to date? • Are there likely to be any time lags in the collection of data on particular indicators? • Have any new data sources become available since the 2015 EMM was designed that may be available on a timelier basis to support the future EMM?

Based on interview feedback, there were some existing indicators that were not universally accepted, or considered to be relevant, two of the criteria. Examples in this regard were provided in Section 2.4.3 – relevance of the EMM indicators. Looking to the new indicator system, the SMART criteria will therefore need to be debated when discussing new potential indicators.

Further details regarding the relevance of the **RACER criteria** – and an explanation of how these will be taken into consideration during the study - are now provided:

RACER criteria – and their relevance to the future EMM

RACER criteria – generic explanation	Questions relevant to the ERA and EMM
Relevant Closely linked to the objectives to be reached. They should not be over-ambitious and should measure the most appropriate changes over time linked to the interventions concerned.	• Have there been any changes in the degree of relevance of 1) headline and 2) operational indicators since the EMM was adopted in 2015? • If yes, what implications do these have for the new EMM? • Does the proposed new indicator system under the future revised EMM reflect the evolution in objectives in the new ERA Communication? • Are additional indicators also now relevant, e.g. due to the evolution in the ERA's priorities?
Accepted Indicators should be accepted by stakeholders. The role and responsibilities for the indicator in terms of data collection need to be well-defined.	• How well accepted are the current set of 24 indicators under the EMM in the 2015-2020 period? • Based on stakeholder feedback obtained through the two workshops, interview programme and online surveys, are the proposed changes to the EMM and to specific indicators accepted?
Credible Credible among key stakeholders, and understandable among non-experts, unambiguous and easy to interpret. Indicators should be as simple and robust as possible.	• How far is the current set of 24 indicators under the EMM in the 2015-2020 period viewed as credible by relevant stakeholders (e.g. ERAC, MS authorities responsible for R&I and for higher education)? • How far is the proposed new set of indicators under the EMM for the 2021-2026 period viewed as credible by relevant stakeholders (e.g. ERAC, MS authorities responsible for R&I and for higher education)?
Easy Easy to monitor (e.g. data collection should be possible at low cost).	• How far were appropriate data sources available across the indicator system under the EMM? • To what extent have relevant stakeholders especially MS authorities responsible for R&I and for higher education been able to gather monitoring data across the 24 indicators? • Are any new data sources available that could support an extension to the indicator system under the EMM?
Robust Standing up to closer scrutiny by stakeholders and a	• How robust is the EMM viewed as being by relevant stakeholders (e.g. ERAC, MS authorities responsible for R&I and for higher education)?

regular review of the data generated.	• Is the quantitative data generated viewed as being robust? • Are there any indicators where qualitative contextual information and/ or evaluative interpretation is required? • Regarding the proposal for a revised EMM and new indicator system, how far do the indicator set proposed appear robust to stakeholders taking part in stakeholder consultations?

Source: Column 1 - Tool 41 of the Better Regulation toolbox - monitoring arrangements and indicators. Authors' own editing.

Some degree of consistency and comparability should be ensured in the redesign of the EMM. As the RACER criteria imply, indicators should be designed so that they can be measured to allow for comparisons of effect over time. This implies making changes and incremental improvements to the future EMM to reflect the evolution in the new ERA, rather than starting from scratch, which would undermine longitudinal continuity.

Annex 2: Review of ERA Roadmap guidance by Priority and detailed assessment of NAP implementation

This section contains a review of the ERA Roadmap by Priority and an assessment of NAP implementation at national level to support the findings in Section 2.2.

Priority 1 – Strengthening the Effectiveness of National Research Systems

High level objective/rationale: Effectively designed and efficiently-functioning national R&I systems responsive to the specific objectives of each individual Member State are central to ERA implementation and the benefit MS derive from it. This depends on the capacity to learn from experiences, and to exchange good practices at European level, backed up by knowledge accumulation within policy-making processes, and in research management at all levels.

This depends on long-term commitment from governments to invest in knowledge-intensive activities such as education, research, innovation and other intangible assets. MS that do these things are attractive places to conduct research and less likely to suffer from brain drain and other one-way flows of knowledge or money.

Suggested national actions: The Roadmap advocates **strengthening the evaluation of research and innovation (R&I) policies** and to seek complementarities between instruments at EU and national levels and the rationalisation, and this raise the overall standard of national policy intelligence tools and procedures through the European Semester process. It also suggests that Member States should promote better alignment of national and European policies through developments at national level.

Study team commentary:

Both of the above suggestions regarding national actions are helpful in that the ERA Roadmap and the development of the NAPs provided an impetus to incentivise the Member States to strengthen their evaluation activities of R&I on the one hand, and to align their R&I policies with the ERA on the other.

However, evaluation as such does not necessarily promote complementarities, unless it is supported by more detailed stipulation of the criteria to be applied and the benchmarks that allow comparison. Nor does it explain how MS should go about undertaking any national reforms of their R&I system in line with evaluation findings, or provide the means of strengthening the effectiveness of the R&I system as a whole. Whilst this is a national competence, the guidance could have been improved if a small number of good practice examples has been included, illustrating how Member States had actually implemented reforms. This could have been especially useful in widening countries, where institutional and structural reforms were often seen as being more necessary. Looking ahead, the provision of such examples could perhaps be made in the next round of ERA implementation and national action planning.

Good practice example:

Taking an example of national institutional reforms that could be used as a good practice:

In various strategic reports on the R&I situation in **Lithuania** (e.g. see for example RIO reports 2016 and 2017), it was noted the need to rationalise the university system, and also the network of nationwide research centres and institutes. A series of mergers took place between universities to help reduce over-fragmentation stemming from Soviet times, and some research institutes were amalgamated with universities, but in a way that preserved their independence. Whilst this was controversial, it was viewed as a necessary step by the national Ministries of Education, Science and Sport and of the Economy and Innovation respectively.

Source: ERA Roadmap, own analysis

Priority 2b – ESFRI research infrastructures (RIs): review of ERA Roadmap guidance

High level objective/rationale: The Roadmap highlights the importance of research infrastructures to the ERA, noting that RIs are central to research, education and innovation. The multi-billion investments made by Member States will support researchers in both academia and industry. RIs provide researchers and policy-makers with the instruments, data and information that underpin evidence-based policy-making. The Roadmap also highlights the role of ESFRI, Horizon 2020 and the ERIC legal framework[90] in supporting this priority.

Suggested national actions: The Roadmap emphasises the optimal use of public investments in RIs by setting appropriate priorities. It suggests that Member States and Associated Countries should ensure that the ESFRI roadmap is compatible with their national RI roadmaps. These should take into consideration the need for the long-term sustainability of facilities, smart specialisation, regular monitoring of feasibility, needs and costs. It adds that access to RIs for countries unable to invest large amounts must be a priority.

Additionally, at the national and European level, there should be a careful examination of the planned financial contributions in order to ensure the sustainability of new and existing projects.

Study team commentary:

The development of RIs in Europe is key to ensuring progress in the ERA, since high-quality, accessible RIs are central to research, education and innovation. In this respect, the high-level objective was appropriate since it laid out the advantages of RIs as well as the investments required, while recognising the leading role of Member States and contribution of EU-level support.

However, it is challenging to harmonise the level of RIs across the continent given the difference in levels of funding provided: the roadmap even mentions that some countries may be unable to invest in large infrastructure projects. Indeed, according to the 2018 progress report, only a third of the 28 EU Member States had identified funding needs. However, the ESFRI roadmaps have been a valuable input into the national decision-making processes and have often led to alignment between national and ESFRI roadmaps. Participation in both ESFRI projects and landmarks has grown, which is a success of ERA. However, moving forward, RIs would benefit from better exchange of information on infrastructure capacity, funding priorities, plans and strategies between all stakeholders. As such, there is scope for building on Europe's strengths in RIs rather than launching multiple new initiatives.

Source: ERA Roadmap, own analysis

Under each Priority in the Roadmap, there is a section entitled *"High-Level Objective/Rationale underlying the priority"*. In the assessment of our study team, the explanation of the objective and rationale is akin to a vision statement. The ERA Roadmap could have benefited from a **complementary heading providing a clear definition of the operational objectives.** An example in this regard is now provided from Priority 3 – an open labour market for researchers.

Priority 3 – an open labour market for researchers: review of ERA Roadmap guidance

High level objective/rationale: "The goal is a truly open and excellence-driven ERA in which highly-skilled and qualified people can move seamlessly across borders, sectors (e.g. academia and industry) and disciplines to where their talents can be best employed to advance the frontiers of knowledge and support innovation throughout Europe and beyond. In an ERA which achieves this goal, research is an attractive career option across Europe and researchers are properly equipped with flexible skills matching current and future needs".

Suggested national actions: The Roadmap refers to the importance of the Charter and the Code of Conduct for Recruitment of Researchers, embracing the principles of openness, transparency and merit-based recruitment, to the need to remove legal barriers or other hindrances to open recruitment of researchers in public sector Research Performing Institutions (RPOs) and to define new structures and approaches to researcher career development. It also encourages RPOs to participate in the Human Resources Strategy for Researchers (HRS4R) and to review their current

90 The European Research Infrastructure Consortium (ERIC) is a specific legal form that facilitates the establishment and operation of Research Infrastructures with European interest. See **https://ec.europa.eu/info/research-and-innovation/strategy/european-research-infrastructures/eric_en**

recruitment processes in a reflective and self-critical way, amending them where necessary to improve their openness and transparency as benchmarked against the Charter and Code.

Other priorities identified during the consultation process in respect of P3 were improving inter-sectoral mobility between public and private sector research bodies in both directions and at all career stages. This could be facilitated through the adoption at national level of the Innovative Doctoral Training principles, generalising the adoption of the European Framework for Research Careers and strengthening initiatives on the professional development of researchers, particularly at an early stage in their careers.

Study team commentary:

The high-level objective defined is appropriate, but could have been supported by a clearer set of operational objectives that would have made it easier for the Member States to grasp how they could translate this narrative into operational practice. Examples of operational objectives are:

Merit-based, transparent and open recruitment of researchers.

The removal of national legal and other single market barriers to researcher mobility (e.g. the eradication of barriers based on nationality, the portability of pensions and social security).

Progress towards these objectives could then have been assessed and measured more readily through indicators. However, this would depend on being able to identify suitable indicators and data sources to shed light on the extent of progress. The actions themselves appear to be appropriate and have potential to create an open labour market for researchers. However, further detail and case study or good practice examples as to how legal obstacles could be removed would have been useful.

Some of the additional areas identified above under suggested national actions arguably have even greater importance in the context of the new ERA, such as fostering inter-sectoral researcher mobility. A challenge is that as under P3, a range of EU and national level initiatives were mentioned, only selected indicators could be included in the indicator system.

Source: ERA Roadmap, own analysis

Priority 4 – Gender Equality and Gender Mainstreaming in research

High level objective/rationale: "both women and men are needed in research and research policy making if Europe is to achieve its ambitions in research and innovation. The objective is to foster scientific excellence and a breadth of research approaches by fully utilising gender diversity and equality". The specific challenges to be overcome were on the one hand persistent gender imbalances within Europe's research and innovation systems at senior levels, and on the other, the problem that the gender dimension in research content is commonly overlooked.

Suggested national actions: Among the suggested national actions to overcome these were (1) translating national equality legislation into effective action to address gender imbalances in research institutions and decision-making bodies and (2) integrating the gender dimension better into R&D policies, programmes and projects. At National level, the Roadmap suggests that Member States and Associated Countries should develop policies on gender equality in RPOs, and regularly monitor their effectiveness. RPOs should also review and enhance their policies for gender equality in research and ensure their implementation, especially in areas where women are underrepresented (e.g. senior positions and in research management) and to the funding schemes and disciplines where the imbalances are greatest.

Study team commentary:

The set of proposed actions under P4 appears to be appropriate to nationally-identified needs, as verified through the stakeholder consultations that were undertaken.

However, whilst the intention underlying the selection of some indicators to measure progress may have been well-

intentioned, not all indicators were necessarily found to be meaningful.

For instance, certain countries already performed very well in respect of gender equality in senior research positions within academia (universities and publicly funded research more broadly). However, in some of the widening countries, especially in central and eastern and in south-eastern Europe, salaries of these senior researchers are very low. Therefore, even if the percentage of women in senior research positions is high, this does not necessarily show that good progress has been made, as strong female representation in academic research positions in some countries has been a longstanding norm, even if these positions are not that well paid.

Source: ERA Roadmap, own analysis

Priority 5a – Optimal Circulation and Transfer of Scientific Knowledge

High level objective/rationale: "Removing the legal, political and technical barriers to the wider circulation and greater use of knowledge will lead to increased growth and competitiveness for Europe, with benefits for scientists, research institutions, citizens and businesses of all sizes." The practical focus of this priority should be on fully implementing knowledge transfer policies at national level in order to maximize the exploitation of scientific results.

Suggested national actions: The Roadmap proposes that Member States could help to remove the legal, political and technical barriers to the wider circulation and greater use of knowledge by a series of steps. These include establishing policies and procedures for the better management of Intellectual Property, by further professionalising Intellectual Property management and the negotiation of collaborative and contract research at HEIs and other PROs, increasing the creation of start-ups and private sector / public sector mobility, for example, by training students in entrepreneurship and corporate culture, and strengthening collaborative research between public and private research performers.

While each of these suggestions have merit at a certain level, the EU has already assembled a substantial body of analysis and identification of best practice across the Member States, which could have been used to provide more concrete orientation, whilst still respecting the rights of Member States to determine their own course of action.

The Roadmap highlights the relevance of knowledge transfer policies at national level with the aim of "maximizing dissemination, uptake and exploitation of scientific results". It emphasizes the role of Research Performing Organisations (RPOs) and Research Funding Organisation (RFOs) in making knowledge transfer part of their daily activities, with a special focus on Intellectual Property management. In that sense, Member States and Associated Countries are encouraged to promote effective knowledge transfer mechanisms in their RPOs, develop indicators to measure the economic and social impact of knowledge transfer policies and promote networking and sharing of good practices between RPOs and the private sector. Further guidance relates to inter-sectoral mobility with the industry and collaborative research between public and private research performers as well as to increase the creation of start-ups.

Study team commentary:

At a high-level, the objective to promote optimal knowledge circulation and the transfer of scientific knowledge seems appropriate, and so does linking it to intellectual property management as main legal barrier and to the role of PROs, RFOs and the collaboration with the private sector overall. Also in this case, including a more specific set of best practice examples at national level could serve as inspiration as of what these actions could look like in practice and allow for knowledge exchange across countries. The reference to other priorities of the ERA roadmap, including P1 (national R&I systems), P3 (mobility of researchers) and P6 (International Cooperation) highlights the interconnection across priorities yet at the same time renders the proposed actions less impactful as standalone actions and might create some confusions as to P5a already being addressed through other measures.

Beyond the intersectoral mobility with the private sector as means of transferring knowledge form a human resources perspective, for example, measures could additionally focus on how to commercially transfer research results to the

market. This would allow to go beyond a more static view of the public-private dichotomy and look at the circulation of knowledge across the entire value chain, something which is not currently included in the ERA roadmap. Examples of how to overcome political and technical barriers and incentives of how to do so would be very welcome by ERA countries. The evolving nature of both knowledge transfer (P5a) and also open access (P5b) is likely to only reinforce the relevance of related national measures in the revised ERA priorities and the years to come.

Source: ERA Roadmap, own analysis

Priority 6 – International cooperation

High level objective/rationale: Effective international cooperation with third countries is necessary, both at national and EU levels, in order to address grand societal challenges, ease access to new emerging markets and increase the attractiveness of the ERA for talented minds and investors worldwide. The aim is to ensure that Europe as a whole, as well as the individual Member States and Associated Countries, is able to take maximum advantage of the best research and innovation opportunities on a global basis. Building on the diverse bilateral and multilateral relations with third countries, ERA needs a common and coherent strategic international focus in order to assert Europe's leading position in R&I in a changing world.

Suggested national actions: Develop and implement appropriate joint strategic approaches and actions for international STI cooperation on the basis of Member States' national priorities. This should make the engagement of Europe and of the individual Member States/Associated Countries with third country partners more coherent, effective and sustainable. At national level, EU MS and ACs should define national strategies for internationalisation to foster stronger cooperation with key third countries. These should reinforce multilateral STI cooperation approaches in order to build critical mass and maximise impact, for example in tackling grand societal challenges.

Study team commentary:

The proposed action of defining national strategies for the internationalisation of research and innovation was appropriate to identified needs at the time. Likewise, the focus on supporting the MS in developing relationships internationally with other EU countries in the R&I fields in order to access global talents and to maximise contributions to societal challenges was also relevant.

However, as with many of the ERA priorities, there have been changes over time in terms of the ongoing relevance of particular priorities and the extent to which priorities are given to particular aspects. For instance, attracting global talents has arguably grown in importance, whereas establishing the internationalisation of research and innovation between particular EU MS and third countries remains important, but there are complex issues in some areas. For instance, whereas fostering bilateral cooperation in R&I with China was a major priority for many EU MS, there are concerns about how extensively reciprocity extends in terms of open science, open access and open data, such that this has raised questions about how international cooperation should be pursued at national level.

Looking ahead, the role of international cooperation in R&I and between key research actors in the EU and third countries remains important to addressing societal challenges. Again, this issue has grown in importance since the UN's Sustainable Development Goals (SDGs) have become more prominent.

Source: ERA Roadmap, own analysis

Detailed review of NAPs within study scope

A more detailed review of the structure and content of the NAPs in the countries within scope is now provided in alphabetical order. This takes into account the diversity of national R&I systems to provide context and additional information to the observations made.

Czech Republic

The National ERA Roadmap of the Czech Republic for the years 2016-2020 provides an overview of the current status of the national R&I ecosystem, and sets out some key goals and top action priorities based on the guidance provided in the ERA Roadmap. It can be seen from the actions highlighted that the Czech Republic, a moderate innovator, is seeking to transition to the status of a strong innovator. Much of the emphasis for the priorities is on providing the necessary funding and developing adequate action plans and methodologies. For example, under Priority 1, two of the actions are the implementation of new methodologies to evaluate research organisations and their institutional funding, and evaluate the benefits of membership in international R&D organisations. Under Priority 3, one of the actions is to ensure public funding of EURAXESS activities, while ensuring public funding of the National Contact Centre for Gender and Science is under priority 4. The roadmap makes it clear that it should be seen as a living document to be developed over time according to the needs of the European and domestic R&I environment, new challenges and new policy areas.

Denmark

The implementation of the Danish roadmap has largely followed the process envisaged at EU level, and moreover it has been completed very effectively. The Danish NAP is closely aligned with the EU's Roadmap, the objectives of which fit well with the Government's ambition to make Danish research among the best in the world within selected areas where the Danish private sector and research communities have particular specialisms and strengths. These are closely associated with societal challenges and lie in fields such as health, energy, climate, environment and food. For each priority, the roadmap sets out the Danish position in relation to the EU's headline indicator and defines a number of objectives and measures (44 in total). The NAP includes specific timeframes or target dates, and in some cases tangible indicators for the expected outcome of the measure. Responsibility for implementing and monitoring the NAP was attributed to the Agency for Science and Higher Education, which has close working relations with all actors within the Danish research community. Based on a feedback mechanism assessing the progress of all involved R&I actors, the Agency developed annual status reports. By September 2018, 24 of the 44 planned measures had already been completed and the remaining measures were mostly progressing faster than planned. Many of these required continuous, ongoing action, such as annual reporting or continued monitoring. By April 2020, all but one of the roadmap's initiatives had been completed. The last action, relating to the Ministry's participation in the EURAXESS Steering Group meetings, continued throughout 2020.

France

The French NAP addresses all the ERA Priorities, but it ranks them according to their respective priority on the policy agenda (namely in this order: Priority 1, 5b, 5a, 6, 2, 3, 4). It proposes an ambitious integrated reflexion on how strategic orientation and concrete policies and initiatives fit into the ERA framework. It does not contain indicators, baselines or targets, but it identifies next steps for each priority, under the form of possible measures and actions. It can be seen as an instrument to illustrate the alignment of French measures with the ERA roadmap, and to sustain the overall contribution of the French reflexion and practice to the EU agenda.

However, the question as to how much of the ERA is new, as opposed to helped to reinforce existing efforts to align French and European R&I policies and priorities can be raised. In 2013, for instance, the Strategic Research Council (CSR), which brings together very high-level French and international scientists and experts defined the key orientations for the strategic agenda, " France-

Europe 2020". The priorities set out in this agenda are closely linked to the ERA and to Horizon 2020. These directly impact the majority of the priorities of the ERA, but were drawn up in 2013.

Germany

The Strategy of the Federal Government on the European Research Area (ERA), Germany's very ambitious NAP, acknowledges the country's economic prowess and status as a driver of internationally-renowned R & I, thriving on excellence. It attributes Germany's status to the high political significance given to research and innovation. In particular, the government is actively promoting the integration of national, bilateral and European research and innovation and the greater involvement of national stakeholders in European programmes – the NAP recognises the importance of Horizon 2020 as a key aspect of the ERA.

The NAP looks at the priorities individually and proposes content, objectives and concrete measures for each one. For example, among the measures proposed for priority 2(B) are: active participation in the further development and updating of the ESFRI Roadmap; further development of ESFRI; strengthening participation in the funding priority "European Research Infrastructures" in Horizon 2020; continuation of the BMBF Roadmap process for research infrastructures; strengthening the connection of universities to research infrastructures; and continuation of the strong commitment of German science to the planning, construction and operation of and participation in research infrastructures.

The extensive nature of the measures serves as an example as to how advanced Germany is in R&I. Additionally, as an innovation leader, Germany sees itself as a pioneer in fostering the international dimension of the ERA. The NAP highlights that Germany has made great strides in international cooperation and sets out further measures, covering the Strategic Forum for International Cooperation in Science and Technology (SFIC), multilateral cooperation and third country cooperation with Member States. The Federal Government also published its Report on International Cooperation in Education, Science and Research, further demonstrating its dedication of resources to foster international collaboration and supporting its position as an innovation leader.

The NAP stresses that the measures proposed are not to be considered a final list and merely demonstrate how Germany will contribute to the development of the ERA, strengthening Europe's scientific performance and expanding its innovative capacity to meet the objectives of the Europe 2020 Strategy.

Greece

The preparation of the NAP was seen as an opportunity to align the Greek R&I system with European objectives and the national strategy for research and innovation and define its future direction, in particular with regards to open access issues. Therefore, the NAP describes the guiding policies at European and national level for each ERA priority and defines how to attain them.

Detailed lists of measures are presented in each ERA priority, but, with the exception of a general reference to milestones to be set for 2020 and 2025, there is no other specific timeframe. A key tool for the implementation of the NAP is the national Research and Innovation Strategy for Smart Specialization 2014-2020 (RIS3), which was formed after taking into account the principles and guidelines of the ERA and the thematic priorities of Horizon 2020. The willingness to follow the ERA recommendations is stated explicitly, but attention is drawn to the fact that reduced means and

resources may hinder implementation of actions related to the development of co-funding schemes.

Ireland

Ireland's European Research Area Roadmap sets out how engagement with the ERA will be deepened, setting out commitments to progressing the ERA priorities in terms of actions, actors, timelines, targets and indicators. The NAP places a strong focus on innovation and on implementing the NAP in parallel with "Innovation 2020", a new strategy for research and development, science and technology. The overall vision of Innovation 2020 is that Ireland, then classified in the Innovation Union Scoreboard as an innovation follower, will transition to becoming a Global Innovation Leader, driving a strong sustainable economy and a better society.

The NAP provides a large number of very specific objectives to be completed by 2020. By mid-2018, Ireland had implemented a number of initiatives that directly contributed to the realisation of its NAP, thereby demonstrating substantial progress in all six ERA priorities. Ireland's performance almost always fell just above or just below the ERA average.

Italy

The Italian NAP is ambitious and sets clear objectives for each priority area of the ERA. It includes specific timeframes by which the measures should be completed and, in most cases, includes quantitative indicators for the expected outcome of the measures. The drafting of the NAP was closely aligned to the ERA Roadmap, which is reflected in different parts of the document. Additionally, Italy has played an important role in shaping the ERA framework. As such, the ERA Roadmap itself reflects the research priorities of Italy. However, the involvement of national stakeholders was limited and there is little awareness of the ERA in Italy. That said, the ERA and other EU policies and initiatives are considered politically valid and of higher quality than national ones, and receive strong political support.

Implementation of the measures has been partially achieved. The medium progress made was confirmed by interviewees, who said it was a result of strong advancements in areas of traditional strengths and slower progress in relatively weaker areas. Structural weaknesses and budget cuts have impacted progress.

Lithuania

Lithuania's NAP is set out in the form of a table. Unlike other NAPs, it does not contain any context or background on Lithuania's baseline situation in respect of R&I or its potential contribution to the ERA. The plan contains measures and actions alongside evaluation criteria. However, Priority 4 does not contain any evaluation criteria, while the action "to promote structural changes to ensure equal opportunities for women and men" is left open-ended and subject to interpretation.

No information is provided or objectives set under Priority 6. However, more detail is provided under other priorities, such as Priority 3. One of the actions is to attract foreign scientists and other researchers to research and higher education institutions, while another action proposes to encourage the employment of researchers in science-intensive enterprises. The NAP intends to evaluate the success of Priority 3 by the number of researchers working in the private sector.

Feedback from the lead Ministry responsible (the Ministry of Education, Science and Sport) was that the reason only a table was prepared was that it was insufficiently clear what kind of NAP should be developed in terms of its structure and content. A model template would have been appreciated.

However, there were further challenges in developing the NAP. For instance, the national strategic planning system on R&I had not foreseen that a NAP would need to be developed, and had been prepared without adequate consideration being given to aligning national with the ERA priorities.

More positively, it was mentioned by several civil servants at the Ministry that in future, the revitalised ERA will be given much greater priority as there has been a change in government. The new government recognises the imperative of closer alignment of national and EU R&I policies. Moreover, it is now clearer what is expected in the NAPs based on some good practice examples from other countries (Austria was mentioned).

Montenegro

The National Roadmap on the European Research Area (ERA) 2016 sets out the current status of R&I in Montenegro and how it intends to contribute to the implementation of the ERA priorities. For each priority, the roadmap provides the status, goals, actions and a time schedule. An EU associate country, Montenegro's priority actions are the strengthening of national R&I capacities, integration of the research community into the ERA and increased participation in international R&I programmes. As such, Montenegro is seeking to develop its R&I sector rather than grow an already developed sector. For example, under Priority 2.1, Montenegro intends to increase its participation in H2020 and develop new legislation on R&I in line with EU strategies. Additionally, under Priority 3, the actions include establishing a workgroup for HR in research and obtaining EU assistance in policy planning, further demonstrating how countries with different R&I systems interpret the priorities and set goals and actions accordingly. Montenegro has ambitions of joining the EU and accordingly has a roadmap which can aid its accession.

Subsequently, Montenegro prepared a Revised Roadmap for Research Infrastructure of Montenegro (2019-2020), which sets out its updated commitments in respect of RIs.

Netherlands

The Netherlands published its ERA NAP in May 2016. This was structured according to the six ERA priorities and sub-priorities. The NAP includes a short description of the NL R&I system and its performance on each of the priority areas. The ERA measures stem from ongoing national policy strategies and decisions such as the 2025 Vision for Science (December 2014) and the Top Sector Policies from the Annual Enterprise Policy Progress Reports. The interviews confirmed that the ERA measures as reported in the 2016 NAP were all ongoing policies that preceded the ERA 2015-2020 Roadmap. Only a few of the measures were inspired by the ERA process, such as the national contribution to ESFRI and additional efforts to increase gender equality.

Nonetheless, national policies were already structurally well-aligned with ERA priorities, as prior to the ERA Roadmap, these were defined in 2012. For example, the Science Policy Strategy 2025 Vision for Science (2014) has quite a number of objectives that are aligned with the ERA roadmap such as:

- Challenging scientists to pursue a broad career (including intersectoral mobility between private sector and academia) and more PhDs in private sector and government;
- Attracting international talent;
- Promoting equal opportunity for female scientists;

- Give scientists more space (less bureaucracy, grant applications and publication pressure);
- Supporting international collaboration;
- Upgrading research infrastructures, in particular digital infrastructures for research; and
- Open Access of government funded science (60% by 2018 and 100% by 2024).

Norway

The National ERA Roadmap, 2016-2020 presents Norway's contribution to strengthening the ERA, noting its position as one of the pioneers of the ERA. Each priority sets out the top action priority, indicators, including its own, and the current performance, along with timeframes. For example, the roadmap notes that the share of national GBARD allocated to transnational public research and development programmes in Norway was 3.24% in 2011, while 26% of professors were women in 2014. The roadmap underlines the importance of international cooperation in R&I with countries outside of Europe. Under priority 6, Norway has selected eight priority countries to collaborate with outside of the EU and has a roadmap for cooperation with each one, demonstrating how advanced its international standing in R&I is. Indeed, international scientific co-publications constituted 62% of all Norwegian articles in 2014.

Norway acknowledges its relatively good performance but also points out that it can improve and have even higher ambitions. Indeed, the roadmap stresses that the goals and actions laid out are tailored to augment performance and mentions that the roadmap will be closely monitored and revised according to updates of the European roadmap.

Poland

There is no NAP in Poland. The six priorities corresponded with some national plans to develop R&I, for example through the 2018 Act on Higher Education and Science. Poland has made substantial progress and adopted a number of important reforms and initiatives in most of the ERA priorities, though there is no mention of the ERA in high-level policy documents. As such, it is difficult to attribute any progress to ERA.

The ERA process lacks visibility and the R&I community is generally not aware of it, while there is no national-level debate or discussion about ERA. There is an absence of leadership in driving the ERA process, which will be required to ensure the revitalised ERA priorities are implemented. A further issue was the question of the extent of involvement of R&I stakeholders in anything related to the NAP. Feedback was that there was one key Ministry official who was aware of what was going on in terms of the ERA since the beginning and had been following the process at EU level, but not other civil servants, which limited the scope for other stakeholders to engage in dialogue on ERA.

Portugal

The Portuguese NAP (in English) presents an overview in bullet point format of ongoing measures and measured to be developed. Structured by ERA priority, these measures are very high level and phrased as a broader declaration of intentions rather than specific actions. Priority 1, for example, lists "Stimulating public & private R&D investment" without additional detail about how and to what extent this will be carried out. Priority 5a mentions "Public Procurement of Innovation as a driver of innovation in SMEs", already in the phrasing as broad objective suggesting limited assessment around actual implementation.

In contrast to that, the NAP includes a list of monitoring indicators that goes beyond those of the EMM, expanding with additional ones for example for Priority 4 on Gender equality and Priority 2b, even including the source on which it would be retrieving these from. This reflects thought around monitoring of the otherwise vaguely phrased measures, possibly aiming at monitoring performance of the Portuguese R&I system beyond the ERA overall.

Romania

The Romanian ERA Roadmap is aligned with the National Strategy for RD&I (2014-2020) in terms of its objectives and measures. The aim of the national strategy is to develop an internationally-facing R&I system and this is reflected in the ERA roadmap.

There is a clear commitment to progressing the ERA as demonstrated by the inclusion of indicators to facilitate monitoring and referral to future ERA progress reports and the EMM. For example, Priority 1 proposes four objectives and six indicators to ensure there is a plan to make significant progress, while these are accompanied by concrete measures. The actions proposed aim to have the most relevant impact on the R&I system and provide benefits to many stakeholders.

Slovenia

The Slovenian ERA Roadmap lays out the country's vision of the ERA as it pursues its ambition of joining the group of countries considered innovation leaders by 2030, and is based on four national strategic documents. Each priority contains objectives, measures and indicators. Indeed, the roadmap stresses that there are 34 objectives with 43 measures reflected in 18 indicators, to ensure Slovenia's strategy not only exists on paper. Moreover, the roadmap highlights the country's recent performance on the indicators, e.g. 91 posts were advertised through the EURAXESS jobs portal in 2015, while the national GBARD allocated to transnational public research, development and innovation programmes was 2.23% in 2012.

Spain

Spain did not produce a standalone NAP and rather considered its State Plan of Scientific and Technical Research and Innovation 2017-2020 as such. This is the main instrument of the Spanish Strategy on Science and Technology 2013-2020, which aimed to broadly "contribute to the objectives established in the «Europe 2020» strategy, the «Innovation Union», the «European Research Area» and the framework programme «Horizon 2020», albeit taking into account the specific requirements of the Spanish Science, Technology and Innovation System"[91] as well as an effort to "align Spanish policies with the RDI objectives pursued by the European Union".

The four objectives of the State Plan are in line yet do not correspond to the six ERA priorities in full. For example, promotion of talent and employability in R&I is very much in line with the ERA priority 3 and so is the promotion of RDI activities aimed at addressing global societal challenges which mirrors ERA Priority 2a even in wording. However, other Spanish objectives such as promotion of business leadership on R&I whilst related diverge from the established ERA priorities.

Sweden

91https://www.ciencia.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_Strategy_Science_Technology.pdf

Sweden did not produce a NAP in 2016. ERA priorities were instead covered through the Research Bill (2016) and later through an ERA Roadmap (2019). No NAP was produced. ERA priorities were instead covered through the Research Bill (2016) and later through the development of an ERA Roadmap (2019), which was much later than in other EU MS. The Swedish Roadmap contained a long list of concrete measures; however, no indicators were included. Some measures however would be subject to their own evaluation (e.g. long-term research programmes established by a number of research funding agencies). Many of the measures were government directions to the research agencies which are also obliged to report back on progress.

The 2016 Research Bill and national measures are well-aligned overall to the ERA priorities, but attribution between the two is rather weak although stakeholders confirm the importance of ERA policies in the Swedish system. The ERA Priorities are not explicitly referred to in the document. The implementation of the ERA roadmap has not followed the timelines of the process envisaged at an EU level, since the Swedish measures have been focused instead on the implementation of the 2016 Research Bill. As a result, much of the ERA implementation process has taken place through the coordination of working groups under the steering of EU-SAM and the government. EU-SAM is considered to be an effective way of managing the ERA process and stakeholders confirm the importance of ERA policies in Sweden.

Switzerland

The Swiss National ERA Roadmap is structured around the six priorities and includes, for each of these, an overview of the current situation, ongoing measures as well as planned measures. A short conclusion for each priority ties ongoing and planned measures together, reinforcing the well-developed status of the R&I system. As indicated in the NAP, the country's ambition is to mainly strengthen its leading R&I position, which is reflected in the NAP mainly including overall objectives rather than very specific measures, e.g. for Priority 2a: "Switzerland tries to expand and promote the participation in such RDI activities. Therefore, the focus lays on the expansion of existing measures". More detailed measures centre around those areas for development, such as Priority 4 on Gender. Here, specific programmes to be launched include the "Promote women in academia" (PRIMA) and the extension of the support grant for postdocs with family to doctoral students.

In terms of monitoring, the NAP includes a specific section at the end outlining the ERAC indicators by priority as chose to be used also at national level, before concluding with a final outlook section reinforcing its commitment to the ERA goals.

Annex 3: Best practices identified at national level

Overview of best practices by priority

Priority	Country	Best practice example
Priority 1: More effective national research systems	• Switzerland	• **The complementarity of EU and Swiss research funding schemes,** the former organized top-down, the latter mainly bottom-up in terms of topic definition that allows researchers to come up with their own topics of interest and innovative ideas. At the same time, the balance between institutional Swiss funding and the competitive based EU which further offers a pan-European environment creates a complementary, powerful dynamic.
	• Lithuania	• **Institutional reform of aspects of the R&I system.** Institutional reforms in the university system and among applied research institutes, including the merger of some institutions to overcome over-fragmentation and to rationalise the structuring of these important R&I actors.
	• Greece	• **Development of a RIS-based National Strategy for RTDI.** The Greek national strategy for R&D was developed in full alignment with RIS3, taking advantage of advice from international reviewers / specialists in Smart Specialization Strategy, as well as inputs by targeted consultations with key stakeholders of the Greek R&I community through the operation of thematic technology platforms. The RIS served as a basis for launching during the period covered by the current NAP the RESEARCH-CREATE-INNOVATE programme, an important public procurement for R&I actions that was clearly linked to current socio-economic needs at national and regional level.
Sub-priority 2a: Optimal transnational cooperation	• Switzerland	• **Mutual recognition of evaluations** is achieved through the DACH framework with Germany and Austria. According to the multilateral agreement, submission and evaluation of projects takes place in one of the three countries, while funding is on a national basis.
Sub-priority 2b: European Strategy Forum on Research Infrastructures (ESFRI)	• EU-level example	• A **3-year H2020 "Coordination and Support Action" project**[92] ***"Support to Reinforce the European Strategy Forum on Research Infrastructures"*** to provide support to reinforce the European Strategy Forum on Research Infrastructures (ESFRI) under the guidance of its Chair, by providing additional resources, tools and expertise for performing its activities and supporting its structures. • The main objectives of the project were to provide support to the ESFRI Chair in ESFRI-related activities, to support the implementation of ESFRI activities, including the development and publishing of the ESFRI Roadmap, to support the effective review and monitoring of research infrastructures on the ESFRI Roadmap through appropriate analytical tools, to support the ESFRI communication, dissemination and engagement strategy, to foster cooperation between ESFRI and e-Infrastructures in the area of data management, and to foster cooperation, exchange of experiences and good practices between research infrastructures, their managers and stakeholders."
Priority 3: Open Labour Market for Researchers	• Netherlands	• **Career development of researcher**s. A major reform of researchers' career development appraisal and scoring system was undertaken at national level. This was partly driven by a desire to move away from conventional metrics such as Journal Impact Factor, publications and citations towards rewarding open science, open peer review practices. *See Universities Study for detail.*

92 https://cordis.europa.eu/project/id/823711

Priority	Country	Best practice example
	• Ireland	• **Researcher Careers.** The **IUA Researcher Career Development and Employment Framework**[93] was published in 2021, as a result of the work done by the Irish Universities Association (IUA) in collaboration with government departments and research funders (Higher Education Research Group). This framework introduces a structured progression for researchers in academia, clear pathways to exiting academic employment, and consistent levels of learning, training and development opportunities and careers advisory services across the higher education sector.
Priority 4: Gender equality and gender mainstreaming in research	• Germany	• To support **gender equality in research**, the Federal Government has set a binding target quota of 30% for the proportion of women on scientific executive committees and committed to its "More Women at the Top" programme.
	• Ireland	• A new gender-targeted **Senior Academic Leadership Initiative (SALI)** was introduced to compliment the wider organisational and cultural initiatives being implemented. This means that there are protected senior posts for women, which had caused some controversy but is functioning well.
Sub-priority 5a: Knowledge circulation	• No examples yet identified	• No examples identified
Sub-priority 5b: Open access	• France	• Different initiatives in the field of Open Science (Loi Lemaire) culminating with a National Plan for Open Science in 2018
	• Netherlands	• In response to the strong support for Open Science / Open Access in the Netherlands, reinforced by the aim of the research funder NWO towards 100% Open Access for all publicly funded research projects, the Association of Dutch Universities (VSNU) developed a **publicly available monitor for Open Access**. This database is compiled based on the willingness of all universities to provide the data. In July 2021 the Monitor has compiled all peer reviewed articles from 2017 from the 14 Dutch universities and shows that 50% of these articles are available in open access. The same monitor can also distinguish Open Access by scientific domains (Sectors).
Priority 6: International cooperation	• Switzerland	• **Breakthrough international cooperation initiatives**, facilitating transnational research collaboration and strengthening the effectiveness of the Swiss national research system. For example, SNSF, the main research-funding organisation, finances short international visits and concrete joint research projects with a large number of countries. The "Money Follows Researcher" and "Money follow Cooperation Line" principles aim to reduce barriers for cross-border collaboration across Europe and allow for researchers to respectively finish their already granted projects abroad or to conduct small parts of it in certain countries, whilst continuing to report to the original funding agency. There are parallels in the approach with the MSCA and ERC grants, where funding also follows researchers in that these are portable.
	• Norway	• Norway wishes to **strengthen cooperation with priority countries outside Europe** through Horizon 2020 and ERA, as per the government's strategy for cooperation with the EU on R&I. Norway also has roadmaps for cooperation with Brazil, Canada, China, India, Japan, Russia, South Africa and the US. Additionally, the government has the Panorama strategy, facilitating cooperation with Brazil, China, India, Japan, Russia and South Africa in higher education and research.

Overview of best practices regarding the ERA Roadmap process overall

93 https://www.iua.ie/wp-content/uploads/2020/12/35916-IUA-Researcher-Career-Development-and-Employment-Framework_v6.pdf

Dimension	Country	Best practice example
NAP and NAP development	• Germany	• Germany's roadmap intends to **strengthen national, bilateral and European R&I policy** to achieve all priorities and further develop the ERA. The measures proposed in the roadmap consistently consider how the overarching goal of ERA can be achieved to strengthen Europe's capacity and compete with international competitors.
	• Sweden	• A somewhat controversial example of a good practice was the fact that the **NAP was replaced by the Swedish Research Bill**, a more influential document among RTDI stakeholders. This provides an interesting example as to how EU policies can be incorporated into national policy cycles.
ERA Roadmap/ NAP implementation at national level	• Sweden	• **The EU SAM coordination group**, which provided input to the ERA process during its finalisation at EU level and which has coordinated the activities in cooperation with extended stakeholders during the 2016-2020 period.
	• Norway	• **Coordination between national and EU programmes**. National strategic documents are well aligned with EU-level activities and the Research Council of Norway (RCN) analyses all national programmes to determine how they complement Horizon 2020. Norway is also involved in EU-level groups to ensure coordination.
	• Portugal	• **Use of additional indicators beyond the EMM ones.** The Portuguese NAP, beyond being structured by ERA priority and well aligned with the EU R&I priorities overall, includes a well-developed set of indicators for monitoring purposes. Expanding on those included in the EMM, it adds further ones available through national or EU level statistics in order to strengthen the monitoring of progress, thereby providing a more comprehensive picture.
ERA Roadmap and MS/AC involvement at EU level	• Slovenia	• The **opportunity taken by Slovenia to shape EU R&I policy at a strategic level** through the active involvement in many of the key developments in the Union in the last decade (Ljubljana Process, JTIs, Spreading Excellence and Widening Participation). Although indirectly related to the ERA, this involvement has contributed to giving Slovenia a good political reputation in RTDI at the EU level.
	• Slovenia	• A **coordination group was set up at national coordinated by a Ministry** that involved several other Ministries. The group brought together different national members of ERAC across the 6 priorities at national level who previously did not cooperate. This in turn strengthened the visibility of ERA at national level.

Annex 4: Thematic case studies

This annex contains four thematic case studies on:

- Research Infrastructures;
- Gender Analysis and Gender Mainstreaming (P4) ;
- Monitoring Open Access publications (a good practice example from the Netherlands); and
- The integration of former ERA Priorities into new ERA objectives.

Case study 1 – Research Infrastructures

Case study on suitable indicators to assess progress towards objectives in field of European research infrastructures

Current thematic priority: Priority 2b (Make optimal use of public investments in research infrastructures)

Short description of objectives and activities supported: P2b was an unusual priority in that it was primarily focused on implementing the mandate of the European Strategy Forum on Research Infrastructures (ESFRI). However, the Member States were also closely involved insofar as many have part-funded, and taken part in, specific pan-European RI projects.

The objectives of ESFRI are to: (1) facilitate multilateral initiatives leading to a better use and development of research infrastructures (RIs) acting as an incubator for pan-European and global research infrastructures; (2) to establish a European Roadmap for research infrastructures (new and major upgrades, pan-European interest) for the coming 10-20 years, stimulate the implementation of these facilities, and (3) update the Roadmap as the need arises (4) to ensure the follow-up of implementation of already on-going ESFRI projects after a comprehensive assessment, as well as the prioritisation of the infrastructure projects listed in the ESFRI Roadmap and (5) to implement the ERA Priority 2b: Research infrastructures.

The Roadmap combines ESFRI Projects, which are new Research Infrastructures under progress towards implementation, and ESFRI Landmarks, successfully implemented Research Infrastructures. ESFRI has already helped to coordination the development of landmark Research Infrastructures (RIs) covering all scientific domains, with over 50 European Research Infrastructures mobilising close to € 20 billion worth of common investments.

Indicators used in 2015-2020 and rationale for their selection:

Priority	Input Indicator	Output Indicator	Outcome/Impact Indicator
• Sub-priority 2b: European Strategy Forum on Research Infrastructures (ESFRI)	• Share of developing ESFRI Projects in which a Member State (MS) or an Associated Country (AC) participates	• Availability of national roadmaps with identified ESFRI projects and corresponding investment needs	• Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner

Input indicator was selected because the share of developing ESFRI Projects in which an EU MS or an AC participates is a barometer for how extensively they are participating in state-of-the-art RI projects.

Output indicator was selected because there was an imperative in developing national roadmaps which identified ESFRI projects. Moreover, a lot of the content from the national roadmaps could be integrated into the ERA NAPs for P2b national level actions / measures.

Outcome/impact indicator was selected as a measure of how extensively a particular EU MS or an AC has been participating in pan-European RIs. Indirectly, also a measure of access to excellence.

No headline indicator was selected. It was not possible to measure the level of investments by individual ERA participant countries in pan-European RIs as the data wasn't comparable.

Evolution in Priority 2b over time: Interview feedback found that the priorities associated with ESFRI have progressively evolved. A vision was set out for a more impactful ecosystem of research infrastructures in Europe in the ESFRI White Paper. [94] Through the White Paper, ESFRI aims to optimise the organisation of the Research Infrastructure ecosystem, in particular by:

facilitating **cross-disciplinary research** and the **exploitation of data interoperability** to produce new science to tackle **new societal challenges** and contribute to the Sustainable Development Goals (SDGs),

- creating more efficient synergies and direction between European and national sources of funding.
- enabling the stronger integration of Research Infrastructures into their host societies.
- continually **modernising their services** in support of European priorities, and
- strengthening **European leadership** in global endeavours.

The White Paper also recommends the implementation of the performance monitoring framework for research infrastructures in the ESFRI Roadmap. An example of a difference between the situation when the ERA Roadmap was adopted and today is the emphasis on maximising the utility and added value of pan-European RIs to the services of society, and on opening up access to leading-edge RIs, including through open access to data, and wider access to broader sets of researchers, including through the role of e-infrastructures.

In 2019, the Monitoring Working Group within ESFRI produced a report which considered **how to strengthen monitoring of research infrastructures' performance.** [95] This acknowledged the fact that pan-European RIs and the work of ESFRI has not remained static, but has evolved over time, as the focus has transitioned from the identification and mapping of suitable RIs through to their funding and infrastructure development, and subsequently to optimising their usage, ensuring open access and open data practices, and harnessing them to the benefit of society. Examples of some of the new areas that the monitoring report highlighted are ***enabling scientific excellence, delivery of education and training, enhancing transnational collaboration in Europe, facilitating economic activities, outreach to the public, optimising data use, provision of scientific advice, facilitating international cooperation*** **and** ***optimising management*** This shows the diversity of areas in which pan-European RIs are expected to contribute towards the ERA.

Interview feedback on implementation of P2b. Feedback in respect of P2b was that the Priority has evolved considerably over time. The European RI landscape has become more mature and comprehensive. As there are already more than 37 landmark ESFRI projects (over 50 in total) which can be considered success stories, there is a need to be more strategic about identifying gaps in research infrastructures. In future, more of a top-down approach will be needed in identifying strategic gaps, as in the past, the identification of RIs was somewhat bottom-up and there were more gaps. This will also depend on more active monitoring of the implementation of existing RIs to facilitate gap identification.

There have been differing degrees of success in ESFRI landmark projects. An interesting issue raised was that some initiatives that were considered to be highly successful 3-4 years ago, may not be considered as such now. This raises the issue as to whether the criteria used to monitor and judge the success of ESFRI projects can be made sufficiently neutral that they could be useful for monitoring purposes.

The continuing importance of the national roadmaps on RIs as a key instrument for ESFRI implementation was also emphasised. It was also noted that a lot has happened in the last 6-7 years, in terms of the alignment of procedures, the growing synchronisation between different national roadmaps, and the common setting of priorities and funding at national level and EU level.

Alignment between P2b and the new ERA Communication and priorities. ESFRI will continue to remain important in the new ERA. Activities under the former Priority 2b will in the new ERA contribute to:

- New P1 (prioritising investments and reforms) e.g. by encouraging major joint-EU Member State investments in globally-leading landmark RIs.
- New P2 (improving access to excellence), e.g. by facilitating virtual access through e-infrastructures to pan-European RIs, especially distributed RIs. These link many different national centres of excellence, with virtual

94 ESFRI White Paper - MAKING SCIENCE HAPPEN, a new ambition for Research Infrastructures in the European Research Area (2020) – see **https://www.esfri.eu/esfri-white-paper**
95 Report of the ESFRI Working Group on Monitoring of Research Infrastructures' Performance (2019).

repositories of data and information accessible to researchers irrespective of which country they come from.

- New P4 (deepening the ERA). ESFRI will play a role in promoting open science. The ESFRI White Paper addresses its role in facilitating access to high-quality, open research data by ensuring the networking of different pan-EU RIs, and through the European Open Science Cloud (EOSC) [96]. A second aspect under P4 is the strategic development of new European technology infrastructures and ensuring these have an appropriate governance structure so as to harness innovation.
- Despite the fact that ESFRI and pan-European landmark RIs are expected to contribute in many different areas to the ERA, there are few suitable indicators where comparable data is available.

Indicators for the new ERA:

	Relevant priority (ies) in new ERA	Input Indicator	Output Indicator	Result Indicator	Impact Indicator
• European Strategy Forum on Research Infrastructures (ESFRI)	• P1 - prioritising investments and reforms	• Level of national investment in ESFRI landmark projects (annual, biennial?) • Number of national ESFRI planned projects in which MS/ AC is participating.	• Availability of national roadmaps with identified ESFRI projects and corresponding investment needs. • Number of national ESFRI landmark projects in which MS/ AC has participated.	• Change over time in level of investment in ESFRI landmark projects (national level). • Comparison against baseline	• Qualitative • Extent to which Europe has state-of-the-art RIs compared with international competitors.
ESFRI	• P2 - improving access to excellence	• Level of national investment in ESFRI landmark projects (annual, biennial?) • Number of national ESFRI planned projects in which MS/ AC is participating.	• Share of developing ESFRI Projects in which a Member State (MS) or an Associated Country (AC) participates	• Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner	• Qualitative indicator – extent to which ESFRI landmark projects have opened up access (physical, virtual) to a broader spectrum of researchers than against baseline.
ESFRI	• P4 (deepening the ERA).	• Level of investment in ESFRI European technology	• n/a	• Change over time in level of investment in ESFRI	• Qualitative: • Extent to which Europe has state-of-

[96] EOSC is being built to become a common, federated, European framework for openly sharing research data and accessing services.

		infrastructures		European technology infrastructures projects (national level). • Comparison against baseline	the-art RIs compared with international competitors.

Existing and possible new data sources:

- Regarding existing data and information sources, national roadmaps for research infrastructures (RIs) will continue to provide an important source regarding MS and AC's degree of prioritisation of RIs, and on the extent to which they intend to participate in particular RIs.
- ESFRI itself has had – and will continue in future – to have a role in gathering data about the planning and implementation of ESFRI projects, as it coordinates planning and investments through its overall coordination role. Data on the three existing indicators could therefore come from ESFRI.
- Whereas data on investments in pan-European RIs was previously not comparable, new data is today available which would allow for comparisons to be made of national investments into ESFRI projects. The data could be normalised (e.g. relative to GDP and/ or population size of country).
- However, data on all expenditure on RI at national and regional level across the EU-27 is still not comparable. Indicators should not be included unless comparability can be guaranteed.

Key findings and lessons learned:

The three indicators selected in 2015 all remain relevant in 2021.

- The share of developing ESFRI Projects in which a MS or an Associated Country participates remains relevant. Such projects are regarded as helping to foster access to excellence, especially in smaller EU MS and in widening countries.
- Although considerable progress has been made in the development of the ESFRI Roadmap, and through the national roadmaps, monitoring of national roadmaps remains relevant, as these are a strategically important mechanism for encouraging MS to commit to making investments in RIs.
- Share of operational ESFRI Landmarks in which a Member State or an Associated Country is a partner likewise remains relevant. There are about 50 landmarks in total, and the extent of participation of a country in these remains an important proxy for the extent of its participation in ESFRI, and a proxy for how far progress is being made in widening countries in terms of improving access to excellence.
- P2b will have an important cross-cutting dimension in supporting implementation of the new ERA policy framework, as it is relevant to the new P1, P2 and P4.
- In the next decade, there could be a greater role of e-infrastructures in maximising the utilisation of pan-EU RIs and this should be reflected in the indicators selected.
- Given the central importance of pan-European RIs to the overall attractiveness of the European Research Area, a headline indicator should be selected in the new ERA Scoreboard.
- Opening up access to RIs to a wider range of researchers could also be considered as an indicator.

Literature reviewed:

ESFRI White Paper (2020) - MAKING SCIENCE HAPPEN, a new ambition for Research Infrastructures in the European Research Area;

WORKING GROUP REPORT - Monitoring of Research Infrastructures Performance (December 2019);

ESFRI Roadmap 2018, interview focusing on 2021 ESFRI Roadmap update process;

Case study 2 - Gender Analysis and Gender Mainstreaming (P4)

The below is based on desk research and an interview with the Head of the ERAC SWG GRI Marcela Linková, the

coordinator of the GENDERACTION project.

The implementation of ERA Priority 4

Within Priority 4 of the ERA Roadmap, EU Member States are required to formulate and implement measures to promote gender equality or gender mainstreaming in science and research around three central gender equality objectives:

1. Equal access for women and men to all areas and hierarchical levels in science and research;

2. The removal of structural barriers to careers of women and increase in the percentage of women in decision making;

3. The integration of the gender dimension in research content and teaching.

The main goal of Priority 4 is simple: to foster scientific excellence and a breadth of research approaches, by fully utilising gender diversity and equality and avoiding a waste of talent. This is based on the premise that:

- There is a positive correlation between the European Innovation Scoreboard[97], Adjusted Research Excellence Indicator[98] and the Gender Equality Index[99];
- There is a positive correlation between the share of research performing organisations with gender equality plans and the innovation and excellence indicators;
- A country's Gender Equality Index is strongly positively correlated with a higher share of research performing organisations and with the share of women on R&I boards.

Therefore, the higher a country scores on gender equality, the higher its innovation potential. And the more gender equality in research performing organisations, the more innovation and excellence.

The 2018 GENDERACTION report on "National roadmaps and mechanisms in ERA priority 4"[100] analysed different approaches of Member States to the implementation of gender equality in National Action Plans (NAPs) and Strategies. The report found the following:

There were different approaches to NAPs in different countries, as well as different levels of implementation of gender equality policies: some countries described the whole gender equality policy mix, others described the current focus of gender equality policy or the process by which an existing policy mix is to be further developed; while others formulated a gender commitment to gender equality or did not address gender equality in their NAPs at all (Bulgaria and Romania, because of the high share of women in Grade A positions).

The NAPs also differed in the concept of gender equality used: some countries addressed all three main ERA gender equality objectives (see above), while others focussed on only one or two objectives.

There were different levels of implementation of priority 4: the report's survey analysis showed that all countries that participated in the survey had either already submitted a NAP or were planning to do so; all but one of these NAPs contained gender equality objectives, yet only two thirds of them also contained concrete targets or measures, while half were linked to a specific national monitoring system.

The gap between objectives and measures appeared for all three objectives: while 19 NAPs addressed the objective to increase the share of women in R&I, only 13 contained corresponding measures and policies; this was also the case for the objective of structural change (mentioned in 19 NAPs, 8 contained measures) and in the case of the objective of strengthening the gender dimension in research content (mentioned in 15 NAPs, 3 contained measures);

[97] **https://interactivetool.eu/EIS/index.html**
[98] **https://ec.europa.eu/jrc/en/publication/adjusted-research-excellence-index-2018-methodology-report**
[99] **https://eige.europa.eu/gender-equality-index/about**
[100] GENDERACTION Horizon 2020 Project 7414 (2018) Report on national roadmaps and mechanisms in ERA priority 4.

10 NAPs mentioned the objective to integrate the gender dimension in teaching, but only 1 contained measures.

Gender was not integrated as a cross-cutting topic: only 7 NAPs linked priority 4 to at least one other ERA priority.

There were differences between EU15 countries and newer EU Member States: these differences emerged in terms of the NAP being the first policy document on gender equality in R&I (57% of newer Member States compared with 25% of EU15 countries) and priority 4 being interlinked with other priorities (39% in EU15 countries compared with 14% of newer EU Member States); newer EU Member States also reported more often difficulties regarding the development of priority 4 and that the structural change goal of abolishing barriers for women's careers was more present in EU15 countries.

The large differences across the EU in how gender equality is tackled and policies are put in place show the importance of policy coordination in this area. The findings also emphasise that the ERA roadmap and the NAPs have been a **catalyst for change,** especially for those countries that did not have gender equality policies in place.

Consequently, the report found it necessary to strengthen the NAPs as a steering instrument for gender equality in R&I. A more detailed guidance for NAP development, the involvement of relevant national stakeholders, the consideration of gender equality in other ERA priorities and a meaningful monitoring were recommended to further support the steering function of the NAPs. To support this process, GENDERACTION has developed a set of criteria of good practice, including practical examples of application of these criteria.[101]

Gender equality in a new ERA

As noted by GENDERACTION, monitoring the progress of gender equality and mainstreaming under the ERA requires a more complex set of indicators[102] than the share of women in Grade A, as it represents only one of the three ERA gender equality objectives and is negatively correlated with the Gender Equality Index. Particularly in countries that are "weak innovators", where proportions of women in Grade A might be higher, this can skew perceptions of progress, as these proportions may be a result of lower spending in R&I, women working for lower pay and men not finding these positions attractive.

GENDERACTION therefore recommends a combined approach to monitoring that uses existing quantitative indicators (e.g. She Figures), qualitative indicators derived from NAP documents (data shows that Gender Equality Plans are a more precise indicator of gender equality) and additional information provided by Member States (e.g. through NAP implementation reports).

These recommendations are particularly pertinent given the requirement of Gender Equality Plans (GEPs) for Horizon Europe. In this context, GENDERACTION is currently preparing a report on GEP implementation at Member State level, finding again a substantial widening divide in the EU between EU15 countries, which tend to have a GEP requirement, and newer EU Member States, which do not, posing an important obstacle that will need to be overcome not only at EU, but also at national level.

In the case of the latter, there is a critical role for national authorities to support research performing organisations in the development of their GEPs, both financially and in terms of capacity building. In the case of the former, it will be necessary to come up with a clear definition for GEPs at EU level, which can build on what the Commission is proposing for Horizon Europe, or be a combination of what is already in place at Member State level. However, it is important to ensure that what is implemented in this area is coherent across Member States, and also monitored coherently in terms of uptake at the national level.

The interviewee also raised the issue of developing a robust evaluation system for GEPs, because in many countries there is a GEP requirement, but there is limited awareness of what is contained in these plans, who evaluates them and whether, in fact, these plans are being implemented or are just a "window dressing" exercise. So another challenge

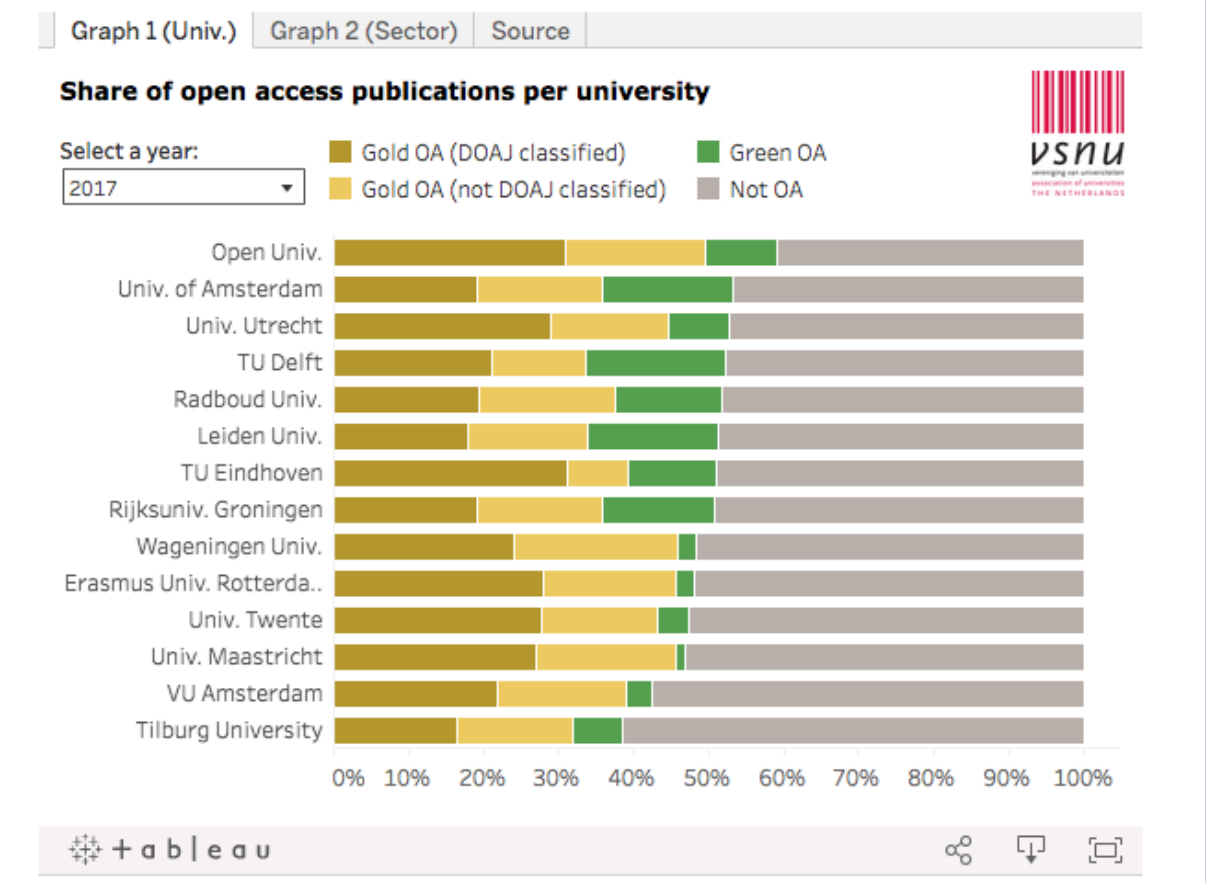
[101] https://genderaction.eu/wp-content/uploads/2019/09/GenderAction_PolicyBriefs_12_GoodPractice4ERA_Priority4.pdf
[102] https://genderaction.eu/wp-content/uploads/2020/06/WhyWeNeedGenderInERA.pdf

for the EC will be to develop a robust evaluation mechanism, based on a qualitative approach, that will evaluate whether GEPs that are adopted are in fact being implemented, and how.

Finally, looking into the future, the approach to gender equality in ERA may want to evolve towards intersectionality. Currently, there is a task force in the SWG GRI on intersectionality, although this issue is only a priority for Ireland, Netherlands and Norway at the moment. However, here also political dialogue between the Commission and Member States will be required on how to tackle the issue of data gaps in this area, as some countries do not collect, for example, data on race and ethnicity. Political dialogue will also be needed to agree on what axes of inequality to tackle, when and how, particularly with an eye towards narrowing the widening divide between EU15 and newer EU Member States and different levels of discourse about gender equality that may exist in these countries.

Case study 3 – Good Practice Example Monitoring Open Access publications

Good practice example: Monitoring of Open Access Publications by the Association of Dutch Universities (VSNU)



In response to the strong support for Open Science / Open Access in the Netherlands, reinforced by the aim of the research funder NWO towards 100% Open Access for all publicly funded research projects, VSNU developed a publicly available monitor for Open Access. This database is compiled based on the willingness of all universities to provide the data. In July 2021 the Monitor has compiled all peer reviewed articles from 2017 from the 14 Dutch universities and shows that 50% of these articles are available in open access. The same monitor can also distinguish Open Access by scientific domains (Sectors).

Note: Illustration of the dashboard as published at July 2021

Sources: https://www.vsnu.nl/en_GB/open-access-publications

https://www.nwo.nl/en/implementation-guidelines-plan-

Case study 4 – The integration of former ERA Priorities into new ERA objectives

Case study on Researcher Careers and the integration of the former Priority 3 into all new ERA priorities.

Under P3, the focus was on Open Transparent and Merit based Recruitment as part of developing an open and attractive research environment and supporting the transnational mobility of researchers based on merit-based recruitment. Researcher careers are now part of all four policy areas albeit concerning different aspects and to a greater or lesser extent.

i. Prioritising investments and reforms: to accelerate the green and digital transformation and to increase competitiveness as well as the speed and depth of the recovery. This requires better analysis and evidence and includes simplifying and facilitating the inter-play between national and European R&I systems. The principle of excellence, **meaning that the best researchers with the best ideas obtain funding**, remain the cornerstone for all investments under the ERA.

ii. Improving access to excellence: towards **more excellence and stronger R&I systems across the whole of the EU** where best practice is disseminated faster across Europe. Member States willing to increase the performance of their R&I system **towards excellence** should be encouraged and supported, building on dedicated Horizon Europe measures and complementarities with smart specialisation strategies under Cohesion Policy.

iii. Translating R&I results into the economy: R&I policies should aim at boosting **the resilience and competitiveness of our economies and societies**. This means ensuring Europe's competitive leadership in the global race for technology while improving the environment for business R&I investment, deployment of new technologies and enhancing the take up and visibility of research results in the economy and society as a whole.

iv. Deepening the ERA: to further progress on the **free circulation of knowledge** in an upgraded, efficient and effective R&I system, in particular by moving from an approach of coordination towards deeper integration between national policies. The ERA will continue to promote adequate framework conditions and inclusiveness, **help develop the skills that researchers need for excellent science**, and connect all actors across Europe, including in education, training and the labour market.

In terms of the new ERA objectives, such as **Prioritising Investments and Reforms (Objective 1)** and **Improving Access to Excellence (Objective 2**), both identify selecting researchers based on merit and excellence. For **Objective 2,** there is also the objective of ensuring a greater spread of excellence across the EU. This relates directly researcher careers in terms of brain circulation and the asymmetric mobility patterns that favour those countries with more established R&I systems. Also, **Translating R&I results into the economy (Objective 3) and Deepening the ERA (Objective 4)** requires greater translation of research results by researchers and greater intersectoral mobility of researchers to non-academic employment.

The previous ERA P3 was encapsulated in the *European Researchers Charter and Code of Conduct for their Recruitment*. This is now being reviewed in order to integrate polices including Open Science, Gender and Research Integrity. Therefore, while the previous P3 indicators may have some relevance, these new aspects must be included.

A major European (and indeed global) challenge is increasing the mobility of researchers to non-academic employment. A key means to achieving this objective is to expand the range of assessment criteria for researchers to include non-academic activities, e.g., internships in industry, publication of patents. This will be critical for achieving the objectives NOE3 and NOE4. A relevant indicator would be the extent to which funders integrate this broader approach to researcher assessment.

Closely related to the Charter and Code are the EURAXESS services that were established to support the greater transnational mobility of researchers. These are also under review as the intention is to evolve to and ERA Talent Platform that would offer wider services. Depending on the how this develops, there may well be data collected at European level that could be used for indicators on researcher careers. For example, the New ERA Communication stresses that researchers in the EU, regardless of their geographical location, can produce and should have access to excellent research across the EU. EURAXESS could host placement opportunities for organisations willing to host virtual research placements that are recognised in researcher track records. The number of such placements would indicate the opportunities for researchers across Europe to access excellent research teams, regardless of their own location.

Case study on Open Science

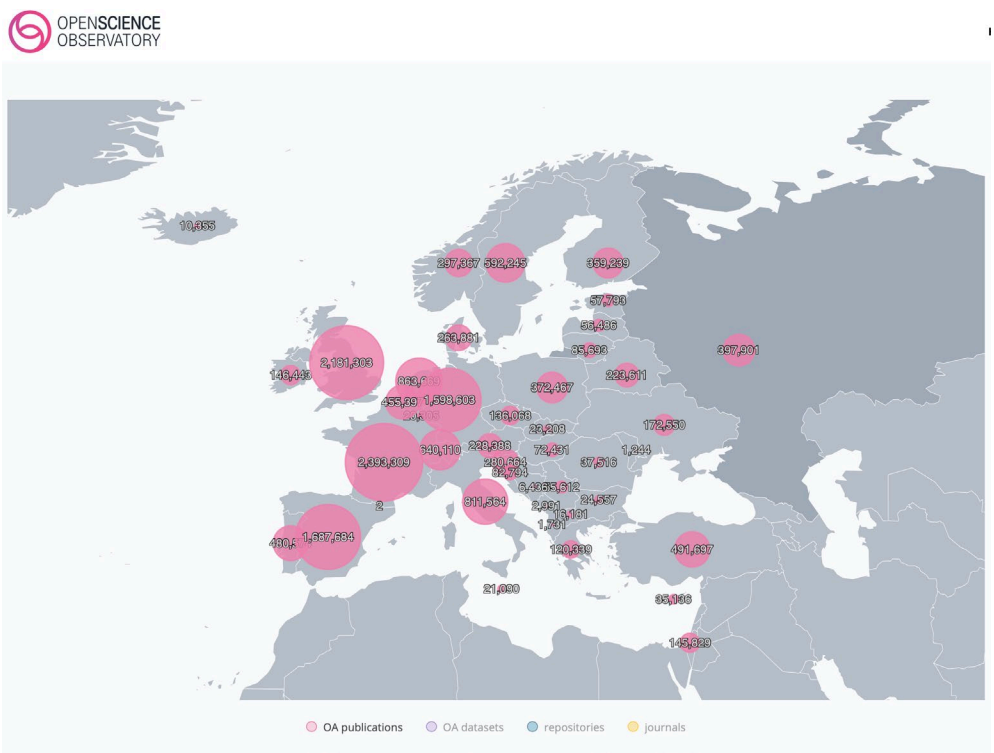
In the case of Open Science, there is a very clear link to **Objective 4** in terms of the free circulation of knowledge. There is also a more indirect link to **Objective 3** in terms of resilience as unregulated openness can leave Europe open to threats to competitivity from non-EU organisations exploiting data produced in Europe. In developing an indicator around Open Science, one must look at the various components including, Open Access Publications, Open FAIR Data, Open Peer Review Open Science Researcher Assessment and Open Science Practices in research. The indicators that could be associated with these are,

- OS1 Number of publications in OA journals and proportion in relation to those in traditional journals in Member States. An aspect of this indicator will be the relative proportion of articles published under with Green, Gold or Diamond access. This will also be tracked as part of the implementation of Plan S so there will be opportunities for collaboration in the capturing of data. Note that all publications with funding from Horizon Europe must be OA so this will not provide a useful indicator.
- OS2 In the case of Open FAIR Data, the European Open Science Cloud (EOSC) will provide an excellent central means to measure the extent of Open FAIR Data. There is a subtlety however that data may be FAIR but with restricted access for security and competitivity reasons. Combined information from EOSC will demonstrate the extent to which the European R&I system providing FAIR data openly (even if with some restrictions).

- OS3 Open Peer Review is a rapidly developing area, and some measure of its use will be indicated by the use of the recently launched Open Research Europe[103] by the EC. While the service is for OA publishing the names of the reviewers are published.
- OS4 Open Science will not be embedded in R&I systems unless researchers at all career stages are recognised, incentivised and rewarded for OS practice. This means that OS must be integrated to researcher assessment for recruitment, institutional career progression and grant applications. Currently there are a variety of approaches to assessing researchers in this context and there is no system wide agreement on any single method. The indicator in this case could be the number of funding agencies across Europe that use OS in their assessment of researchers. There would also be the option of measuring the number of funders that have ceased to use traditional metrics, especially the Journal Impact Factor, in their assessment of researchers.
- OS5 Integration of Open Science into research methodology as part of national funding agency programmes. Note that a major innovation in Horizon Europe is that OS research methods are part of the Excellence criteria for grant applications (exception is the ERC). The indicator in this case will be the number of national funding agencies that have included OS methods in grant evaluation.

The combination of these indicators could help to assess the roll-out of Open Science in its broadest form across Europe. Each of the indicators posited above will be relevant to one or more of the four New ERA policies.

The point was made in section 2 that ideally indicators could be captured centrally through data gathered in European and national initiatives. Focusing on data that is of clear interest to Member States will bring about greater national buy in and commitment to the EMM. In the case of Open Science there is the OpenAire project funded under Horizon 2020. This developed and observatory to track the evolution of OS across MS and ACs with others including Russia and the Ukraine.

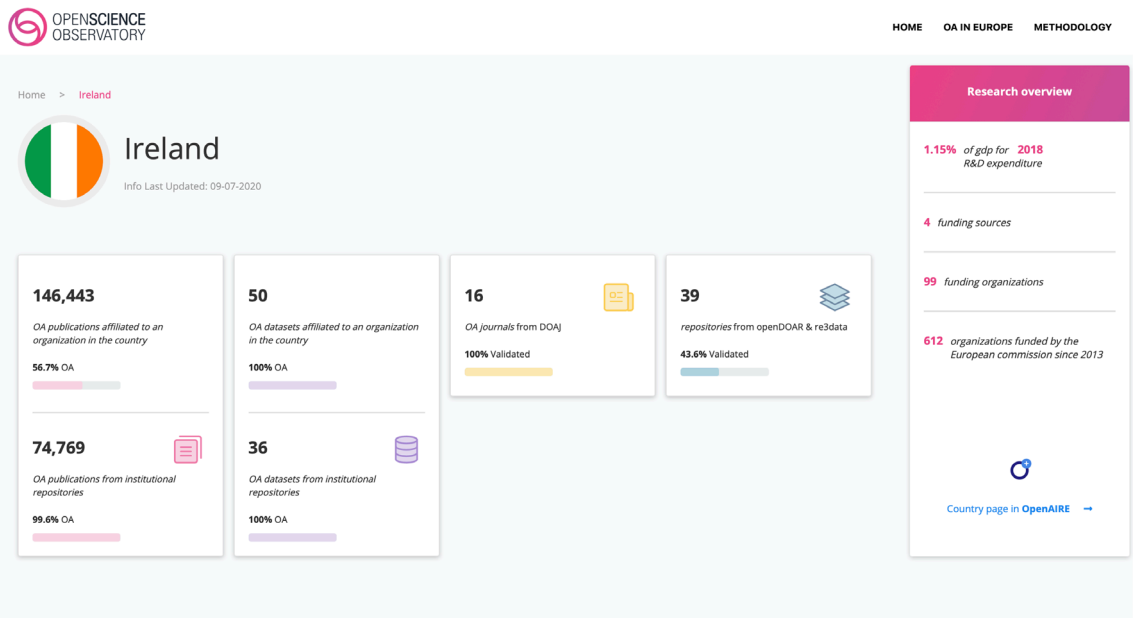


europe.ec.europa.eu/?utm_source=linkedin&utm_medium=social&utm_campaign=JPG15771&utm_term=post

Figure A1 Representation of the penetration of OS in countries across Europe (45 in total).

The observatory tracks trends for Open Access to publications, data, software and other research products (including workflow, methods and protocols). The observatory collects information from existing research related data sources and presents them in an interactive format with accompanying detailed data and metrics. The dashboard above (Figure A1) shows national details that can be further investigated for more detailed information. The details in Figure A2 below shows national information that can be further investigated for more detailed information.

Figure A2 Example of national dashboard providing details OA publications and data



Another opportunity to take advantage of relevant initiatives is the European Open Science Cloud (EOSC). The purpose of EOSC is to provide researchers open and seamless services for storage, management, analysis and re-use of research data. There are currently 13 Research Funding and 114 Research Performing Organisations as members of EOSC covering a wide range of countries across Europe (including almost all Member States)[104]. As Open Science continues to spread it is to be expected that membership will increase.

EOSC has established Key Performance Indicators (KPIs) that have the role of delivering trustworthy Open Science for society[105]. These KPIs address directly the issue of researcher assessment in the context of Open Science. For example, there is the KPI of the percentage of EOSCO Association members that recognise Open Science activities in research career assessments. There are also very detailed KPI's relating to Open Science data standards, tools, access and sharing.

[104] https://www.eosc.eu/members

[105] Strategic Research and Innovation Agenda (SRIA) of the European Open Science Cloud (EOSC) https://eosc.eu/eosc-sria-v10-15-february-2021

The two examples above illustrate the possibilities to take advantage of data that is gathered in other contexts which can be used to develop indicators. Moreover, this is data that is also valuable at national level for both research funders and performers. They also illustrate the power of major European initiatives that can be employed to assess ERA progress in a way that was not possible in the previous period.

Annex 5: Monitoring system to keep track of ERA priorities

Monitoring of the ERA Roadmap process was carried out at EU level by the European Commission through the ERA Progress Report and at country level by the ERAC Working Groups, assessing the extent of NAP implementation at the priority level. These two levels of monitoring are now examined:

Role of the ERA Progress Reports in monitoring system

Every two years, the Commission publishes the ERA Progress Report, which provides an overview of the implementation of the ERA across all ERA participant countries.

The **2016 ERA Progress Report** showed that substantial progress had been made in the last decade on ERA implementation. At an EU level, all headline indicators were found to have shown improvement, although there were disparities between Member States ("MS") in respect of their overall ERA performance. The report highlighted that the attention should be on reinforced implementation to deliver on all the ERA priorities, a responsibility of the MS with support from the European Commission. Additionally, the report mentioned that the integration of the ERA Roadmap was a powerful tool to help countries with the necessary ERA reforms at the national level and suggested strengthening the implementation process through streamlining with other reports, using the EMM to aid the NAPs and mutual learning exercises for the next progress report.

The 2016 Progress Report relied on **composite indicators** "as experimental tools to synthesise progress towards achieving the ERA both within and across priorities"[106] combining findings from headline and complementary indicators. Difficulties in interpreting composite indicators, also confirmed through the interview programme, led to the decision to drop them in the 2018 monitoring exercise, which otherwise mainly built on the 2016 methodology.

The **2018 ERA progress report 2018** (published 2019[107]) was the second consecutive Progress Report when the EMM was used to measure progress at an EU level, but with country fiches developed for the first time. The use of composite indicators was dropped in 2018, following the less positive experiences mentioned above.

Changes over time have been made to the methodology used to assess progress in ERA implementation through the Progress Reports. Although the individual indicators have remained broadly stable over time, there have been some changes and discontinuity in data collection approaches, and some indicators were updated, modified or replaced in 2018. For example, an initial modification was introduced for the complementary EMM indicators of Priority 2b (Optimal use of public investments in research infrastructures), for which findings are now provided on a combined indicator that is considered to better illustrate how the level of engagement in ESFRI developing Projects and Landmarks are connected, rather than presenting these two indicators separately. As comparatively slow progress has been made in ERA implementation in the past few

[106] European Commission (2016) ERA Progress Report 2016, Science Metrix Study, https://era.gv.at/public/documents/3073/era_progress_report_2016_technical_report.pdf

[107] 4th ERA Progress Report, 2018 - https://ec.europa.eu/info/research-and-innovation/strategy/era/progress-report_en European Commission's DG RTD. Carried out by PPMI and Science Metrix.

years compared with earlier periods, especially at national level, the trio of EU Presidencies (Germany, Portugal and Slovenia) prioritised the development and implementation of a revitalised ERA[108] in order to deepen ERA implementation.

In terms of how the **ERA Progress Reports** might be taken forward in future, issues include:

- If an annual ERA Scoreboard is adopted, is it necessary to continue in parallel producing Progress Reports on national implementation?
- If yes, should the Progress Reports continue to be produced biennially?
- What are your views on the manageability of Member State involvement in the ERA monitoring process (reporting frequency, MS contributions to ERA Progress Reporting process)? Should the ERA monitoring and reporting process in future be top-down, bottom-up or a combination of both?
- How useful and effective is a Progress Report in PDF form, as opposed to a possible ERA Scoreboard? How comparable is performance between Member States in ERA implementation both overall and across the 6 priorities?

Monitoring NAP implementation

Monitoring progress towards the six ERA priorities through the NAPs is the responsibility of **ERAC and the ERA-related working groups**[109]. Indeed, this was a collective responsibility of all ERA-related working groups which collected the information, analysed and reported the progress periodically to then, as agreed in the ERAC plenary in 2017, feed findings back to ERAC for its annual reports.[110] For that purpose, different approaches were initially used at the Priority level as the different working groups took slightly different approaches. The box below showcases the **methodology developed by the High-Level Group on Joint Programming (GPC)**, which was considered to be a relevant means of monitoring progress, and assessing whether planned activities and measures mentioned in NAPs had gone ahead, been delayed, postponed, or cancelled. This approach was later adopted by most of the other ERAC Standing Working Groups (SWGs).

Good practice example by the GPC Priority 2a - Progress monitoring tool

The Progress Monitoring Tool developed by GPC in Excel format served as simple yet systematic approach for GPC delegates to analyse and report progress made in the implementation of the P2a Optimal Transnational Cooperation measures outlined in the individual ERA NAPs. The following three questions helped assess progress made whilst also accounting for delayed actions:

(1) Has any activity for this action, item… taken place?
(2) Was the activity delayed?

[108] The presidency is currently, as of July 2020, held by Germany. Three successive presidencies are known as presidency trios. The current trio (2020-2021) is made up of Germany (July–December 2020), Portugal (January–June 2021) and Slovenia (July–December 2021).

[109] ERAC (2020) Final Report on Monitoring ERA Priorities with ERA Roadmap National Action Plans, https://era.gv.at/public/documents/4340/Item_3_2_Final_Report_2020_Monitoring_NAPs_ERAC_10sept2020__002_.pdf

[110] ERAC (2019) Draft Report on Monitoring ERA PRIORITIES WITH ERA ROADMAP National Action Plans, https://data.consilium.europa.eu/doc/document/ST-1212-2019-INIT/en/pdf

(3) Is the activity stopped?

This approach allows to indicate the current status of each planned activity at the time of the review using the categories indicated below, combining these with a very visual colour-coded system for easier navigation.

FINISHED
ON TRACK
ON-GOING WITH DELAY
POSTPONED
TERMINATED
CANCELLED
SCHEDUELED FOR

(1) Has any activity for this action, item... taken place?	YES				NO			
(2) Was the activity delayed?	YES		NO		YES		NO	
(3) Is the activity stopped?	YES	NO	YES	NO	YES	NO	YES	NO
	TERMINATED	ON-GOING WITH DELAY	FINISHED	ON TRACK	CANCELLED	POSTPONED TILL	CANCELLED	SCHEDULED FOR

This systematic, simple approach minimized additional administrative burden on MS/ACs and helped understanding the status of the individual measures as initially developed in the NAPs at country and as well as the overall progress made across countries for P2a at EU level.

Indeed, beyond establishing the country level progress, this tool also allowed to get an aggregate view of measures across NAPs by categorising these under specific areas: "governance", "communication and information", "funding" or "monitoring". This allowed to get insight into the main areas of development across the EU and observe trends across areas for the EU as a whole.

A parallel can be drawn between the monitoring approach developed by the SWG on the Joint Programming Initiative and the traffic light monitoring and reporting system developed under the Single Market Scoreboard (SMS), which also served to provide a simple, easy to understand colour coding system regarding the extent of progress made. The SMS had the advantage that progress can be assessed in a simple way that it is easily understood visually. However, a potential disadvantage of a traffic light system was that there may be legitimate reasons why particular measures have not gone ahead, and this will not be apparent to a general audience, who will assume that there is a problem in a particular area being monitored if the progress is indicated as being problematic using a red colour. A further drawback is that the red colour may be perceived by some national authorities as being akin to a name and shame approach. However, there may be perfectly reasonable reasons why particular measures have not gone ahead (e.g. lack of human resources, change in policy approaches due to a change in government, etc.). This feedback has general applicability to the use of such a system to monitor ERA implementation.

Since the ERAC plenary of December 2018 decided for all ERA-related groups to **"use (at least) an adapted High-Level Group on Joint Programming (GPC) monitoring tool"** [111], the approach has slightly changed over the past two years. Overall, ERAC's objective was to harmonize the format to monitoring while allowing WGs to adapt the tool to fit the needs of the individual priority. As such, in 2018 the GPC monitoring tool was used to monitor Priorities 2a, 5 and 6, while

[111] ERAC (2019) Draft Report on Monitoring ERA Priorities with ERA Roadmap National Action Plans, https://data.consilium.europa.eu/doc/document/ST-1212-2019-INIT/en/pdf

Priorities 1, 2b and 3 used a simplified version of the tool which only distinguished between "finished", "ongoing" or "cancelled" status of the measures. The main benefit of this exercise lied in the fact that, although the differences in procedure, details and information collected did not allow for full comparison across priorities, all WGs reported status, situation and degree of progress.

The following year, the ERAC took the monitoring of the implementation of the ERA NAPs a step further by asking delegates to **"report on the progress but also on the degree of implementation (if applicable) of the measures included in the NAPs"**.[112] As such, the GPC tool, used in 2019 for Priorities 1, 2b, 3, 4 and 5, was further developed to include the degree of progress for those cases in which measures were being developed, by indicating "On-going (greater or equal 50%)" or "On-going (less than 50%). By going beyond looking at the extent of implementation at a strategic level to include reporting on the status of the implementation of ongoing measures, this adjusted methodology helped to add an additional level of nuance to the measuring and reporting of progress. The monitoring tool for 2a remained the same as in the previous year (see box above) and Priority 6 used a slightly modified tool to fit its needs.

Also in this case, the goal of ERAC was not so much to compare countries, but to provide insights and conclusions regarding the individual priorities at EU level. Indeed, the two annual reports published by ERAC as a means of overview bringing together the monitoring findings across the 6 priorities by the individual WGs, published in 2019 and 2020 respectively, categorized the measures taken by MS and grouped them to assess progress by priority at EU level in general[113]. Overall, this approach allowed progress to be captured against commitments made in the NAPs and a broader set of measures, activities, initiatives and policies to be reported upon, going beyond the specific indicators outlined in the EMM. ERAC representatives mentioned how the first annual report on Monitoring ERA Priorities with ERA Roadmap National Action Plans of 2019 concluded it was possible to monitor the NAPs and that this exercise was useful to measure to what extent the ERA Roadmap was being implemented at national level.

Challenges to monitoring however remained, especially due to the fact that reporting progress to ERAC was a voluntary exercise. Moreover, not all countries had developed a NAP, and some NAPs did not include any planned actions or measures for a given priority. Nevertheless, despite the varying response rate across priorities, ERAC considered in its report of 2020 "coverage is high enough to tentatively report on status and situation, as well as to indicate the degree of progress for each of the priorities"[114].

In light of the future ERA policy framework, strategic decisions are needed also in terms of the extent of NAP monitoring and ownership as well as methodology of such monitoring, including:

- Should MS and ACs continue producing a NAP as part of the future ERA Roadmap?
- If so, who should conduct the monitoring of the NAP measures and degree of implementation? With what

[112] ERAC (2020) Final Report on Monitoring ERA Priorities with ERA Roadmap National Action Plans, https://era.gv.at/public/documents/4340/Item_3_2_Final_Report_2020_Monitoring_NAPs_ERAC_10sept2020__002_.pdf

[113] The ERAC plenary decided to proceed with the Monitoring ERA Priorities with ERA Roadmap National Action Plans at the end of 2018, which explains the publication of two annual reports since then.

[114] Ibid

frequency and link to a broader ERA Roadmap monitoring at EU level?

- How can the impact of the NAP monitoring and resulting findings be maximised in the eyes of national stakeholders?
- To what extent should a NAP monitoring system be standardised or rather customized to account for country specific characteristics and R&I systems? Should the NAP monitoring be done using the EMM indicator system or rely on different indicators?

Annex 6: Lessons learned from comparable governance, monitoring and reporting processes

Lessons from comparable systems

In this section, comparable policy governance/monitoring systems are analysed with the aim of identifying approaches and practices that could be adapted to the ERA policy framework. These are: (1) the European Semester process (2) the climate and energy policy monitoring used by the Commission and (3) the Bologna Process, an example of an Open Method of Coordination (OMC). The analysis focuses on aspects related to (a) political commitment; (b) the development of strategies and roadmaps; and (c) monitoring practices.

A number of different comparable policy governance/monitoring systems are now examined. The extent to which these could be relevant for the ERA policy framework and associated monitoring processes is now considered, including how progress monitoring may fit into the EU policy development cycle. The specific policy monitoring processes that are examined include those with more binding characteristics, namely the European Semester process, and those following more OMC-type processes, such as climate and energy policy monitoring and the Bologna Process.

The European Semester

Objective: Ensuring convergence and stability within the EU

The European Semester is a multi-annual exchange/discussion between the European Commission and Member States (MSs) to achieve the EU's targets, both in terms of broader European Strategies set out for each programming cycle and of the Stability and Growth Pact. The European Semester influences legislation at national level in the field of public expenditure, employment, education and social care. The European Semester supports MS in making effective reforms of their national and regional policies and systems taking into account the SDGs. Through the European Semester, necessary reforms are linked with appropriate investments from the relevant programmes in the Multiannual Financial Framework of the Commission, including ESIF and Horizon Europe. Quite recently, the European Semester has included Research and Innovation assessment and considerations on progress of the European Research Area.

Key commitments – reporting process

Each year, the European Commission analyses in detail each EU Member State's economic and structural reform programmes and provides them with a set of recommendations for the following 12-18 months. During this time, the MSs have to align their budgetary and economic policies with the objectives and rules agreed at EU level, within the targets previously mentioned.

The European Semester process is based on three key documents which are published each year:

- **The Annual Growth Survey (AGS)** - published by the Commission in November/December, launches the European Semester and represents the document setting out the basis for building a common understanding about the priorities for action at the national and EU levels.
- **The National Reform Programmes (NRPs)** – submitted by the MSs in April – detail how the targets of the EU 2020 Strategy are being reached, which national policies will be

implemented, and how EU guidance has been taken into account, also according to previous CSRs and AGS.

- **The Country-Specific Recommendations (CSRs)** – published in June by the Commission, recommend a set of actions for each MS to take, according to its economic and social performance during the previous year and to the delivery of priorities set out in the AGS. The CSRs are based on **Country reports**, published each January, which assess each government's implementation of the previous years' CSRs and strategic priorities.

After the publication of the AGS, the Commission continues the dialogue with Member States, stakeholders and social partners to develop a common understanding of the challenges in the Member States. Member States have several opportunities to feed into the Commission's assessment, including technical missions, bilateral meetings and political missions.

The Commission analyses the NRPs submitted in April and issues the CRSs in May, in time for these to be endorsed by the European Council and adopted by ECOFIN in July. Member States should then incorporate this policy guidance into their annual budgets, national legislation and policy plans.

Some R&I stakeholders at EU and national levels interviewed mentioned that **they would have preferred if the new ERA were to be formally linked to the European Semester process**, with binding quantitative targets. Their rationale was that this would strengthen national attention at Ministerial level to the new ERA, and reinforce attention to the topic. However, many national governments do not appear to be in favour of this approach, and would prefer to retain the ERA's voluntary nature, which in turn implies that any targets set for monitoring indicators (if any) should be non-binding. Nevertheless, as the European Semester includes R&I, the reporting process nonetheless provides an opportunity to report on strategic aspects of ERA implementation.

Building a stakeholder consensus in this regard appears however to be difficult. Nonetheless, **even if the new indicator set is non-binding, there are still strategic choices to be made regarding whether or not to set some quantitative targets**. Moreover, if such targets are set, there is a question as to whether these should be strategic and limited to a few indicators, or whether there should be targets for all indicators. National-specific variations would also need to be recognised, depending on the prevailing baseline situation and national contextual factors etc. This could be achieved quantitatively through data normalisation and through qualitative assessment to contextualise data interpretation.

Another approach would be to align the R&I part already been included in the European Semester reporting process during the previous reporting period to the new ERA Pact's objectives. For example, the R&I part of the European Semester could focus more on reporting on the reforms undertaken by MSs in the context of their ERA national roadmaps and discuss progress on a regular basis. This point relates to the need to increase the high-level political engagement with the ERA process.

The climate and energy policy monitoring

Objective: reaching the targets of the 2030 Climate and Energy Policy Framework

One of the main objectives of the EU's 2030 Climate and Energy Policy Framework is to implement the EU's emissions reduction contribution under the Paris Agreement. The Agreement relies on nationally-determined contributions (NDCs), that is, climate change mitigation plans that the parties define on a national basis. The EU submitted its intended NDC in 2015, pledging 'an at least 40%

domestic reduction in greenhouse gas emissions by 2030 compared to 1990', to be achieved without the use of international carbon credits but including land use, land-use change and forestry.

Key commitments – reporting process

The Governance Regulation for the 2030 Framework Climate and Energy Policy Framework requires Member States to prepare two plans, national energy and climate plans (NECPs) and long-term strategies (LTSs). The Commission must prepare an LTS for the EU as a whole.[115] NECPs are prepared every 10 years and updated at five-year intervals. In the NECP, each Member State defines its national contribution to the five Energy Union objectives. According to the Governance Regulation, Member States should establish a multilevel climate and energy dialogue involving various stakeholders and the general public to discuss different scenarios for climate and energy policies.

Member States are also required to specify their plans to reach these targets along with their national greenhouse gas emission reduction targets. NECPs are prepared and updated through an iterative process in which the Commission plays an important role, since it is required to assess whether the final NECPs are sufficient to meet the Energy Union objectives and the EU's 2030 targets and whether the EU MS have taken due account of the Commission's recommendations.

The LTSs have a time horizon of at least 30 years covering, among other things, greenhouse gas emissions and removals by sinks, emissions and removals in individual sectors, as well as expected progress towards the low-carbon economy. The strategies should be updated every five years 'where necessary. The Commission is required to assess Member States' LTSs.

From 2023 and every two years thereafter, Member EU MS must prepare integrated national energy and climate progress reports (biennial progress in NECP implementation. In addition, each Member State must submit annual greenhouse gas inventory reports to the Commission and the UNFCCC due by January 2029 and every 10 years thereafter.

The Governance Regulation creates a monitoring system to track the implementation of the 2030 Framework and the associated targets at the EU and Member State levels. The system relies on ex ante and ex post monitoring by the Commission.

Starting in October 2021, the Governance Regulation requires the Commission to biennially assess progress towards the Energy Union objectives and 2030 targets both at the EU level and with respect to each Member State. Ex-post monitoring is based, in particular, on biennial progress reports by the Member States, other information reported under the Governance Regulation, as well as indicators and European statistics, where available. In addition to biennially assessing progress, the Commission must prepare an annual State of the Energy Union Report.

The Governance Regulation also includes an obligation for the Commission to propose additional measures at the EU level to address insufficient ambition or implementation.

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[115] Kulovesi, K. and Oberthür, S. (2020). Assessing the EU's 2030 Climate and Energy Policy Framework: Incremental change toward radical transformation?. Reciel, vol 29 (2) - https://onlinelibrary.wiley.com/doi/full/10.1111/reel.12358

In terms of how this approach may be relevant in terms of the potential scope for adaptability and transferability to the new ERA context, some interviewees pointed out that as the country-specific situation in terms of R&I systems and structures across the EU-27 and associated countries varies significantly, monitoring the extent of progress by each country needs to be relative to its baseline situation and starting point. Performance changes over time across the EU-27 as a whole and ERA participant countries are useful in measuring progress towards the ERA's objectives, but equally, performance should be seen in the context of the country's own specific situation. The logic to climate and energy policy monitoring is that nationally-determined contributions are set based on a particular country's own circumstances, the baseline position, and what is deemed realistic to be achieved in their country-specific context. Embedding similar principles within the ERA could make sense, for instance in respect of target-setting and in ensuring data normalisation, such as to ensure that the assessment of progress made by particular countries is fair.

The possibility also exists to consider linking National Energy and Climate Plans (NECPs) and National long-term strategies (LTSs) with national R&I strategies that would contribute to attaining the corresponding energy and climate targets. Such an approach would be in line with Priority 1 of the new ERA (Table 3-1), as it would allow an operational context to be provided regarding the level of R&I investments that are helping to support the green transition.

The Bologna Process

Objective: Building an attractive and competitive Higher Education in Europe

The Bologna Process is a collective effort of the now 48 participating countries to improve the global attractiveness and competitiveness of European higher education, by building transparency and trust among higher education systems in the region.[116] A major achievement of this transnational cooperation was the launch of the European Higher Education Area (EHEA), in which goals and policies are agreed upon at European level, and then implemented in national education systems and higher education institutions.[117]

The initiative has set a good example internationally, as the move towards harmonization is being attempted in several countries outside Europe. Examples are Latin America, where the Inter-American Organisation for Higher Education initiated a programme to create a Latin American and Caribbean Higher Education Area, and West Africa, where 15 countries signed an agreement to promote intraregional student mobility.[118] Moreover, there are initiatives to create a South-East Asian higher education space.[119]

The origin of the Bologna Process is the Bologna declaration[120], formulated at a time when the shift towards knowledge-based economies gave higher education a prominent position in the policy

[116] http://www.ehea.info

117 The official launch of EHEA was made by the Budapest-Vienna Declaration on 12 March 2010: http://www.ehea.info/media.ehea.info/file/2010_Budapest_Vienna/64/0/Budapest-Vienna_Declaration_598640.pdf.

[118] Crosier, D., and Parveva, T. (2013). The Bologna Process: Its impact in Europe and beyond. Paris, UNESCO: International Institute for Educational Planning.

[119] Cheng, M.W. (2017). The Southeast Asian higher education space: Transnational, international or national in new ways? https://doi.org/10.1177%2F1474904117699627.

[120] The joint declaration adopted by ministers of education of 29 European countries (the at the time 15 member states, 11 candidate countries and 3 associated countries) at their meeting in Bologna in June 1999. The European Commission,

domain. This major development came because a core function of higher education is the production and transmission of knowledge, a key driver for economic development and competitiveness.

The Bologna declaration envisaged the creation of a common degree structure, the introduction of a common credit system and quality assurance mechanism, and the promotion of the mobility of students and academic and administrative personnel between institutions and countries. The Bologna Process has used two main tools to harmonize the differences in the European educational programmes and turn them into comparable, compatible, and coherent systems of higher education: (a) the European Credit Transfer and Accumulation System (ECTS) developed in the late 1980s, prior to the launch of the Bologna Process, with the objective of facilitating student mobility through the Erasmus programme, and (b) the Diploma Supplement that describes the nature, level, context, content, and status of the studies completed by the individual holding the original diploma, based on a standardised template[121].

Key commitments

As stressed in the Paris Communiqué[122], there are three key commitments for countries participating in the EHEA that are crucial to reinforcing and supporting cooperation within the agreed common framework:

- a three-cycle system compatible with the overarching framework of qualifications of the EHEA and first and second cycle degrees scaled by ECTS
- compliance with the Lisbon Recognition Convention
- quality assurance in compliance with the Standards and Guidelines for Quality Assurance in the EHEA.

This means that to allow recognition and mobility across the whole EHEA to function, participating countries should first structure education programmes according to the three cycle-system of the Bologna model - a first study programme leading to a Bachelor's degree, a second leading to a Master's degree and a third cycle for doctoral studies, while ECTS materialises the link between programme components and learning outcomes and acts as the "currency" measuring study achievements of (temporarily mobile) students for the first two cycles[123].

The second key commitment refers to the cross-border recognition practices that should be in compliance with the Lisbon Recognition convention[124]. The development of National Qualifications Frameworks (NQF) stating and clearly expressing the differences between qualifications in all cycles and levels of education has been encouraged by a range of initiatives. The overarching Framework for Qualifications of the European Higher Education Area (FQ-EHEA) was adopted by

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the Council of Europe, and associations of universities, rectors, and European students participated in drafting the declaration.

[121] Diploma Supplement was developed by European Commission, Council of Europe, and UNESCO-CEPES in the 1990s.

[122] http://www.ehea2018.paris/Data/ElFinder/s2/Communique/EHEAParis2018-Communique-final.pdf

[123] Three-year Bachelor and two-year Master programmes were generally established, and five years of study up to Master degree level is the most widespread model, but room for manoeuvre has remained for other options. Typically, first-cycle qualifications comprise 180–240 ECTS credits and second-cycle qualifications 60–120 ECTS credits.

[124] The Convention on the Recognition of Qualifications concerning Higher Education in the European Region was developed by the Council of Europe and UNESCO and adopted by national representatives meeting in Lisbon on 8 - 11 April 1997. https://www.coe.int/t/dg4/highereducation/recognition/lrc_EN.asp

European ministers of education in Bergen in May 2005. In this context, the Diploma Supplement provides a common structure to translate qualifications across different national education systems for the purposes of securing employment and facilitating academic recognition for further studies. So, ideally, NQFs should work in close conjunction with the ECTS and Diploma Supplement.

The third key commitment deals with ensuring and improving quality of higher education and establishing Quality Assurance (QA) systems for the programmes leading to university degrees. As a follow-up of the Berlin ministers' conference of 2003, the European Association for Quality Assurance in Higher Education (ENQA), together with the European University Association (EUA), the European Association of Institutions in Higher Education (EURASHE), and the National Unions of Students in Europe (ESIB), have developed the European Standards and Guidelines (ESG) for the QA of higher education institutions. The progress made in QA as well as in qualifications frameworks recognition and the promotion of the use of learning outcomes contributed to a paradigm shift towards student-centred learning and teaching that led to the 2015 update of ESG[125].

Most QA systems in the EHEA countries focus on a combination of institutions and programmes. A major change in the governance structures in higher education was the development of external quality assurance systems, under the responsibility of external agencies.

The introduction of a clearly structured three-cycle degree structure in most institutions and programmes has been one of the most significant achievements of the Bologna Process, as this is the dominant European model at present. Progress has also been made in developing NQFs, the ECTS, and Diploma Supplement, and in increasing student mobility. Moreover, formal compliance with most aspects of the Lisbon Recognition Convention (LRC) at national level is considered to be well established across the EHEA. Another area of success has been the creation of quality assurance mechanisms and the establishment of the European Quality Assurance Register (EQAR). A growing number of higher education institutions follow the requirement to develop and publish quality assurance strategies and evaluation reports, while external quality assurance is almost always undertaken by independent agencies working in line with ESG.[126]

Reporting on the implementation of the Bologna Process

The first stocktaking of progress in the Bologna Process was carried out in the Ministerial Meeting held in Bergen in 2005. The stocktaking reports assessed the action lines in an integrated way, taking account of the strong interdependencies between them, and in particular the relations linking learning outcomes with other elements, such as qualifications frameworks, quality assurance, recognition and lifelong learning. The main sources of information for the underlying assessments were national reports. The bi-annual Ministerial meetings continued to use the stocktaking reports to monitor progress made towards achieving the goals set in previous meetings till the Leuven/Louvain-la-Neuve meeting in 2009 that looked into the goals formulated in the London meeting in 2007.

In 2009, increased coordination was required to stocktake and further refine the evidence-based methodology. Eurostat together with Eurostudent (in cooperation with Eurydice) invited to

[125] Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Brussels, Belgium.
[126] European Commission/EACEA/Eurydice, 2018. The European Higher Education Area in 2018: Bologna Process Implementation Report. Luxembourg: Publications Office of the European Union.

contribute through relevant data collection. As a result, the Bologna Process Implementation Report (BPIR) that continues to be the norm since then. The 2012 report[127] and subsequent BRIPs provide a snapshot of the state of implementation of the Bologna Process from various perspectives, using qualitative information and statistical data collected the year prior to their publication, and covering all main aspects of higher education reforms aiming at a well-functioning EHEA. Each BPIR edition has been developed through agreement in the BFUG and the relevant working group on the issues to be covered. This has resulted in pattern, where the topics covered in the reports remained the same and gradually enhanced with new issues in order to respond to evolving political priorities.

European higher education is evolving in a context of continuous and rapid changes, bringing about new challenges. Important developments since the beginning of the Bologna Process were an impressive expansion in the number of students in higher education and the implementation of system reforms. At the same time, the post 2008 economic crisis has led to public funding cuts that had a strong negative impact on the higher education sector, as did the demographic changes observed in many European member states, an increasing marginalization of young people, and more recently the new migration patterns. These effects stress the need to intensify European cooperation in higher education, but also the importance of having more targeted monitoring mechanisms in assessing the impact of strategic decisions and ongoing reforms. The 2020 BPIR aimed to introduce changes in this direction that are discussed next.

With reference to the 2020 BPIR, the BFUG took the view that a different approach should be adopted for the 2020 report, aiming at producing a more concise account that should focus on progress achieved throughout the Bologna period. While the overall structure was similar to other BPIR, the report took a longer-term view and discussed key changes in the EHEA brought about through the Bologna period 2000 – 2020.[128]

While all main thematic areas dealt with by the Bologna process have been tackled in the 2020 report, the main research theme to be addressed was "what have been the achievements of the Bologna Process with regard to this thematic area, and how far have we now come".[129] The 2018 BPIR contained about 190 statistical indicators. For the 2020 report there were fewer indicators, but the ones selected examined longer term trends, and not just developments over the years since the last report, as was the case up to now.

The relevance of the Bologna process to the ERA is that it demonstrates that even without binding commitments against quantitative targets, through an Open Method of Coordination (OMC)-type approach, significant progress can be made towards shared EU and national policy objectives.

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[127] EACEA/Eurydice (2012). The European Higher Education Area in 2012: Bologna Process implementation report. Brussels: EACEA P9 Eurydice

[128] The broad areas to be covered are: (a) EHEA development throughout the 20 years of the Bologna Process, (b) Degrees and qualifications, (c) Quality Assurance and Recognition, (d) Social dimension in higher education, (e) Employability and lifelong learning, (f) Mobility and internationalisation, and (g) Future challenges for the EHEA.

[129] The general approach was to report on how Bologna commitments have progressed since they were set: ECTS use can be tracked since 2000 to the present day, but the development of NQFs can only be considered from 2003 onwards.

Annex 7: Benchmarking case studies on scoreboards

Several case studies on different EU and international scoreboards presented in 3.5 are now presented more in detail.

Overall, the benchmarking of other Scoreboards demonstrates that there are many opportunities to strengthen the structuring and presentation of the ERA monitoring indicators when transitioning to a Scoreboard approach. There is also the possibility of improving User Experience (UX) and data visualisation.

European Innovation Scoreboard

DESCRIPTION

The EIS provides information on research and innovation performance in EU countries, European countries and neighbouring countries through an assessment of strengths and weaknesses of their Research, Development and Innovation (R&D&I).

AIMS AND OBJECTIVES

By assessing strengths and weaknesses of the national innovation systems, the scoreboard allows countries to identify areas of improvement and benchmark their performance against that of other countries in general and at indicator level.

POTENTIAL RELEVANCE TO THE ERA SCOREBOARD

The high level of interaction allows the user to customise their own chart and visually observe trends in research and innovation across Europe, something which could be integrated into the proposed streamlined indicator system of the ERA scoreboard.

In addition, the user-friendly presentation, grouping countries by performance in an easily identifiable colour scheme based on their innovation level invites the user to experiment with the multiple drop-down menus to the left of the side, allowing for the selection of: *Country*, *Year*, *Indicator Group*, *Data Type*, and *Innovation Profile* (for example: innovation leader, strong innovator, moderate innovator, modest innovator). In effect, users can select the options they are most interested in and thereby create their own tailored chart of R&D&I in Europe. A similar user-friendly approach would make the ERA scoreboard attractive a wider audience and allow for the strengthening of ERA visibility overall.

European Industrial R&D Investment Scoreboard

DESCRIPTION

The European Industrial R&D Investment Scoreboard provides economic and financial data and analysis of the top corporate R&D investors from the EU and abroad. Based on company data extracted directly from each company's Annual Report, the scoreboard is published annually since 2004.

AIMS AND OBJECTIVES

The main aim of the scoreboard is to serve as reliable, up-to-date benchmarking tool for comparisons between companies, sectors, and geographical areas, and to monitor and analyse emerging investment trends and patterns. This allows to benchmark the performance of EU innovation-driven industries against major global counterparts, and contributes to increasing transparency by encouraging companies to disclose information about their R&D

investments.

Potential relevance to the ERA scoreboard

The dual approach to offering EU and world data allows to put EU performance into perspective and compare its performance in the global context. For that purpose, the scoreboard combines these two levels when presenting the findings in form of several visual dashboards that allow for some level of interaction, e.g. to display the relevant region or country or to expand on certain elements by clicking on the item to learn e.g. about the top 3 investors by country.

The underlying data both for EU+UK top companies and for the world top companies separately is accessible on the website in downloadable PDFs as well as in Excel format, which allows for the users to perform their own analyses. A similar combination of interactive, visually attractive scoreboard and downloadable data could be relevant for the ERA scoreboard, also allowing for increased visibility through infographics and dashboards.

Also relevant for the ERA scoreboard can be the inclusion of certain elements linking to the digital and green transition. In the case of the European Industrial R&D Investment scoreboard, this link is done through the inclusion of Green Technologies in form of share of green inventions in overall patent activity.

OECD Science, Technology and Innovation (STI) Scoreboard

Description

The STI Scoreboard brings together indicators traditionally used to monitor developments in science, technology, innovation and industry and complements them with additional indicators drawing on the latest statistics from OECD and partner international organisations.

Aims and objectives

The Scoreboard allows for science and innovation policy makers, analysts and the public at large to retrieve, visualise and compare statistical indicators of science, technology and innovation (STI) systems across OECD countries and several other economies. Traditionally published every two years in print format, the scoreboard not only provides indicators in a digital platform but also updated them on an ongoing basis.

Potential relevance to the ERA scoreboard

The transition from a static PDF to a dynamic, interactive scoreboard that combines statistics from different sources in one centralized data visualization tool is especially relevant for the ERA context. Beyond allowing to navigate the platform to connect and display different indicators to be visualized together, the tool further allows the user to generate, save and share their own charts and datasets in a user-friendly way.

In order to bring clarity and transparency into the methodology, the scoreboard includes an aid to data interpretation, with upfront information on indicator definition, data sources, specificities for each country and date of the last update, among others. This can serve as best practice for the ERA scoreboard as it would make it easier to read for a wider audience and bring together the different fields of research, innovation and education in a more coherent way.

The link to the STIP Compass, a database combining quantitative and qualitative data in form of over 500 interactive dashboards on national trends in science, technology and innovation policy, is worth noting. The STIP Compass features the STI scoreboard and further includes country policies on a wide range of STI policy issues, thereby adding a strong qualitative element.

Annex 8: Bibliography

This Annex contains a bibliography with key documentation. It includes documents mentioned in the ToR and wider literature. The EU policy documents are listed chronologically:

EU documentation relating to the ERA

ERAC Opinion on the ERA Roadmap 2015-2020, Brussels, 20 April 2015, ERAC 1208/15

Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions of 18 January 2000: Towards a European research area [COM (2000) 6 final - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Ai23010

Commission communication 'A Reinforced European Research Area Partnership for Excellence and Growth' (COM(2012)

Overview of the ERA and factsheet - https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_factsheet-era_2019.pdf

Conclusions on the definition of a "2020 Vision for the European Research Area" (2/12/2008).

Green paper 'The ERA: new perspectives', 2009

2015-2020, Doc. ERAC 1208/15, 20 April 2015: http://data.consilium.europa.eu/doc/document/ST-1208-2015-INIT/en/pdf

New ERA Communication - Brussels, 30.9.2020, COM(2020) 628 final, Commission Communication A new ERA for Research and Innovation

COMMISSION Staff Working Document accompanying the Commission Communication: A new ERA for Research and Innovation, SWD/2020/214 final

Council Conclusions

Council Conclusions of 2012 on "A Reinforced European Research Area Partnership for Excellence and Growth".

Conclusions of May 2015 on the "European Research Area Roadmap 2015-2020".

Conclusions of December 2015 on a "Review of the European Research Area advisory structure".

Conclusions of December 2015 on "Advancing gender equality in the European Research Area"

Council conclusions on the governance of the European Research Area, 2018, https://data.consilium.europa.eu/doc/document/ST-14989-2018-INIT/en/pdf

Conclusions of December 2017 "From the Interim Evaluation of Horizon 2020 towards the ninth Framework Programme".

Conclusions of 29 May 2018 on "Accelerating knowledge circulation in the EU", in which the Council expressed the importance of further advancing Open Access and Open Science policies within the FP and beyond.

Council conclusions on the European Research Area Roadmap 2015-2020 (9351/15).

Council conclusions on 'A Reinforced European Research Area Partnership for Excellence and Growth' (17649/12)

Council conclusions on the New European Research Area, Brussels, 1 December 2020 - https://data.consilium.europa.eu/doc/document/ST-13567-2020-INIT/en/pdf

Draft Council Conclusions on the future governance of the European Research Area (ERA) of 7 September 2021, Brussels 7 September 2021, https://data.consilium.europa.eu/doc/document/ST-11622-2021-INIT/en/pdf

Analysis of ERA implementation, history of the ERA and considerations on its future evolution

European Parliamentary Research Service (2016), European Research Area - Cost of Non-Europe Report; European Parliamentary Research Service (2016),

The European Research Area - Evolving concept - implementation challenge, In-depth Analysis.

ERA monitoring related activities

ERA roadmap 2015-2020.

First ERA progress report 2013

Second ERA progress report 2014 (comprised of the report and the facts and figures document)

Third ERA progress report, 2016

Fourth ERA progress report, 2018. The ERA monitoring mechanism (EMM), including the two-yearly ERA Progress Reports.

European Research Area (ERA) Progress Report - 2016-2018. - staff working document, technical report, monitoring handbook and the indicators tables. https://ec.europa.eu/info/research-and-innovation/strategy/era/progress-report_en ERA NAPs

ERA Monitoring Handbook, 2018. This provides methodological guidance on the calculation of indicators, on the documents review and on the interviews that were conducted for the ERA Monitoring 2018 publication. https://op.europa.eu/en/publication-detail/-/publication/26ea90f4-34c1-11e9-8d04-01aa75ed71a1/language-en

ERA-LEARN - monitoring of call implementation - https://www.era-learn.eu/support-for-p2ps/implementing-joint-calls/after-the-call/monitoring-of-call-implementation

Final report on monitoring ERA priorities with ERA Roadmap NAPs (September, 2020), Final version for ERAC Plenary, 10 Sept, 2020, Cecilia Cabello, rapporteur of the monitoring exercise

ERA Priority-specific documentation

Priority 1

European Commission (2019), Directorate-General for Research and Innovation, Policy paper by the Commission services, ERAC Plenary Meeting How to improve national Research and Innovation systems of Member States and Associated Countries.

European Commission, Directorate-General for Research and Innovation (2017). Research, innovation and economic growth - R&D policy reforms and strategies.

Adjusted Research Excellence Index 2020 - Methodology Report G Caperna, 2020, JRC Technical Report - https://ec.europa.eu/jrc/en/publication/adjusted-research-excellence-index-2020-methodology-report

Priority 2a

Monitoring tool to assess progress in implementation of Priority 2a (developed by the GPC SWG)

European Commission (2016) Directorate-General for Research and Innovation, Analysis of ERA-NET Cofund actions under Horizon 2020, Final report of the expert group, Niels Gøtke (Chairperson), Effie Amanatidou (Rapporteur), Ioana Ispas, Daria Julkowska, Joaquín Serrano

Priority 2b

ESFRI (2020), MAKING SCIENCE HAPPEN, A new ambition for Research Infrastructures in the European Research Area, ESFRI WHITE PAPER

ESFRI (2010) Strategy report on research infrastructures roadmap - https://ec.europa.eu/research/infrastructures/pdf/esfri-strategy_report_and_roadmap.pdf

European Commission (2010), Directorate-General for Research and Innovation, A vision for strengthening world-class research infrastructures in the ERA, Report of the Expert Group on Research Infrastructures

European Commission (2016), European Charter for Access to Research Infrastructures, https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf

ESFRI (2018) Strategy Report and Roadmap 2018 on Research Infrastructures

CERIC (2020), Contribution of Research Infrastructures to the Renewed European Research Area

ESFRI (2021) Strategy report on Research Infrastructures - Roadmap 2021 and Project Monitoring Questionnaire

Priority 3

The European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (2005)

The Human Resources Strategy for Researchers (HRS4R) [8]

ERA Priority 3 study for DG RTD (CSES). Study ongoing. Full title “Taking stock, evaluating the achievements and identifying the way forward for the ERA Priority 3 policy measures with a focus on European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (C&C), the Human Resources Strategy for Researchers (HRS4R) and EURAXESS”

Studies within the EURAXESS Services network [9]

European Commission (2017), Directorate-General for Research and Innovation, Evaluation of Research Careers fully acknowledging Open Science Practices Rewards, incentives and/or recognition for researchers practicing Open Science

Priority 4

SHE Figures 2018, 2015, 2012

European Commission (2018-2020), Directorate-General for Justice, Consumers and Gender Equality, Annual report on equality between women and men (2020, 2019, 2018)

ERAC Standing Working Group on Gender in Research and Innovation (2020), Report on the Implementation of Targets: Follow-Up on the 2018 Guidance Recommendations, of the ERAC Standing Working Group on Gender in Research and Innovation.

GenderactionEU (2018) GENDer equality in the ERA Community To Innovate policy implementatiON), Horizon 2020 Project. Two relevant reports:

- Report on national roadmaps and mechanisms in ERA Priority 4
- Monitoring of ERA priority 4 implementation

Priority 5

European Commission (2020) Directorate-General for Research and Innovation, Progress on Open Science: Towards a Shared Research Knowledge System Final Report of the Open Science Policy Platform

European Commission (2017), Directorate-General for Research and Innovation, Evaluation of Research Careers fully acknowledging Open Science Practices Rewards, incentives and/or recognition for researchers practicing Open Science

Priority 6

European Commission (2019), Mutual Learning Exercise (MLE) on International Cooperation. has started an MLE (Mutual Learning Exercise) on National Strategies and Roadmaps for International Cooperation in Research and Innovation with 15 participating countries. The MLE is part of the Horizon 2020 Policy Support Facility. See https://rio.jrc.ec.europa.eu/policy-support-facility/mle-national-strategies-and-roadmaps-international-cooperation-research-and

MLE on National Strategies and Roadmaps for International Cooperation in Research and Innovation: factsheet

Stakeholder inputs to the future evolution and revitalisation of the ERA

ERAC opinion on the ERA Roadmap, 24 January 2020. As the ERAC consists of high-level representatives from the MS, their views on the future ERA are of crucial importance.

The Helsinki call for action. This resulted from the Finnish Presidency conference on 'Research and Innovation Excellence through gender equality: New pathways and challenges' held on 23-2' October 2019 stressed the need for gender equality and gender mainstreaming to be embedded in the core of the future ERA.

Inputs from the university networks, such as LERU and the Guild, who have actively been contributing to a process of ongoing policy debate relating to the future of universities, which is one important aspect among others of the future ERA Communication.

National documentation

Country profiles 2018 within the ERA Progress Report.

Strategy of the Federal Government on_the_European_Research Area - Guidelines and national roadmap (Germany).

Federal Government Report on International Cooperation in Education, Science and Research 2017–2018, Political summary.

Annex 9: Online Survey Questionnaire

Centre for Strategy & Evaluation Services

Study to evaluate the ERA policy framework/ERA monitoring mechanism: data gathering and analysis of policy developments and reforms

Introduction

The study objectives are, in summary, to:

- Evaluate the European Research Area (ERA) policy framework's efficiency and effectiveness in 2015-2020, including its role in promoting ERA implementation at national level and in stimulating policy reforms in Member States, and the monitoring system;
- Contribute to the political process by assisting the Commission, Member States and stakeholders participating in ERA governance to design and co-create a future ERA policy framework; and
- Deliver evidence-based proposals and recommendations to monitor progress towards the new ERA's strategic objectives as part of a future ERA policy framework and monitoring and indicator system ("ERA Scoreboard").

The launch of the new ERA provides an opportunity for stocktaking, to assess lessons learned and to look to the future.

Why we need your help

We would appreciate your participation in the survey, since this study will need to deliver evidence-based proposals and recommendations regarding the scope to adapt and improve the ERA policy framework and monitoring system in future to ensure its fitness for purpose.

The survey will complement other data-gathering tools (e.g. desk research, interview programme). The survey aims to ensure that as wide a spectrum of stakeholders as possible can provide input.

A letter of introduction from DG Research and Innovation, Unit G1 of the European Commission can be found here.

Completion instructions

- The survey can be accessed via the link provided which has a unique identifier code. This feature also allows those completing the survey to return to the survey if they are unable to complete the survey in a single session.
- The response is automatically saved on completion of each page, so there is no need to enter any information twice.

  The questionnaire should take no longer than 15-20 minutes to complete.

  The majority of the closed questions are mandatory to complete. It is optional for respondents to elaborate on their initial responses in the comment boxes included throughout the questionnaire.

  All responses will be treated anonymously and in line with GDPR.

  If you need any support when completing the questionnaire, or have questions about the survey or study more generally, please contact Lisa Ensor (lensor@cses.co.uk) for technical support or study team director Mark Whittle (mwhittle@cses.co.uk).

Thank you for your valuable contribution!

Centre for Strategy & Evaluation Services

Study to evaluate the ERA policy framework/ERA monitoring mechanism: data gathering and analysis of policy developments and reforms

Information about the respondent

*** 1. To enter the survey, you must express your agreement with the statement on data protection and privacy relating to this survey, which is available here.**

All survey data will be analysed anonymously and kept confidential. Your personal data will be kept only for the time necessary to fulfil the purpose of collection or further processing.

We care about your data protection rights, so if you do not agree with the statement, you will exit the survey and no personal data will be collected.

The Data Controller for this study is the European Commission, Directorate-General for Research and Innovation, Unit ERA & country intelligence (RTD.G.1) until 31 March 2021. From 1 April 2021 onwards, Directorate A, Unit ERA Governance and Implementation (RTD.A.2). They can be contacted via the functional email: RTD-STUDY-ERA-POLICY-FRAMEWORK@ec.europa.eu

- ◯ I AGREE with the statement on data protection and privacy relating to this survey
- ◯ I DO NOT AGREE with the statement on data protection and privacy relating to this survey (EXIT SURVEY)

Centre for Strategy & Evaluation Services

European Commission

Study to evaluate the ERA policy framework/ERA monitoring mechanism: data gathering and analysis of policy developments and reforms

Information about the respondent

*** 2. Please describe the type of organisation which you represent (or individual).**

- ○ National policy making organisation with responsibility for RTDI
- ○ Regional policy making organisation with responsibility for RTDI
- ○ Organisation responsible for national R&I policies and programme development
- ○ National or sectoral association focused on science, research and innovation and higher education (e.g. rectors conference)
- ○ EU association focused on science, research and innovation and higher education (e.g., EUA, LERU, CAESAR)
- ○ Individual expert, academic or researcher
- ○ Other type of organisation

*** 3. Please tell us in which country your organisation (mainly) operates**

*** 4. In order to provide background information regarding the nature and extent of your involvement in the implementation of the ERA in 2015-2020, please indicate your relevant involvement.'**

- ☐ ERAC member / national representative on EU R&I policy
- ☐ H2020 national delegate e.g. in Horizon 2020 Programme Committee
- ☐ Member of H2020 Expert Group
- ☐ None of the above

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Study to evaluate the ERA policy framework/ERA monitoring mechanism: data gathering and analysis of policy developments and reforms

ERA policy framework in 2015-2020

*** 5. In your view, to what extent were the six priorities incorporated into the ERA Roadmap 2015-2020 process relevant to identified needs at the time at national level in the country in which you are located?**

	Very relevant	Somewhat relevant	Neutral	Not relevant	Don't know
P1 - More effective national research systems	○	○	○	○	○
P2 - Optimal transnational cooperation and competition	○	○	○	○	○
P2a - Jointly addressing grand challenges (joint programming)	○	○	○	○	○
P2b - European research infrastructures	○	○	○	○	○
P3 - An open labour market for researchers	○	○	○	○	○
P4 - Gender equality and gender mainstreaming in research	○	○	○	○	○
P5 - Optimal circulation, access to and transfer of scientific knowledge	○	○	○	○	○

	Very relevant	Somewhat relevant	Neutral	Not relevant	Don't know
(5a) Knowledge transfer/uptake and strengthening links between public/private sector - open innovation, access to digital access services (digital ERA)	○	○	○	○	○
(5b) Open access to scientific publications and research data (open science)	○	○	○	○	○
P6 - International cooperation	○	○	○	○	○

Please explain your response further if you wish to do so:

*** 6. To what extent was there stakeholder buy-in at national and regional level to the ERA Roadmap process? Please differentiate between 1) the development of the 2016 ERA national action plans (NAPs) and 2) NAP implementation.**

	Very high stakeholder buy in	High stakeholder buy in	Mixed levels of buy in among stakeholders	Low level of stakeholder buy in	Don't know
NAP development	○	○	○	○	○
NAP implementation	○	○	○	○	○

Please explain your response below if you wish to do so:

*** 7. In your opinion, how effective has the ERA Roadmap process been overall as a coordination mechanism for countries to ensure active Member State/ Associated Country participation in contributing towards the achievement of ERA policy objectives?**

- ○ Very effective
- ○ Somewhat effective
- ○ Neutral
- ○ Not effective
- ○ Don't know

*** 8. In your opinion, how far – if at all – has the ERA Roadmap process in 2015-2020 had an impact in shaping the formulation and implementation of national R&I policies generally?**

	To a large extent	To some extent	To a limited extent	Not at all	Don't know
Formulation of national R&I policies	◯	◯	◯	◯	◯
Implementation of national R&I policies	◯	◯	◯	◯	◯
Aligning the ERA priorities and integrating them into national R&I policies	◯	◯	◯	◯	◯

*** 9. In your opinion, how far – if at all – has the ERA Roadmap had an impact on other elements of R&I at national level?**

	Considerable positive impact	Some positive impact (e.g. on a few actors)	No difference	Negative impact	Don't know
National R&I performance	◯	◯	◯	◯	◯
National innovation performance (e.g. in the annual EIS)	◯	◯	◯	◯	◯
Promoting reforms of national systems and structures	◯	◯	◯	◯	◯
Promoting interest in reforming national R&I policies	◯	◯	◯	◯	◯

10. Please comment on your response above.

Has the ERA stimulated reforms of national R&I policies? How far has it strengthened the effectiveness of national systems and structures, and how? What role has the ERA Roadmap process played?

*** 11. To what extent were the following national-specific drivers in place at the start of the implementation of the new ERA policy framework in 2015 to facilitate the process?**

	To a large extent	To some extent	To a limited extent	Not at all	Don't know
Ready availability of national R&I strategies and action plans	○	○	○	○	○
High policy attention and political commitment to the ERA	○	○	○	○	○
Availability of financial resources	○	○	○	○	○
Availability of human resources	○	○	○	○	○
Level of personal commitment of ERAC national delegates on working groups	○	○	○	○	○
Presence of a suitable legal framework	○	○	○	○	○

Please comment on what were the main drivers.

*** 12. To what extent were there national-specific barriers at the start of the implementation of the new ERA policy framework in 2015 which made the NAP development process more challenging?**

	To a large extent	To some extent	To a limited extent	Not at all	Don't know
Non-availability or non-timeliness of national R&I strategies and action plans to integrate into NAPs	○	○	○	○	○
Lack of policy attention and political commitment to the ERA	○	○	○	○	○
Lack of financial resources	○	○	○	○	○
Lack of human resources	○	○	○	○	○
Absence of personal commitment of ERAC national delegates on working groups	○	○	○	○	○
Absence of a suitable legal framework	○	○	○	○	○

Please comment on what were the main barriers.

*** 13. During ERA Roadmap implementation in 2015-2020 , how important were the following factors at national level in shaping whether measures and actions identified in the NAPs went ahead or not?**

	Very important	Quite important	Neutral	Not important	Don't know
Degree of policy attention and political commitment to the ERA	○	○	○	○	○
Prevailing national R&I policy framework in 2015-2020	○	○	○	○	○
Prevailing legal framework in 2015-2020	○	○	○	○	○
Extent of availability of financial resources in 2015-20	○	○	○	○	○
Extent of availability of human resources 2015-2020	○	○	○	○	○
Cultural openness to the ERA priorities at national level 2015-2020	○	○	○	○	○

14. Can you provide any examples of incentives that may have encouraged the Member States and Associated Countries to implement ERA-relevant measures?

- ○ Yes
- ○ No
- ○ Don't know

If yes, what were these incentives and how effective were they?

*** 15. In your assessment, how effective were the ERA governance arrangements in the 2015-2020 period in supporting the Roadmap's implementation?**

- ○ Very effective
- ○ Somewhat effective
- ○ Neutral
- ○ Not effective
- ○ Don't know

Centre for Strategy & Evaluation Services

Study to evaluate the ERA policy framework/ERA monitoring mechanism: data gathering and analysis of policy developments and reforms

The ERA Monitoring System in 2015-2020 and updating the future monitoring and indicator system

This section is concerned with the effectiveness of the 2015-2020 ERA Monitoring System, potential improvements and lessons learned. Considerations relating to taking into account the new ERA Communication priorities, and issues relating to the design of a future ERA monitoring system and ERA Scoreboard are considered.

*** 16. In your opinion, how effective was the ERA Monitoring Mechanism (EMM) function overall in the 2015-2020 period?**

- ◯ Very effective
- ◯ Somewhat effective
- ◯ Neutral
- ◯ Not effective
- ◯ Don't know

17. In your opinion, were there any aspects that were ineffective?

- ◯ Yes
- ◯ No
- ◯ Don't know

Please explain your response:

*** 18. The EMM in 2015-2020 had 24 indicators across 6 ERA priorities (an input, output, outcome and headline indicator). The complete set of indicators is available here.**

Overall, was the number of indicators proportionate?

- ◯ Yes
- ◯ No
- ◯ Don't know

Please explain your response:

*** 19. How useful are the following types of indicators in the view of your country or organisation?**

	1 - Most useful	2 - Useful	3 - Somewhat useful	4 - Not useful at all	5 - Don't know
Operational indicators (directly measuring activities)	◯	◯	◯	◯	◯
Proxy indicators (indirect indicators of impact not necessarily directly linked to activities)	◯	◯	◯	◯	◯
Both operational and proxy indicators	◯	◯	◯	◯	◯

Please explain your response if you wish to do so.

*** 20. Are there any among the existing set of 24 indicators that have now become obsolescent?**

- ◯ Yes
- ◯ No
- ◯ Don't know

If yes, can you provide any examples?

21. How would you improve on the existing monitoring system in future?

*** 22. To what extent does the new ERA Communication (30th September 2020) require changes to the ERA monitoring and reporting process? In particular:**

	To a large extent	To some extent	No change	Don't know
Updating the ERA policy framework and ERA Roadmap	○	○	○	○
Aligning the former ERA priorities (operational in nature) with the strategic priorities in the new ERA	○	○	○	○
Updating and making adjustments to the set of indicators in the EMM to reflect the four new strategic ERA priorities	○	○	○	○
Updating the indicators to reflect changes in the six former ERA priorities (e.g. to reflect evolution in activities and initiatives)	○	○	○	○
Updating the indicators to integrate broader EU policy priorities e.g. the dual digital and green transitions.	○	○	○	○

*** 23. In your opinion, to what extent can R&I performance at country level (e.g. in Member States and Associated Countries) be directly compared through a monitoring system?**

- ◯ To a large extent
- ◯ To some extent
- ◯ No change
- ◯ Don't know

Please explain your response to the above question. For example, does comparability vary across the ERA priorities? Are there any limitations regarding comparative assessment, e.g. country-specific contextual factors?

*** 24. In your opinion, to what extent should the indicators measure and monitor the following?**

	To a large extent	To some extent	No change	Don't know
Strategic progress towards ERA priorities and objectives	◯	◯	◯	◯
Operational activities supported to help implement ERA	◯	◯	◯	◯

25. How best can a balance be struck between continuity and change in the monitoring and indicator system to reflect the new ERA priorities, continued relevance of the former ERA priorities, etc.?

The new ERA priorities are:

- **Prioritising investments and reforms:**
- **Improving access to excellence:**
- **Translating R&I results into the economy:**
- **Deepening the ERA**

26. What are the advantages and disadvantages of an ERA Scoreboard approach in your view? Do you have any suggestions as to how the ERA Scoreboard could be implemented in an optimal way?

27. In planning for a future ERA Scoreboard, which other scoreboards could provide good practice examples (e.g. European Innovation Scoreboard (EIS), Digital Economy Scoreboard (DESI), blue economy, others)?

28. How can the ERA Scoreboard be differentiated from other existing scoreboards (e.g. European Innovation Scoreboard, EU Industrial R&D Investment Scoreboard)

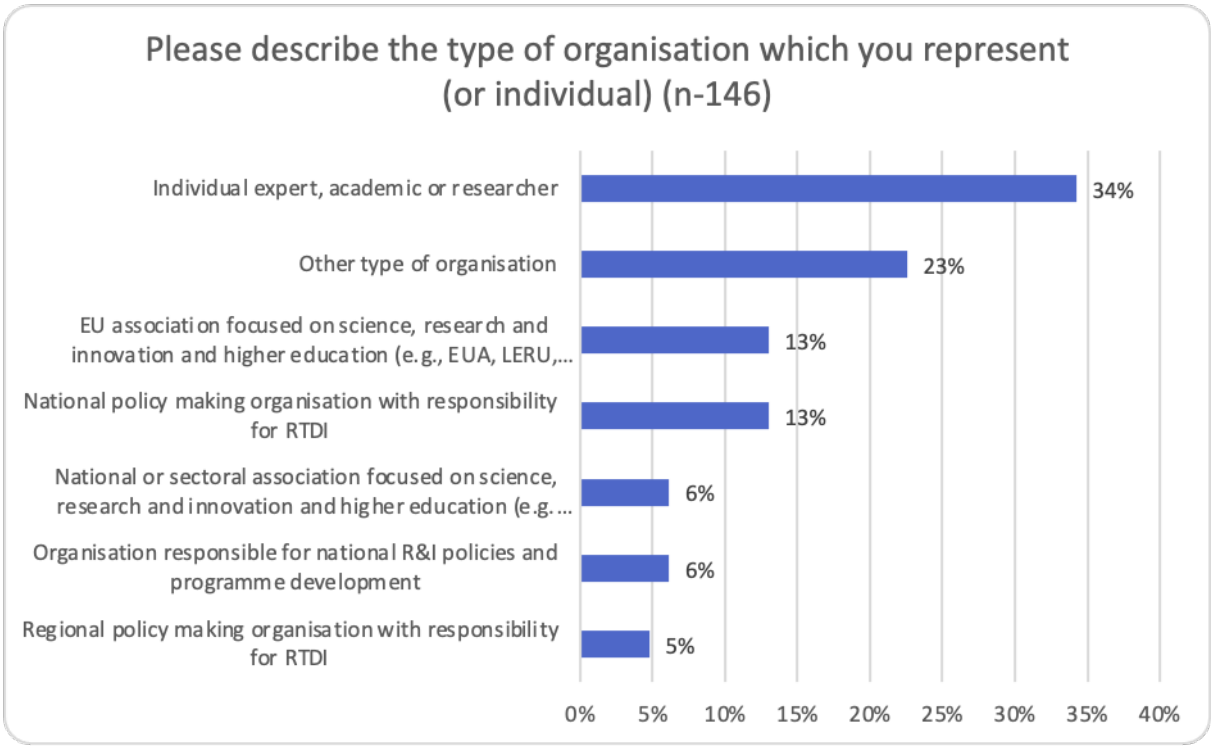
29. Would you be willing to discuss your responses in a brief follow-up interview?

If yes, please provide your contact details below. They will be processed in line with the data protection and confidentiality requirements set out in the GDPR (2016/679) and in accordance with Regulation 2018/1725 setting out rules on the processing of personal data by European Union institutions, bodies, offices and agencies.

Thank you very much for your input!

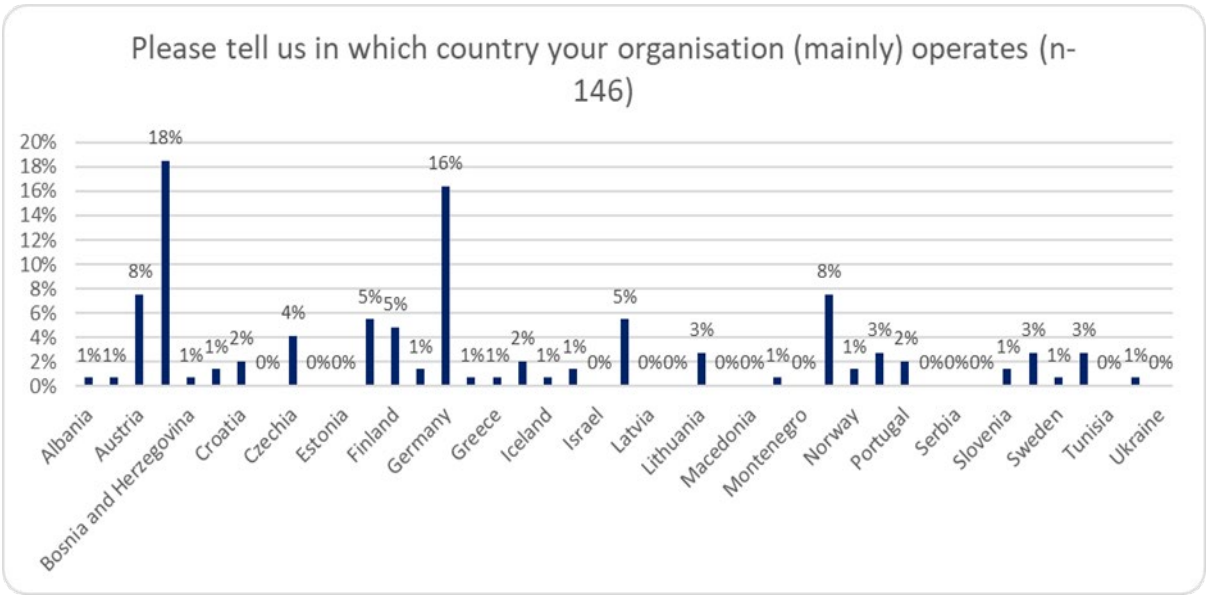
Annex 10: Online Survey Responses

Q2: Please describe the type of organisation which you represent (or individual).



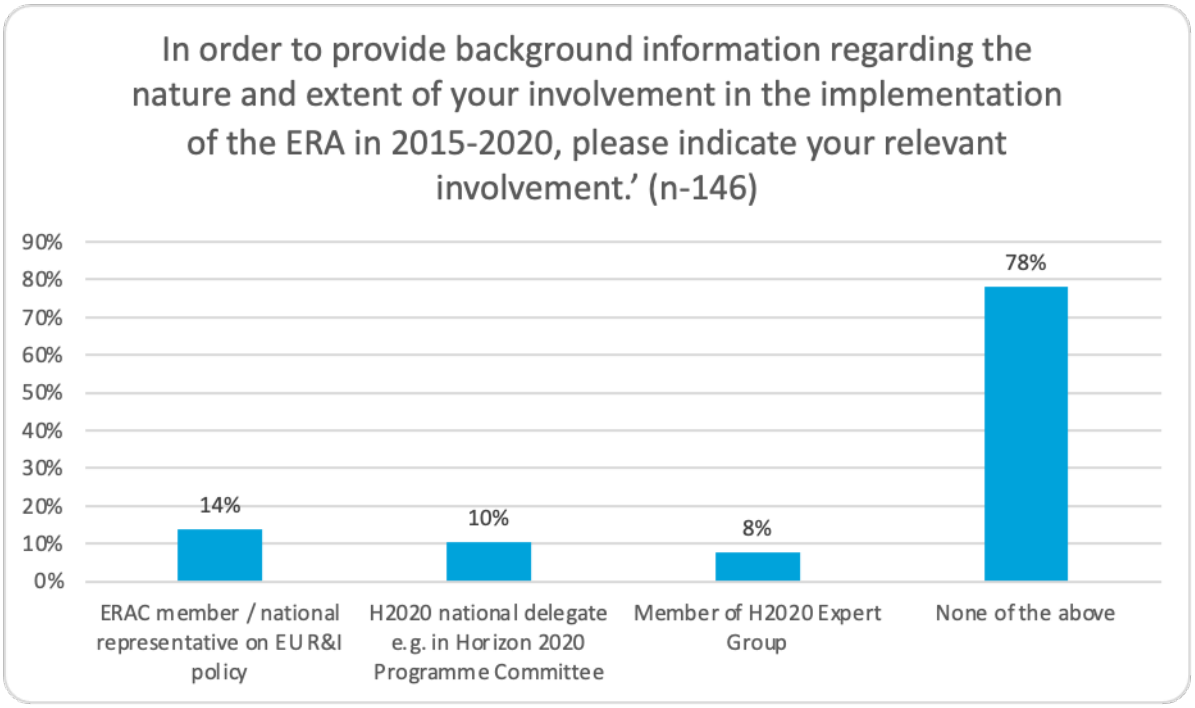
Source: CSES online survey

Q3: Please tell us in which country your organisation (mainly) operates



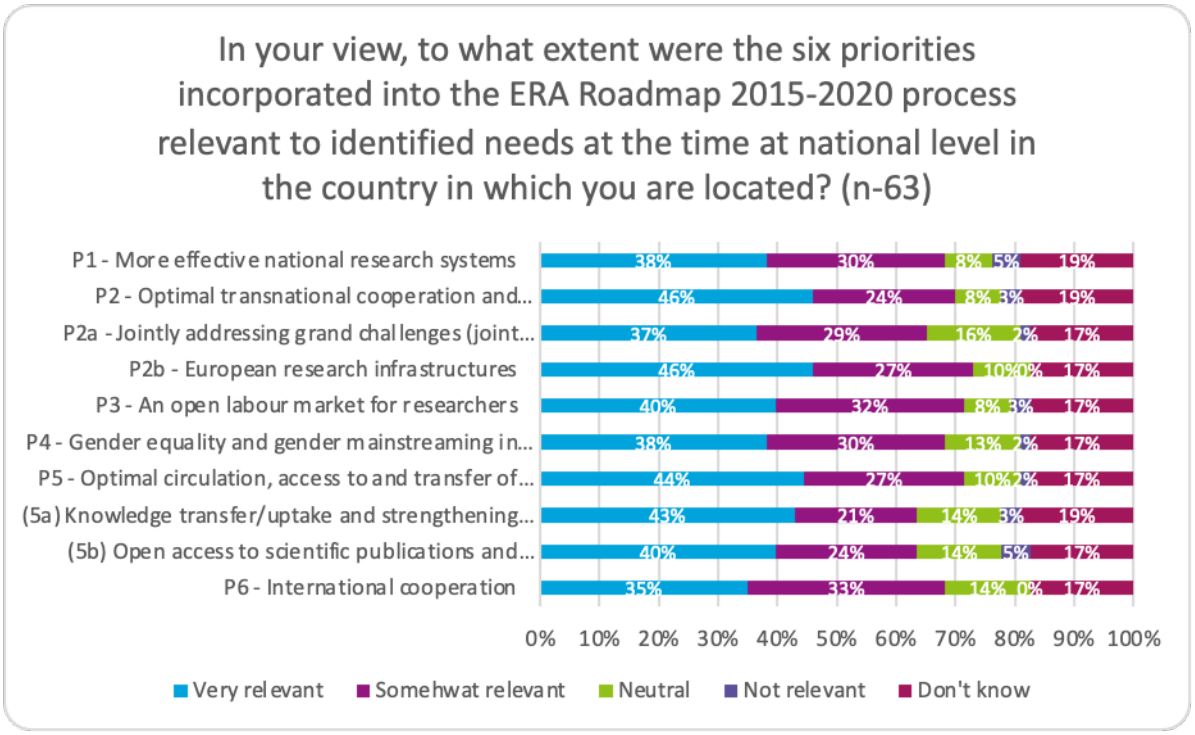
Source: CSES online survey

Q4: In order to provide background information regarding the nature and extent of your involvement in the implementation of the ERA in 2015-2020, please indicate your relevant involvement.'



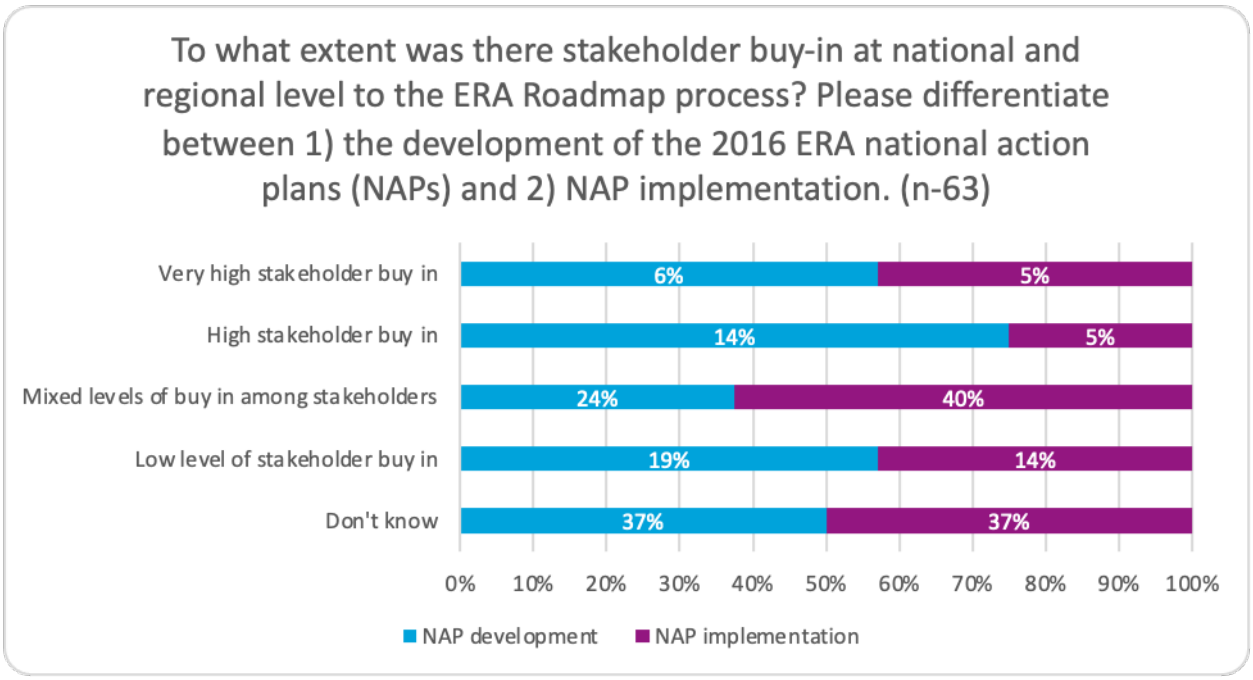
Source: CSES online survey

Q5: In your view, to what extent were the six priorities incorporated into the ERA Roadmap 2015-2020 process relevant to identified needs at the time at national level in the country in which you are located?



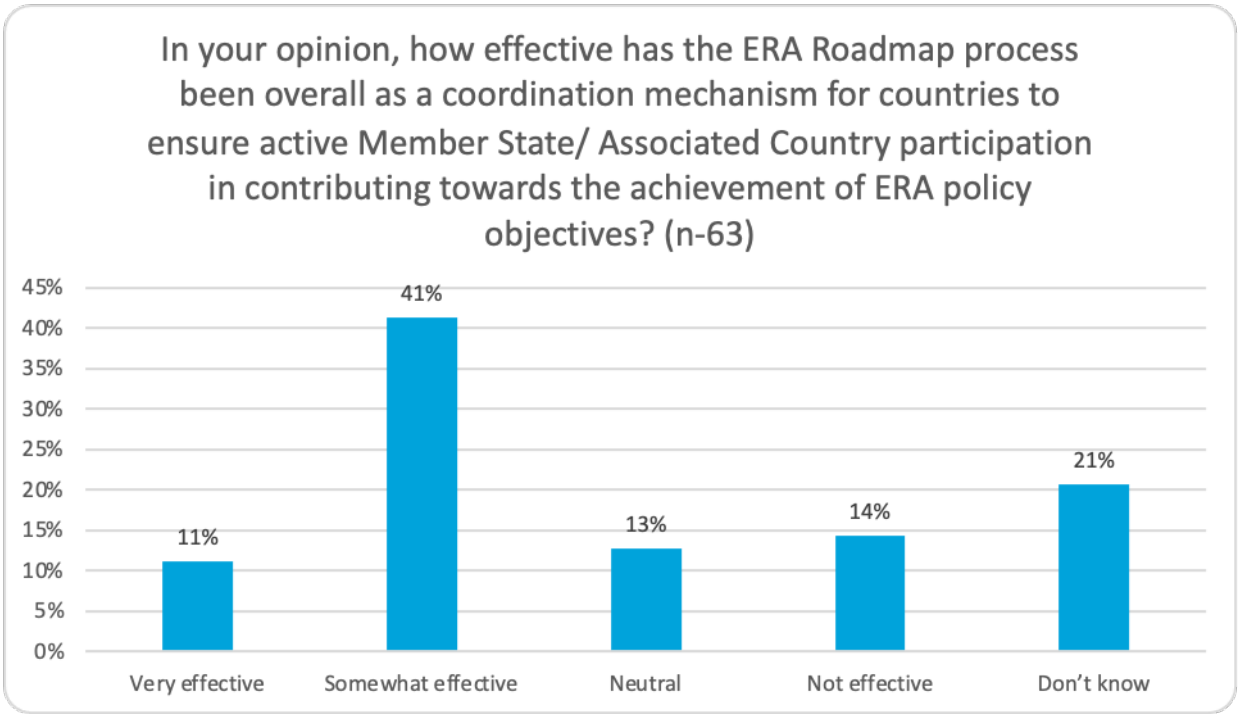
Source: CSES online survey

Q6: To what extent was there stakeholder buy-in at national and regional level to the ERA Roadmap process? Please differentiate between 1) the development of the 2016 ERA national action plans (NAPs) and 2) NAP implementation.



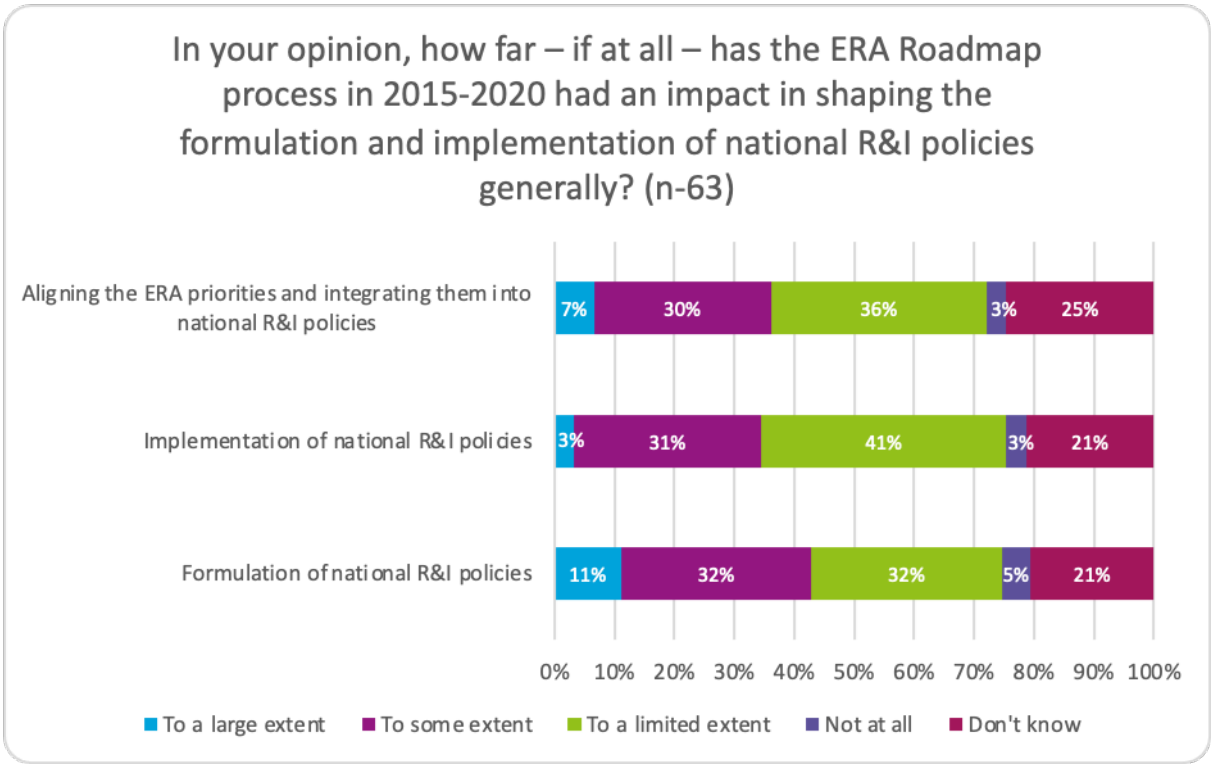
Source: CSES online survey

Q7: In your opinion, how effective has the ERA Roadmap process been overall as a coordination mechanism for countries to ensure active Member State/ Associated Country participation in contributing towards the achievement of ERA policy objectives?



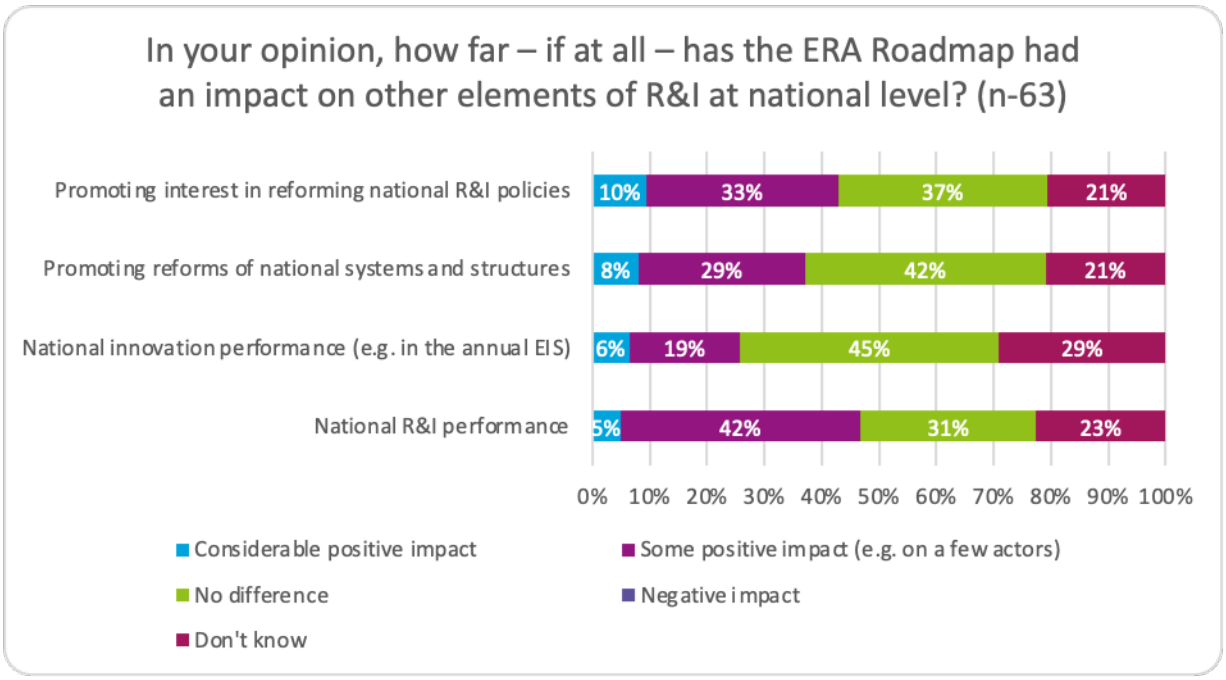
Source: CSES online survey

Q8: In your opinion, how far – if at all – has the ERA Roadmap process in 2015-2020 had an impact in shaping the formulation and implementation of national R&I policies generally?



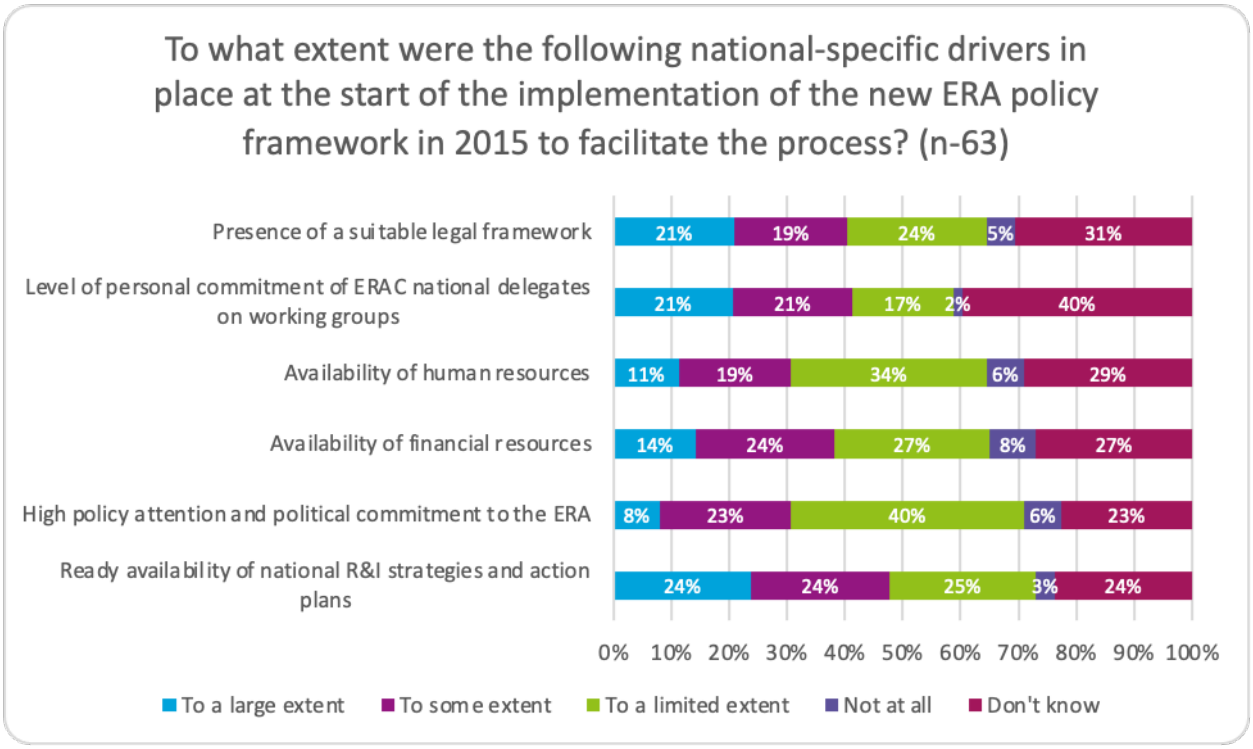
Source: CSES online survey

Q9: In your opinion, how far – if at all – has the ERA Roadmap had an impact on other elements of R&I at national level?



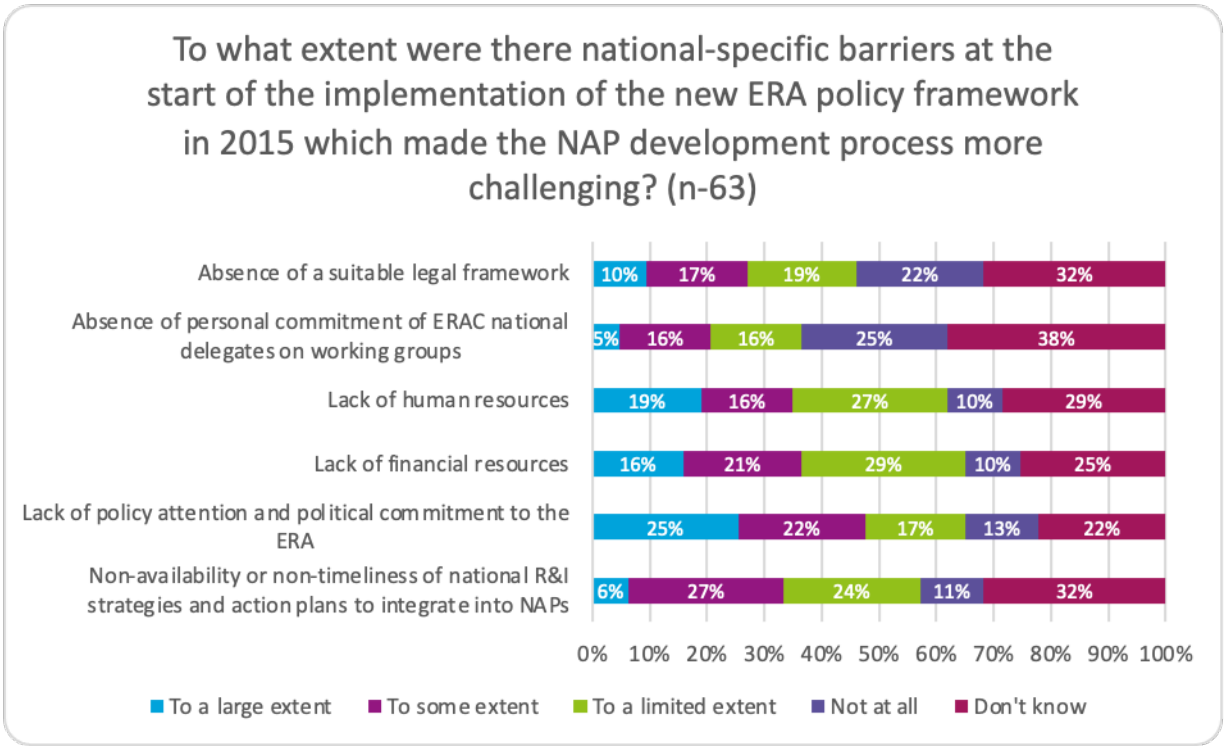
Source: CSES online survey

Q11: To what extent were the following national-specific drivers in place at the start of the implementation of the new ERA policy framework in 2015 to facilitate the process?



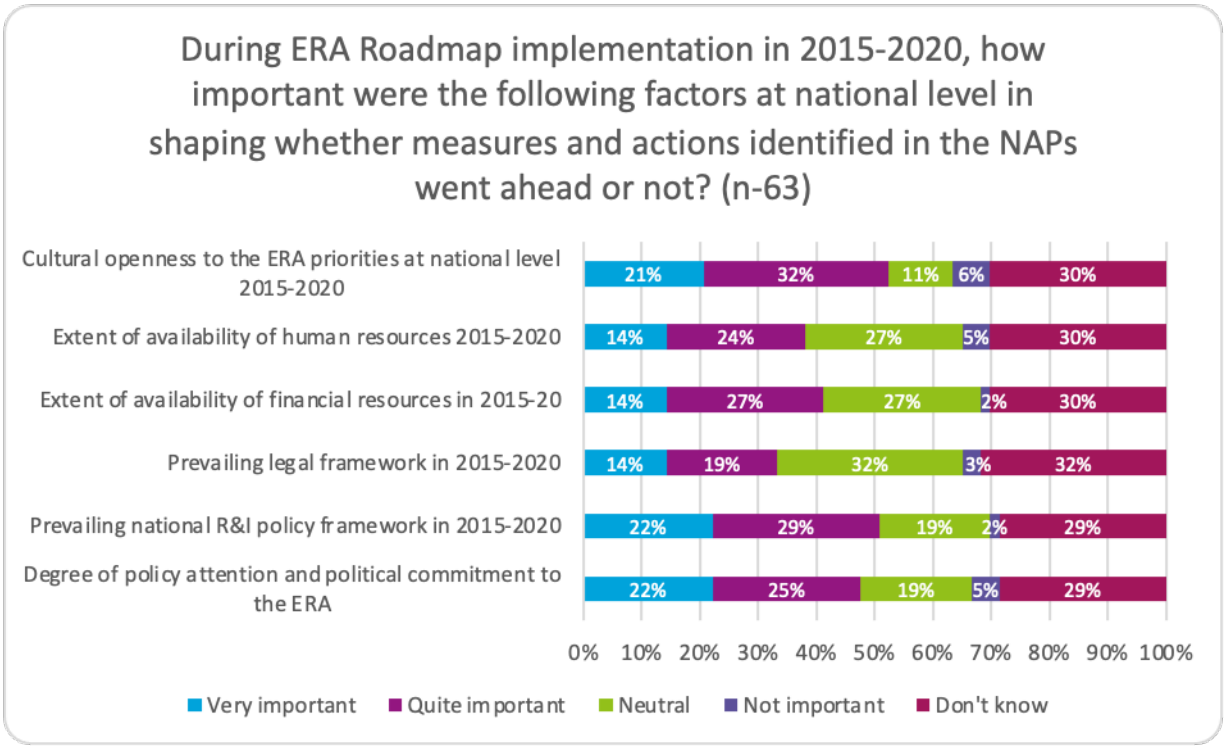
Source: CSES online survey

Q12: To what extent were there national-specific barriers at the start of the implementation of the new ERA policy framework in 2015 which made the NAP development process more challenging?



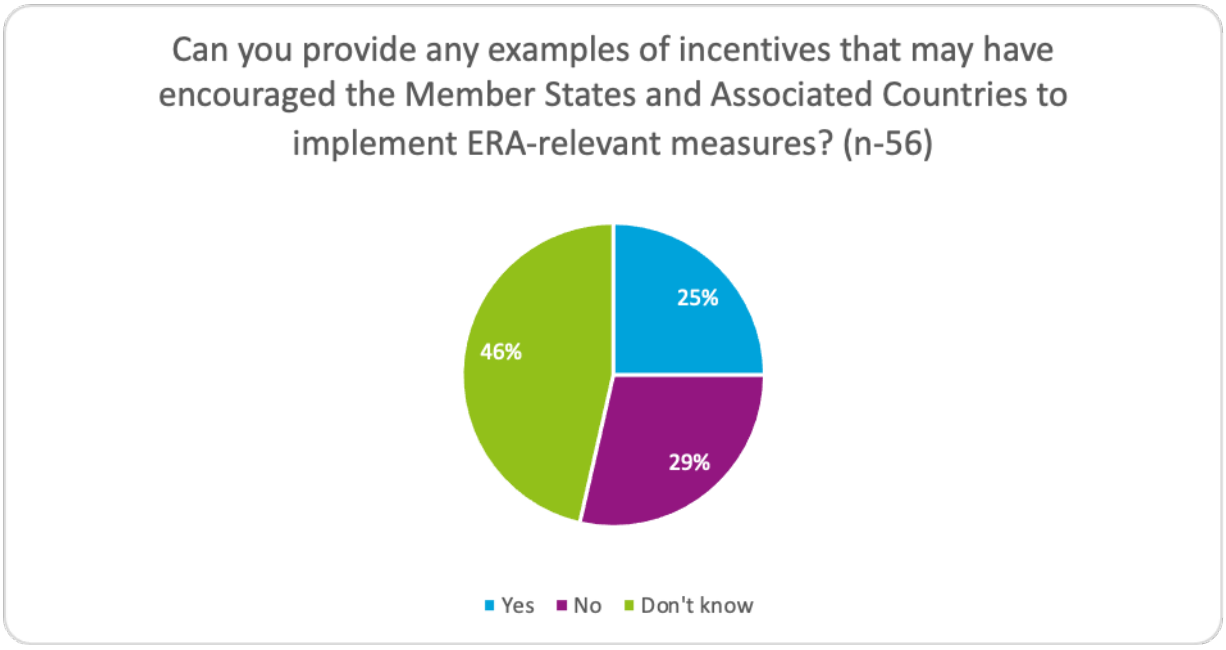
Source: CSES online survey

Q13: During ERA Roadmap implementation in 2015-2020, how important were the following factors at national level in shaping whether measures and actions identified in the NAPs went ahead or not?



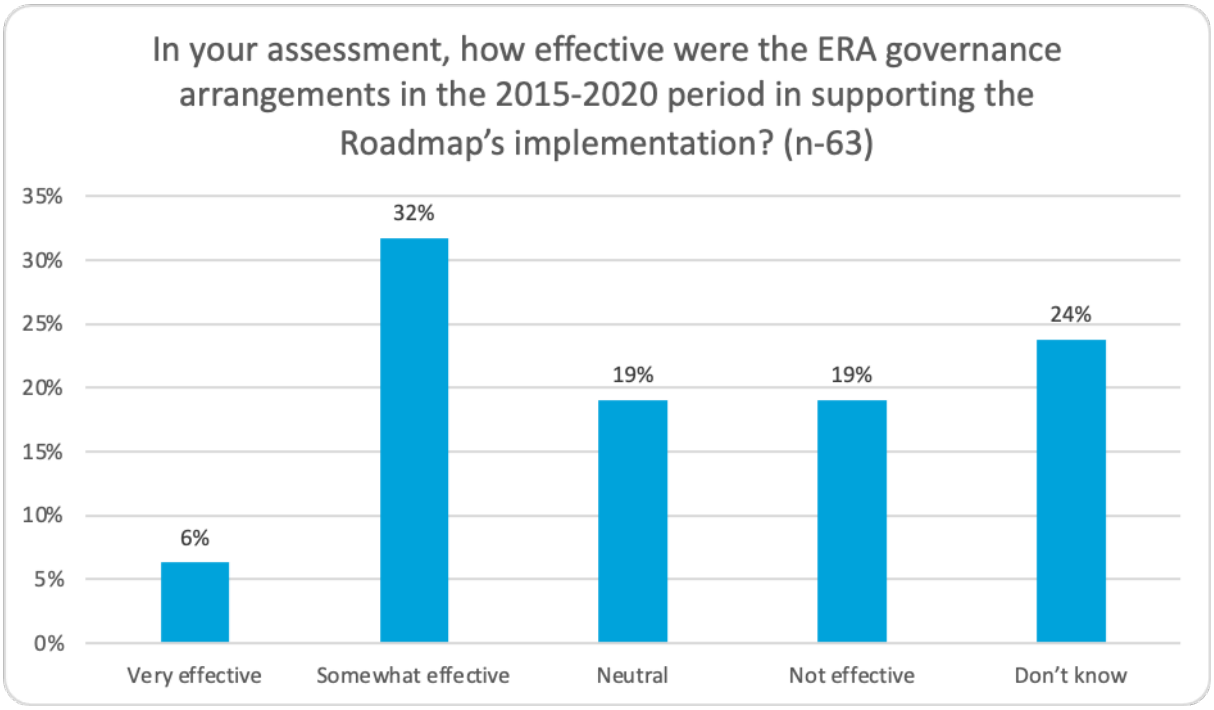
Source: CSES online survey

Q14: Can you provide any examples of incentives that may have encouraged the Member States and Associated Countries to implement ERA-relevant measures?



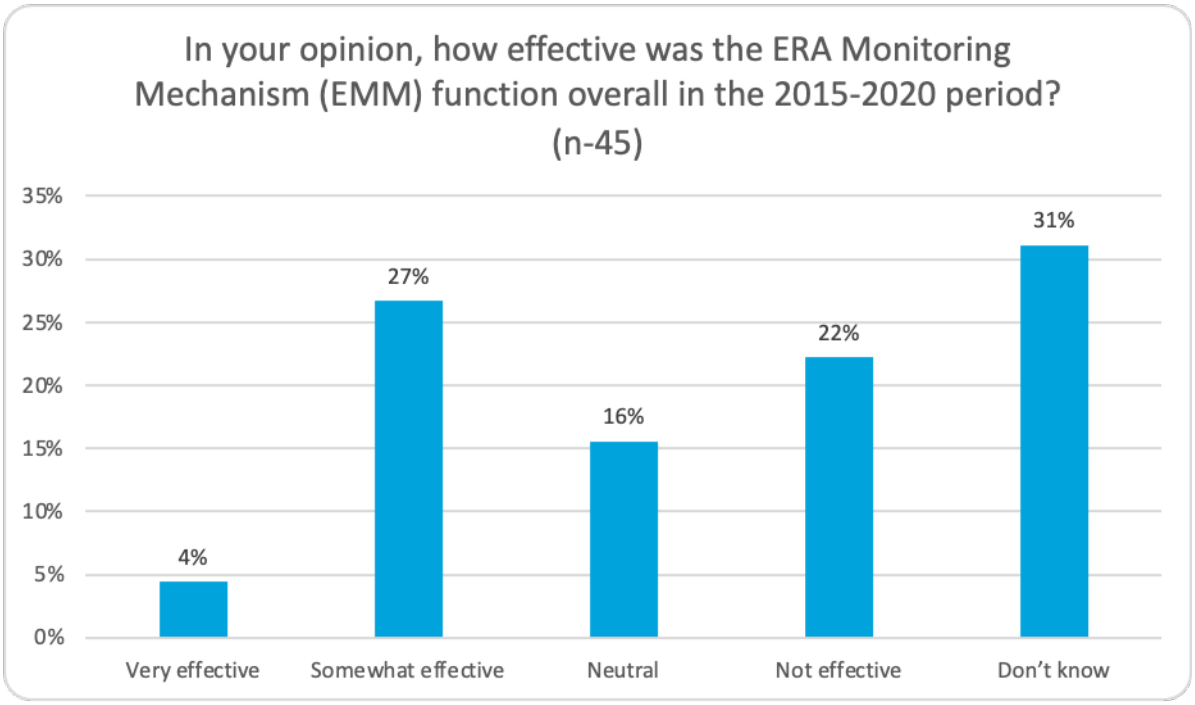
Source: CSES online survey

Q15: In your assessment, how effective were the ERA governance arrangements in the 2015-2020 period in supporting the Roadmap's implementation?



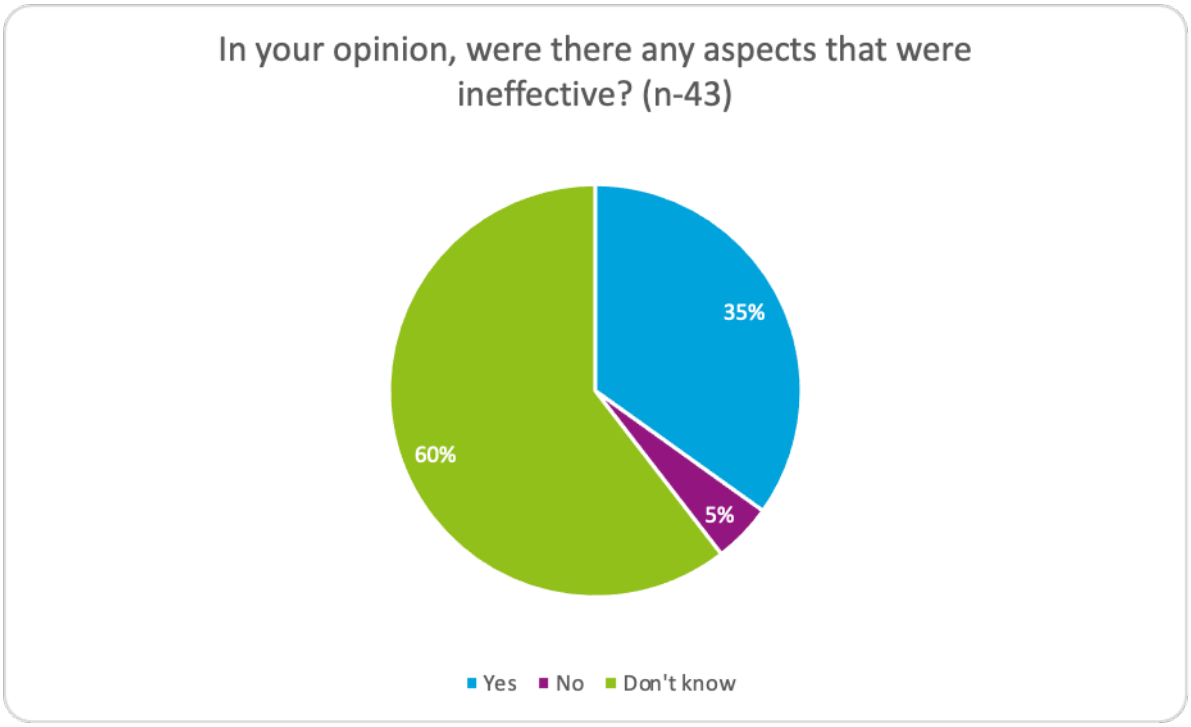
Source: CSES online survey

Q16: In your opinion, how effective was the ERA Monitoring Mechanism (EMM) function overall in the 2015-2020 period?



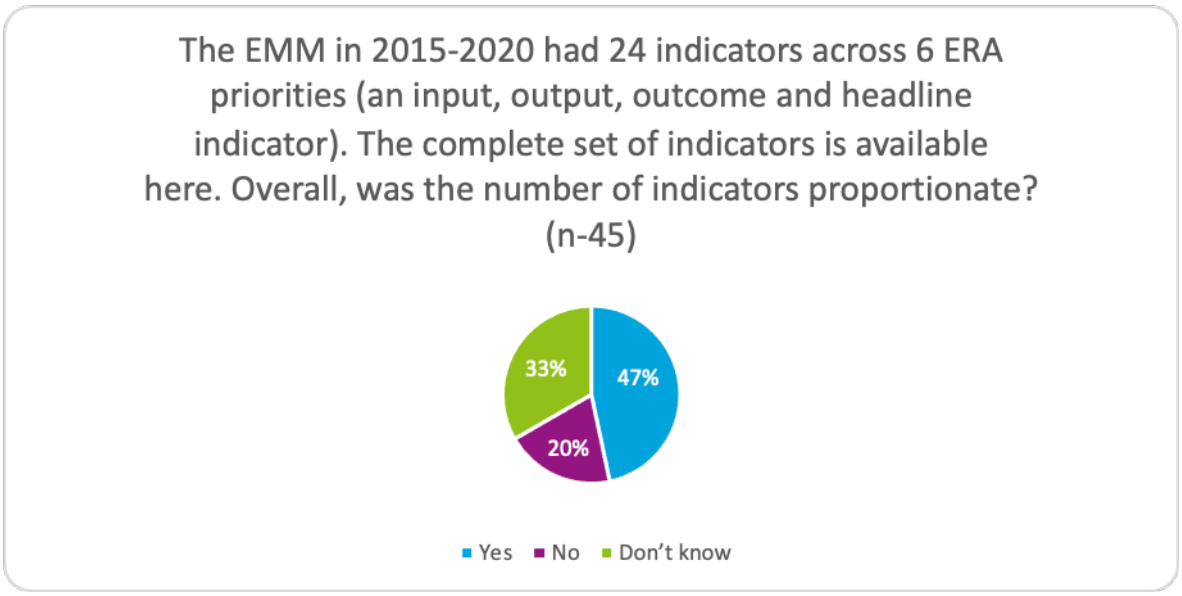
Source: CSES online survey

Q17: In your opinion, were there any aspects that were ineffective?



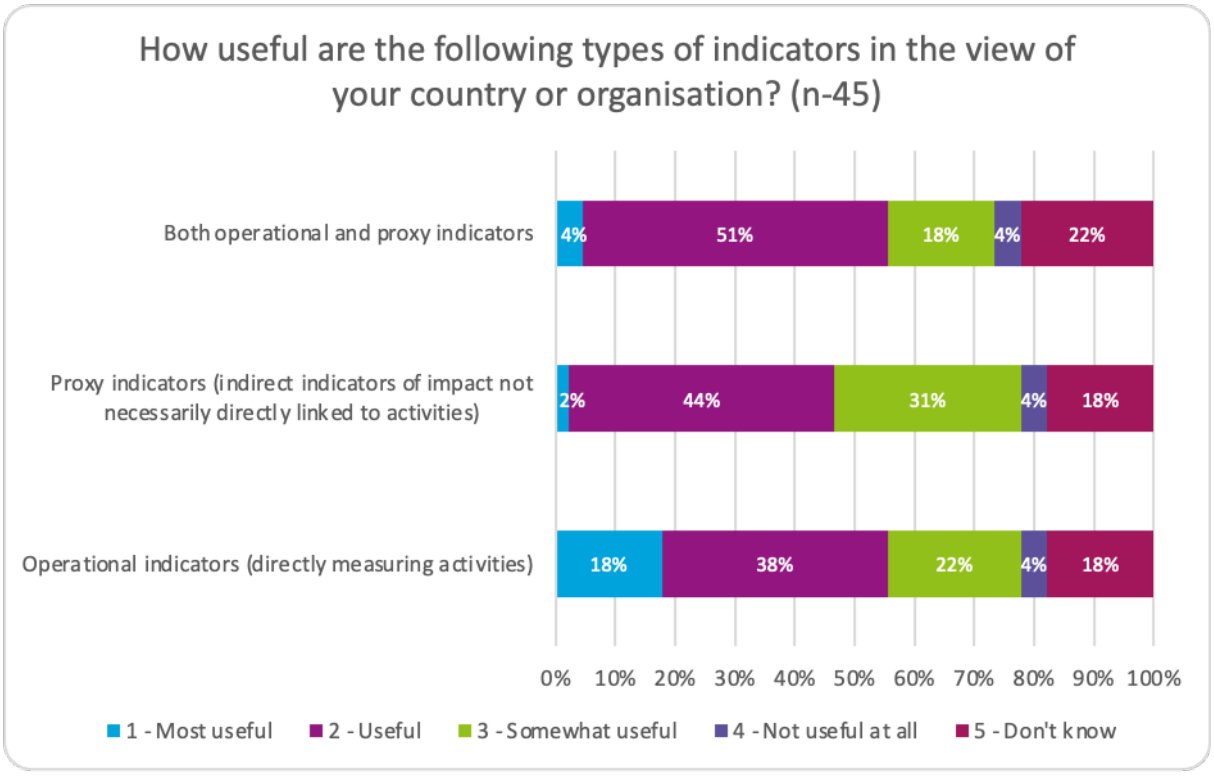
Source: CSES online survey

Q18: The EMM in 2015-2020 had 24 indicators across 6 ERA priorities (an input, output, outcome and headline indicator). The complete set of indicators is available here. Overall, was the number of indicators proportionate?



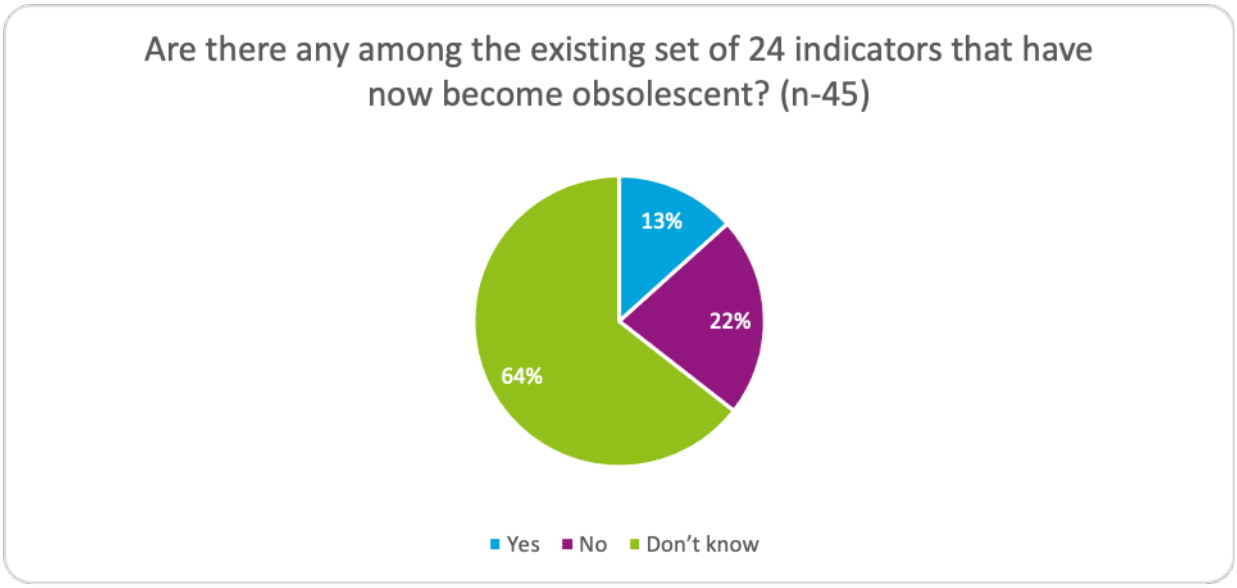
Source: CSES online survey

Q19: How useful are the following types of indicators in the view of your country or organisation?



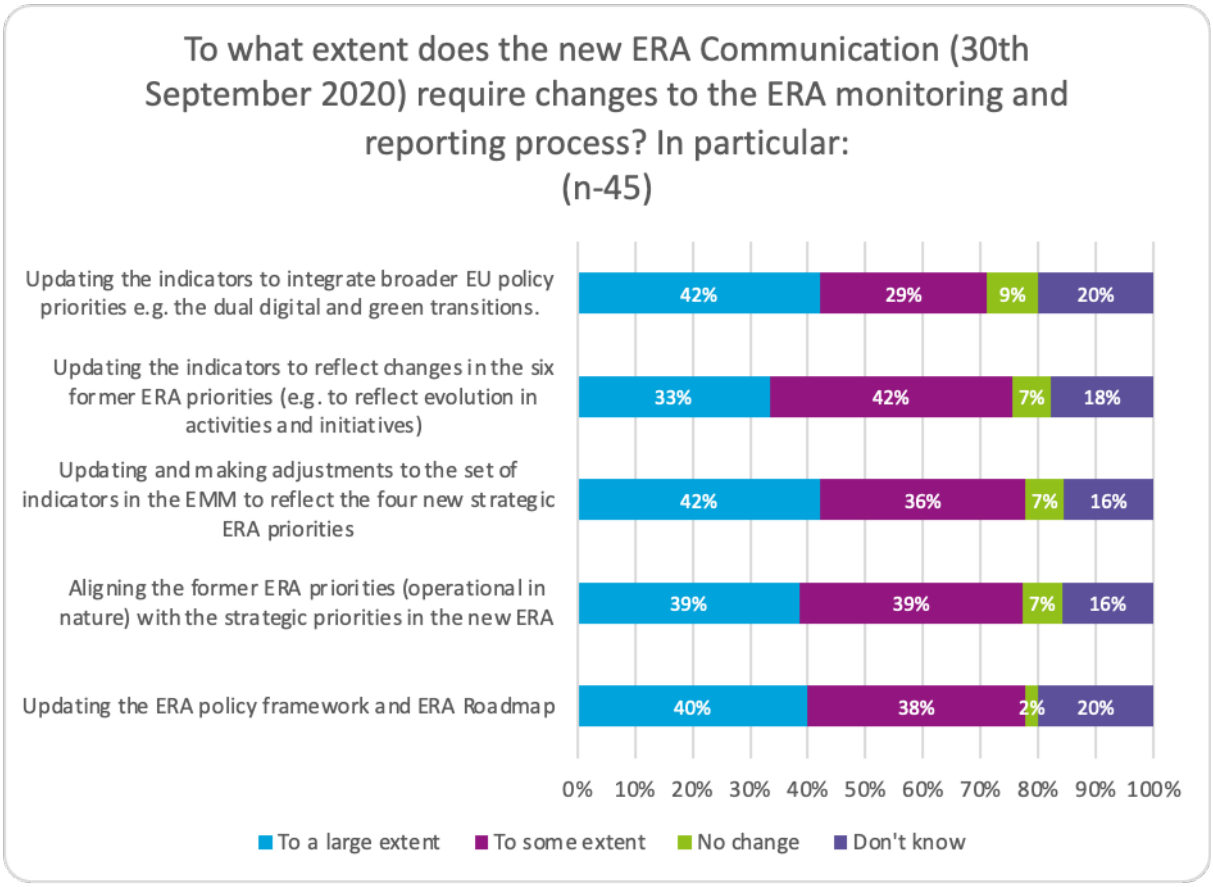
Source: CSES online survey

Q20: Are there any among the existing set of 24 indicators that have now become obsolescent?



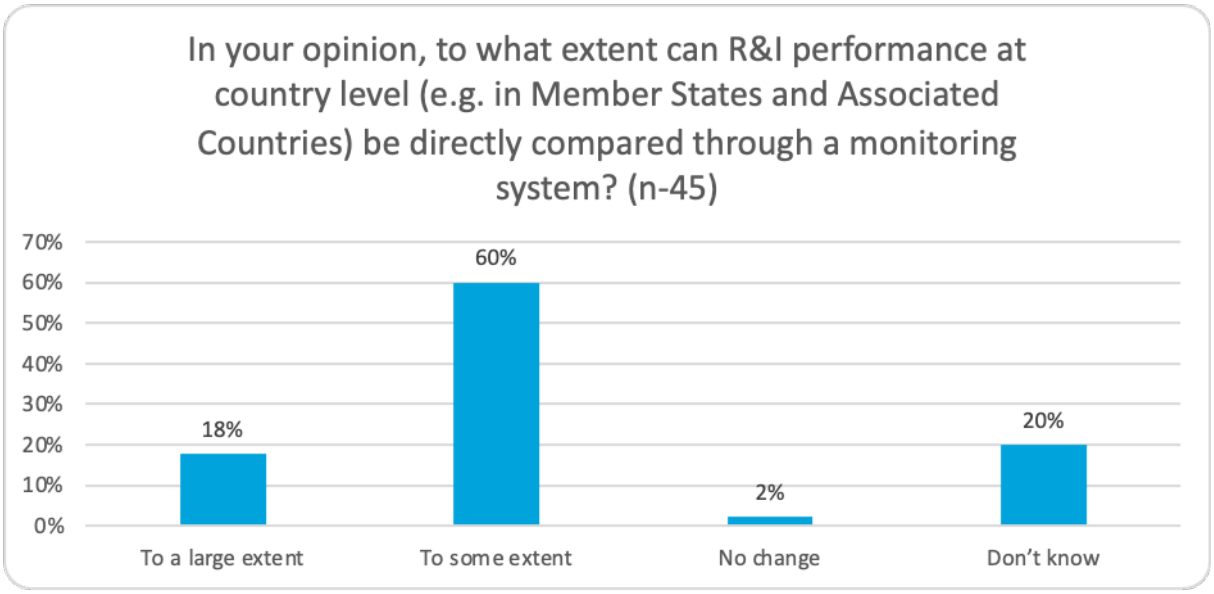
Source: CSES online survey

Q22: To what extent does the new ERA Communication (30th September 2020) require changes to the ERA monitoring and reporting process? In particular:



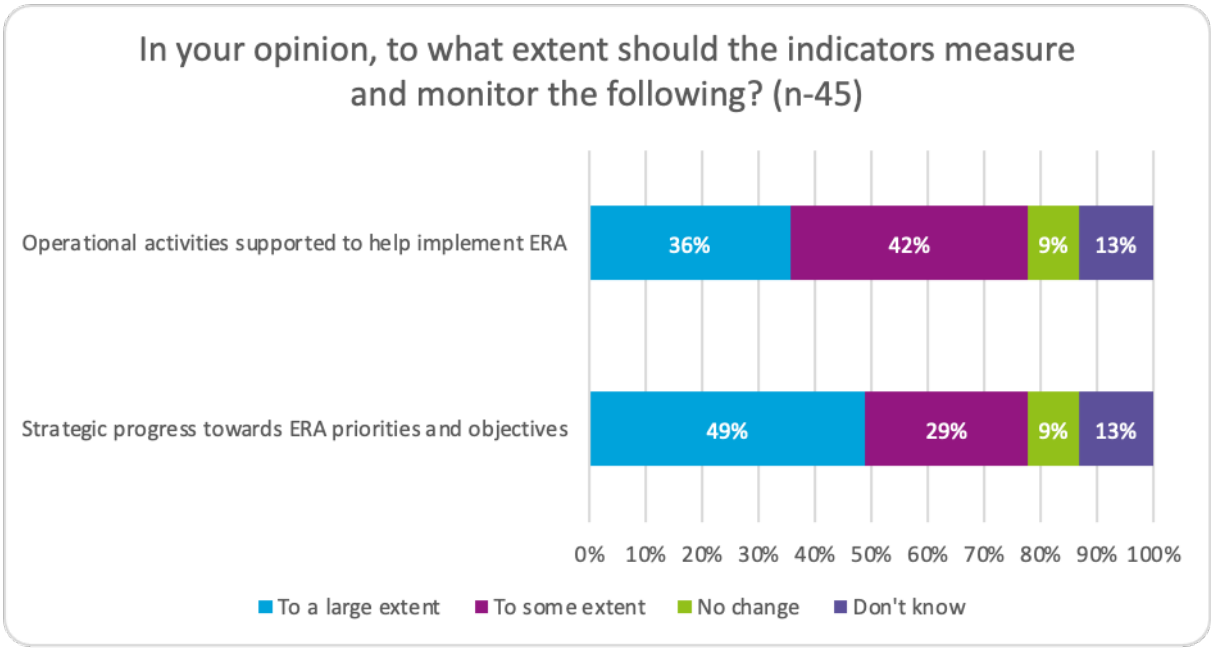
Source: CSES online survey

Q23: In your opinion, to what extent can R&I performance at country level (e.g. in Member States and Associated Countries) be directly compared through a monitoring system?



Source: CSES online survey

Q24: In your opinion, to what extent should the indicators measure and monitor the following?



Source: CSES online survey

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The EU Open Data Portal (**http://data.europa.eu/euodp/en**) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

The European Research Area (ERA) aims to harmonise the framework conditions for R&I in Europe. To achieve these goals, the ERA Roadmap 2015-2020 set out a framework for implementing the ERA in a more structured way that aimed to strengthen the contribution of national measures to ERA implementation, recognising the crucial role already played by EU measures. Within the ERA Roadmap, the National Action Plans (NAPs) played an important role in setting out the contribution of the Member States and other ERA-participant countries to the ERA. Additionally, the European Research Area and Innovation Committee (ERAC) provided technical inputs to facilitate ERA implementation across the 6 thematic ERA priorities defined in 2012 and incorporated into the ERA Roadmap. The study reviewed ERA governance arrangements in 2015-2020 and the monitoring and indicator system.
The revitalised ERA Communication of September 2020, subsequent Council Conclusions and the new ERA Pact further elaborated the approach to the new ERA. An assessment of the proposed approach to governance arrangements and new monitoring and indicator system in the form of an ERA Scoreboard and broader performance monitoring framework was developed. This incorporated lessons learned to date and a multi-level governance and partnership-based model.

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