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Responsible Partner	**VITO**			
Responsible Author	Jos Bessems		**E-mail**	jos.bessems@vito.be
	Partner	VITO	**Phone**	00 32 14 33 51 57
Other authors	Natasha Wauters			

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Introduction

This deliverable describes the development of a model using KPIs to monitor and evaluate the performance of EIRENE RI following the current preparation phase, i.e., the implementation and operation phases via key performance indicators (KPIs). The EIRENE RI KPIs are being developed based on the Report of the ESFRI Working Group on monitoring RIs performance (ESFRI Working Group, 2019). The intention is to monitor the KPIs at the level of the core facilities, summarise the results per country and/or pillar and present the results in a report. In this deliverable an initial set of KPIs is being proposed for further discussion. The final set for evaluations during of the implementation and operational phases will be proposed by the EIRENE RI management and is to be approved by the General Assembly in the future.

The set of KPIs proposed in this deliverable are an initial set that will be subject to change in the future. They will be slightly more high level than what would ideally be required because the objectives of EIRENE are also still high level at this point and the activities to fulfil those objectives are not worked out. Therefore, it will be difficult to determine the method of calculation and define the required data for the KPIs. This will have to be reevaluated and adapted where necessary when more information becomes available throughout the current Preparatory Phase Project.

Definitions

Key performance indicators are parameters that **measure or quantify** the **performance**, not impact. KPIs are a tool to monitor performance regarding progression towards objectives and not to monitor impact. Performance should be monitored so that progression can be evaluated to identify possible issues that could interfere with good progress to enable corrections to be made where necessary. KPIs are thus developed based on the objectives from inputs through activities and outputs to outcome. Normally they are monitored on a regular basis, often annually (1). Although, some measures only yield sensible information when tracked over a longer period of time (2).

Evaluation of impact usually needs a more in-depth evaluation as is often performed by external experts, while KPIs are an internal management tool for regular **performance** monitoring of a project. Impact monitoring is generally done after a longer time, in order for the impacts to manifest more clearly. A framework for socio-economic impacts of RIs was developed by the RI-PATHS project (co-funded by the European Commission) in the form of a toolkit. This toolkit enables RIs to assess the impact on the economy and contribution to society of the RI. A methodological guidebook accompanies the toolkit (3,4).

Since KPIs are always related to objectives (as noted, KPIs are 'Project-management tools' used to monitor the performance vis-à-vis objectives, and to ensure the efficient use of resources (5)), the first step in developing KPIs is to identify the objectives after which the relevant factors to achieve the objectives should be identified in order to quantify or qualify them into indicators which are the KPIs (1).

KPIs should always be tested against and comply with substantiated criteria for the development of indicators. Such internationally recognised standards are RACER (Relevant, Acceptable, Credible, Easy and Robust) criteria (developed as part of the Impact

Assessment Guidelines of the European Commission), SMART (Specific, Measurable, Achievable, Relevant and Time-bound) criteria and CREAM (Clear, Relevant, Economic, Adequate and Monitorable)(2).

KPIs should never be used to compare organisations, it is only used to benchmark against the own performance (2).

Objectives EIRENE

The vision of EIRENE RI is to mediate an open access to the infrastructures supporting world-class research expanding the scientific knowledge in the area of the human exposome, supporting the development of new technologies and translation of the research results to the daily lives of citizens via public-private (industry, spin-offs) or public-public (policy-making) partnerships in order to tackle a problem of non-genetic factors behind the development of chronic conditions and to improve the population health.

The mission of EIRENE RI is to establish a sustainable distributed research infrastructure enabling the advancement of exposome research in Europe by bringing together complementary capacities available in the member states, harmonizing and upgrading them to address current scientific and societal challenges in the areas of chemical exposures and population health.

EIRENE RI services will support on-going projects (e.g., environmental monitoring, cohort studies, etc.) in Europe to enhance the exploitation of existing capacities and synergistic and harmonised development of new capacities. This will foster excellent research toward an improved understanding of environmental and health research (e.g., environmental exposures and their health impacts, generating validated data for evidence-based policy, further development of personalized medicine and prevention, etc.).

Short term ambitions of EIRENE RI are to integrate complementary capacities of the infrastructures in the European research area (ERA), enhance cooperation between the initiatives at the EU and national levels and exploitation of existing (bio)monitoring programmes, population cohorts and samples, experimental facilities and information databases. EIRENE shall build on European excellence and strengthen the focus on education, training, capacity building, knowledge transfer and dissemination of best practices. Long term ambitions entail the supporting of the development of improved and harmonized methods for sampling, sample analysis, data management, and validated exposure and effect biomarkers. EIRENE RI will aid in closing the gap between environmental and health sciences, eliminate fragmentation of environmental and health data in Europe and allow for more efficient application and exploitation of available knowledge for improved risk assessment, chemical management, evidence-based regulation and sound policymaking for an improved protection of the health of EU citizens. EIRENE will support the development of innovative health policies and better healthcare provision and simultaneously enhance industrial competitiveness. It will do so by supporting development of new exposure, effect and susceptibility biomarkers, and improved analytical and risk assessment methods. Please find more information in the EIRENE RI Design Study.

Below the objectives of EIRENE RI:

- Enabling scientific excellence
- Delivery of education and training and enable knowledge transfer
- Enhancing collaboration in Europe
- Facilitating economic activities
- Outreach to the public
- Providing scientific data and associated services
- Providing scientific support/advice (to policy)
- Facilitating international cooperation
- Fostering innovation

ESFRI KPIs

In 2019 the working group of ESFRI on the development of a common approach across RIs to **monitor performance** based on **KPIs** published a comprehensive framework of KPIs that can be adopted by RIs and adapted where needed to fit their specific needs. The KPIs were developed to address the most common objectives of pan-European RIs and to increase the usefulness and relevance for the widest ranges of RIs.

They were not invented from scratch but based on KPIs already established in ERICs and ESFRIs already in place at that time. The ESFRI Working Group recommended that in the end, KPIs should be tested against some kind of widely accepted 'standard' for developing indicators. The RACER criteria were chosen since they were developed by the European Commission, and they are relevant for the European Research Area. The RACER criteria are the following: (a) Relevant = closely associated with the objectives of the RI over a specific period of time, (b) Accepted by the RI and stakeholders to ensure sufficient implementation, (c) Credible = unambiguous and easy to interpret also for non-experts, (d) Easy to monitor and data collection as low cost as possible and (e) Robust against manipulation (1).

Stakeholder consultation was held via surveys and workshops to evaluate the suitability of the KPIs. Adaption of the KPIs is needed to effectively implement the KPIs given the diverse landscape of RIs and their respective missions. The WG notes that it is especially important for RIs in earlier phases to develop customized KPIs according to their phase of development and to achieve this via dialogue between all relevant parties (1).

Key reasons on why to adopt KPIs according to ERICs is to have an internal management tool to achieve tangible results and enable monitoring of progression, to document developments and improvements, to have an instrument to communicate successes, to improve the chances for long-term impact and value, to be able to mitigate risks as problems can be detected early and lastly, to measure the level of engagement with each national node (2).

KPIs are the most used method to monitor progress towards objectives but they are often poor proxies of progression. The WG therefore suggests a shift towards including narratives and context to accompany the adopted KPIs.

It is very important to realise that the ESFRI KPI framework is meant as a supporting tool for RIs and it is not meant to be adopted integrally. RIs should evaluate their objectives and which data can be gathered and then propose, evaluate and adopt relevant KPIs.

The WG recommends a dialogue between the RI, ESFRI and other relevant parties to determine the KPIs to be adopted. RIs should collect the data and periodically calculate the KPIs in such a way that it can be presented to evaluators during the periodic evaluation by ESFRI.

The WG has made some practical recommendations:

- A reference sheet with a definition, data sources, method of calculation and other relevant information regarding the calculation or applicability should be created for each KPI,
- Quantitative KPIs should be accompanied with a short narrative that describes the specific context of the KPI,
- Specific methods or tools to collect data in order to reliably report on the indicators need to be developed or agreed by RIs,
- Qualitative indicators should be used in addition to quantitative indicators to present the progress towards the objectives,
- Collect data and periodically calculate KPIs and make this available for consultations in the future.

The WG identified the objectives with the highest relevance for the most RIs in general whereby at least 40% of all ERICs share the objective. Nine such objectives where identified of which the first one was shared by all ERICs: (1) enabling scientific excellence, (2) delivery of education and training, (3) enhancing transnational collaboration in Europe, (4) facilitating economic activity, (5) outreach to the public, (6) optimising data use, (7) provision of scientific advice, (8) facilitating international co-operation and (9) optimising management. A set of 21 KPIs were developed which complied with the RACER criteria. Certain indicators that did not comply with the RACER criteria were regarded as valuable additions to the KPIs and were formed into narratives. As mentioned earlier not all of these objectives and KPIs are relevant for every RI either at their current phase or never. Also, some might not be relevant in their current form and require adaption to become relevant.

Table 1: Set of 21 KPIs associated with the nine general objectives.

General Objective	**KPIs**
Enabling scientific excellence	Number of user requests for access
	Number of users served
	Number of publications
	Percentage of top (10%) cited publications
Delivery of education and training	Number of master and PhD students using the RI
	Training of non-RI staff
Enhancing collaboration in Europe	Number of members of the RI from ESFRI countries
	Share of users and publication per ESFRI member country
Facilitating economic activities	Share of users associated with industry and publications with industry
	Income from commercial activities and the number of entities paying for service
Outreach to the public	Engagement achieved by direct contact
	Outreach through media
	Outreach via the RIs own web and social media
Optimising data use	Number of publicly available data sets used externally
Provision of scientific advice	Participation by RIs in policy related activities
	Citations in policy related publications
Facilitating international cooperation	Share of users and publications per non-ESFRI member country
	International trainees
	Number of members of the RI from non-ESFRI countries
Optimising management	Revenues
	Extent of resources made available

As previously mentioned, the ESFRI WG recommended that a data sheet or reference sheet is created for each KPI in which following information is taken up:

- Indicator,
- Definition(s),
- Rationale,
- Assumptions,
- Data/information needs and resources,
- Information provider,
- Detailed methodology for the calculation of the indicator,
- Unit of measure,
- Frequency of measurement,
- Assessment of indicator quality and comparability,
- Estimated cost of data collection (incl. access to external databases),
- Level of reporting burden,
- Additional issues or observations.

KPIs of some other ERICs – For comparison

BBMRI-ERIC

BBMRI-ERIC defined KPIs as performance measures that are quantifiable and relevant to a specific goal and are related to an activity of BBMRI-ERIC, which can be either absolute numbers or relative numbers. They describe KPIs as the relative difference between the baseline value at beginning of a period and the target value at the end of a period and define calculate with the following formula: *i* (relative difference = KPI) = *(m_{target}* (target value) – *$m_{baseline}$* (baseline value)*) * 100%/ $m_{baseline}$* (6). The actual performance of BBMRI-ERIC should be calculated against the KPI as set according to the formula above.

BBMRI-ERIC defined 42 candidate indicators of which we think 16 are interesting to look at when developing the KPIs for EIRENE. In bold, some more concrete suggestions are provided for similar KPIs for EIRENE.

- Number of biobanks connected to core BBMRI-ERIC CS IT services
- Number of recognized individual users using services (a per service and aggregated)
- Ratio between number of samples delivered to requesters and the total number of samples stored by the biobank
- Ratio between number of accepted applications and number of received applications for samples and/or data
- Number of papers where biobank was acknowledged as provider of samples, data, or expertise
- Number of domain experts involved (per service/working group and aggregated)
- Number of countries involved in BBMRI-ERIC Working Groups
- Number of data sets with complete provenance information available
- Number of biobanks implementing certain quality standards
- Number of biobanks supported for certification & accreditation
- Number of projects that return data to biobanks
- Number of Expert Centres
- Number of members participating in the CS IT User Forum
- Number of services
- Number of Members and Observers of BBMRI-ERIC
- Number of users receiving outputs of dissemination activities from National or Organizational Node

BBMRI.be

The KPIs of BBMRI.be are specifically developed to show the added value of BBMRI.be and to highlight what sets BBMRI.be biobanks apart from other Belgian biobanks. The KPIs are an incentive for biobanks to join BBMRI.be and they should be able to be leveraged to obtain (additional) funding for BBMRI.be biobanks. BBMRI.be explicitly focused on the strong points of BBMRI.be to develop useful but realistic KPIs. They identified that quality of samples and data and outreach (e.g., collaboration, projects) on biobank related topics are the two main strengths that could be an added value to the community.

Five working groups focusing on a different expertise field were defined in the action plan of BBMRI.be. The KPIs are a reflection of those fields of expertise. A least one metric KPI

was determined and one milestone per year will be defined for each WG. These metrics and milestones need to be easy to monitor and for the metrics the goals number will be defined. In addition to the WGs KPIs, KPIs on BBMRI.be level to monitor the results of the node as a whole were defined. These national level KPIs must be in line with the ERIC KPIs.

The WGs KPIs seem less interesting to look at for us at this stage because they are very specific to the WGs. The metric KPIs for BBMRI.be are (1) number of online/face-to-face events (co)-organized by BBMRI.be, (2) number of requests for BBMRI.be samples in Directory[1] and (3) number of local, national, international granted projects with BBMRI.be involvement.

ELIXIR

Elixir Pharmacy reports annually on specialty KPIs which monitor member experience and show how the activities of Elixir impact lives of patients (albeit it is noted that the latter is actually in general not seen as a 'performance indicator' as in KPIs. These specialty KPIs are member satisfaction, net promoter score (both measured through member surveys) and inbound call handling (call centre data). In addition, case studies on specific conditions are done to evaluate several parameters that show good impact on patients when using specialty pharmacy (7).

Preliminary KPIs for EIRENE RI

As described in this report, the proposed set of KPIs is a preliminary set. The final set of KPIs for EIRENE RI will be proposed by EIRENE RI management and approved by the General Assembly in the future. As noted earlier, to be able to develop a project's KPIs, objectives need to be clear. Listing the objectives of EIRENE RI (see above) was the first course of action in the development of the KPIs. We then used the ESFRI Working Group report on 'Monitoring of Research Infrastructures Performance' as the basis and complemented that with the OECD report on the reference framework for assessing the scientific and socio-economic impact of research infrastructures (albeit noted that the OECD report is partially on impact which in general is not part of KPIs). Additionally, we identified some KPIs from BBMRI-ERIC that might be interesting for EIRENE RI. Most of the objectives identified in the ESFRI report match the objectives of EIRENE RI. The corresponding KPIs may therefore also be applicable to EIRENE RI. OECD identified some additional KPIs that may correspond to the objectives of EIRENE RI. We made a list of the objectives and related KPIs in Table 2. At this stage the specifics and details of the internal working of EIRENE RI are not worked out. The relevance and feasibility of the proposed KPIs (will the required data be available?) remains to be evaluated once the operations of EIRENE RI are clearer. This also means that we cannot really give a detailed methodology for the calculation of the indicators at this moment. For the indicators described in the ESFRI report, we can take the reference sheets as a basis and adapt where needed.

Table 2: Proposition of preliminary set of KPIs for EIRENE RI (1,8). The cursive KPIs are based on some KPIs

[1] The BBMRI.be Directory is an online platform on which BBMRI.be biobanks upload the sample collections that are stored in their biobank (level of detail can be chosen by the biobank). The Directory enables researches to look up which samples are available in Belgian biobanks. Via another tool in the Directory requests for samples can be made directly to the biobank.

from BBMRI-ERIC and adapted to the context of EIRENE RI.

EIRENE RI Objective	**Proposed preliminary KPIs**
Enabling scientific excellence	Number of user requests for access
	Number of users served
	Number of user requests
	Number of publications
	Number of citations
	Percentage of top (10%) cited publications
	Ratio of number of services delivered and total number of services available in the network
	Average ratio of number of services on number of infrastructures
Delivery of education and training and enable knowledge transfer	Number of master and PhD students using the RI
	Total number of trained non-RI staff
	Number of scientific conferences, seminars, webinars, … organised by the RI
	Number of educational and outreach activities
	Number of participants in educational and outreach activities
Enhancing collaboration in Europe	Number of members of the RI from ESFRI countries
	Share of users and publication per ESFRI member country
Facilitating economic activities	Income from commercial activities and the number of entities paying for service
	Number of regional firms using the RI (can be categorized by size/turnover)
	Number of suppliers (local/regional) (may also add turnover data)
Outreach to the public	Engagement achieved by direct contact
	Outreach through media
	Outreach via the RIs own web and social media
Providing scientific data and associated services	Number of publicly available curated data sets used externally
	Number of data requests
	Facilities connected to IT services
Providing scientific support/advice (to policy)	Participation by RIs in policy related activities
	Citations in policy related publications
	Number of resources (data, specimen, informatics) dedicated to support policy
Facilitating international cooperation	Share of users and publications per non-ESFRI member country
	International trainees
	Number of members of the RI from non-ESFRI countries
Fostering innovation	Number of patents and licensing
	Number of innovations/patents co-developed with industry

KPIs are tools to measure the progress of a project. As such an aim for the KPIs need to be set at the beginning of every new reporting period. This will be the ambition to strive for by the end of the period. An example for an aim is 100 users served. This allows the evaluation of the progress in two ways: evaluating the aim on itself (Was the aim achieved? Was the aim not achieved and if so, how far off was the aim? Was the aim surpassed?), and comparing the aim with the achievement the year(s) before (Was the progress of the same magnitude? Was less or more achieved?). This allows evaluation of the progress isolated to the past reporting period and evaluation of the progress across the years. The latter will ensure that possible trends of progress stagnation can be recognised.

The aims for the KPIs cannot be set at this moment, they will be set in the future for the final set of KPIs.

A reporting system will need to be set up that will enable efficient collecting and reporting of the data.

As described in the EIRENE RI Design Study a biannual evaluation is proposed with an off-site evaluation (study of the KPIs and their background materials) and an on-site evaluation (on-site visit of selected EIRENE RI Nodes and/or Head Office and discussion with Node managers/directors and users).

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Annex - Example reference sheet KPIs

Objective	**Enabling Scientific Excellence**
Indicator	Number of user requests for access
Definition	*How is the indicator defined.* Access to facilities: number of applications for access. Use of services: number of applications for the use of services.
Rationale	*What is the reasoning behind the indicator and how is it linked to the objective.* Indication of the attractiveness of the RI.
Assumptions	*Assumptions that need to be taken into account as they can influence the data used to calculate the indicator.* New RIs will start with a small community which will grow with time and the RI becomes more visible. Requests for access to facilities will be impacted by the individual success of the facilities. In some RIs request data is maintained at the individual facilities because researchers don't make central access requests. In case of resource RIs, the number of access requests will be impacted by the request rules. Some require no registration others do with varying complexity. Additionally, monitoring access through IP addresses as many users may use the resource through the same IP address.
Data/information needs and resources	*What data/information is needed to calculate the indicator? How will it be maintained?* The RI should set up a tracking/recording system.
Data source	*Who is providing this information/data?* RI
Methodology	*A detailed methodology on how to calculate the indicator.* Record and report the number of access request/registered users. In case of unneeded registration, record and report number of unique users/visits/logins. In case of multiple types of offered services (e.g. data, services, access to facilities, platform and event-based access) record and report values for all types. Subgroup of users may be reported (e.g. share of users per ESFRI country, international users, academic users, non-proprietary industrial users).
Unit of measure	Number
Frequency of reporting	Annually
Assessment of indicator quality and comparability	*How widely is the indicator used.* Commonly used
Estimated cost of data collection	*Cost includes access to external databases.* Generally low. Can be high for RIs offering fully open and free access resources.
Level of reporting burden	*Effort needed to report on the indicator.* Generally low. Can be high for RIs offering fully open and free access resources.
Additional issues or observations	*Any considerations that could impact the indicator.*