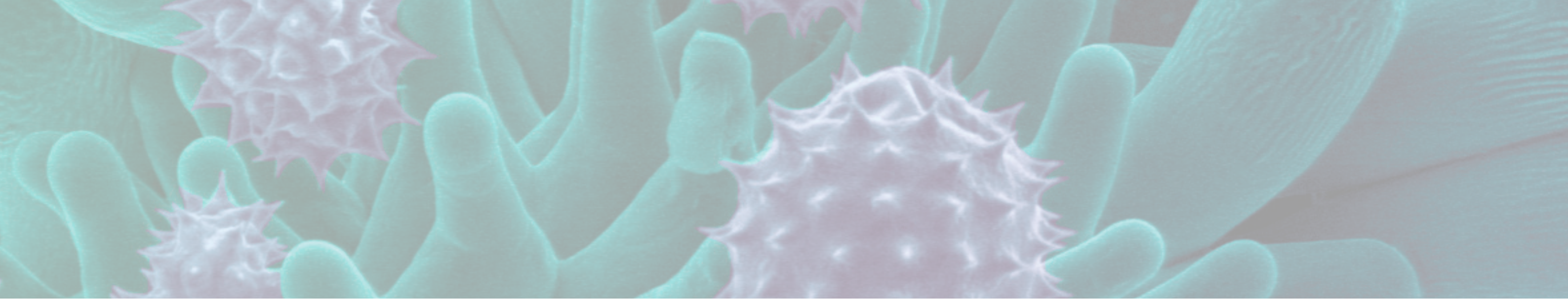
INTERNATIONAL RECOMMENDATION FOR MEASURING IMAGING CORE FACILITY IMPACT:

Key Performance and Social Economic Indicators

GLOBAL BIOIMAGING
growing collaboration



GLOBAL BIOIMAGING PUBLICATIONS PART 1: IMPACT

INTERNATIONAL RECOMMENDATION FOR MEASURING IMAGING CORE FACILITY IMPACT:

Key Performance and Social Economic Indicators

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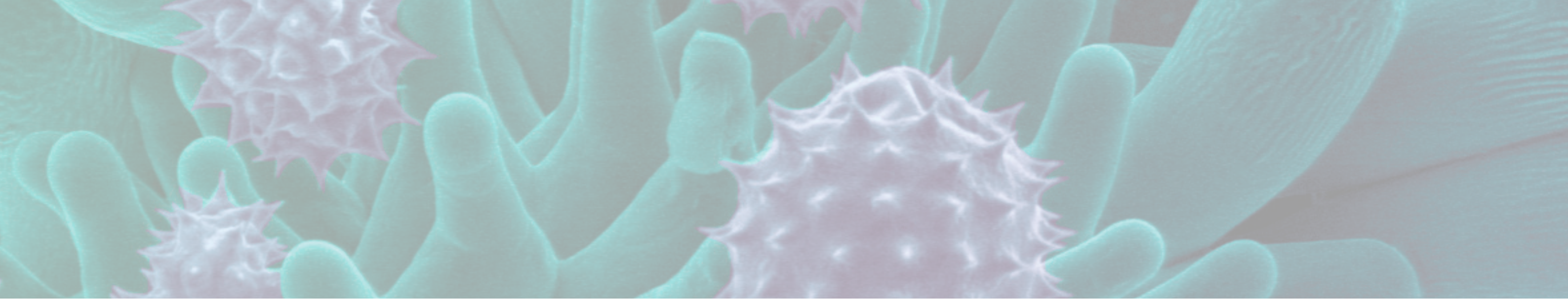

GENERAL INTRODUCTION

The choice of indicators and the significance of the indicators chosen will be highly dependent on the mission statement of the infrastructure. For example, an infrastructure focused on fundamental quantum physics with a very "fundamental research" mission statement, will not have the same innovation impact or economic impact as a platform in materials engineering with a mission statement including innovation, partnership with companies, and patents on device production plans and protocols. Similarly, the relevance of the indicators listed below will vary for different infrastructure platforms. This framework represents a recommended toolkit for microscopy imaging infrastructure core managers or directors to assist in the selection of metrics and indicators that are most appropriate for their Imaging Core Facility.

The objectives of this document are to provide a comprehensive framework of highly relevant key performance indicators (KPI) and socio-economic indicators (SEI), evaluate how easy or difficult it might be to gather information to measure the related metrics from an imaging core facility perspective and give a common set of guidelines for the community that will act as a resource and a tool for demonstrating value and importance of these facilities to colleagues, departments, faculties, institutions and funding bodies.

Contents

KEY PERFORMANCE INDICATORS

INTRODUCTION

Key Performance Indicators (KPIs) are used to measure facility impact and progress or evolution over time within a given infrastructure. KPIs could be measured in an ongoing way ideally annually.

In our perspective, KPIs are not meant to be used to compare facilities with each other but to measure continuous improvement. KPIs can provide a comprehensive understanding of the quality of the infrastructure including many factors involved, and many that are usually not evaluated or measured in classical frameworks.

The KPI list is structured to provide a definition and description of the KPI, along with an indication of the level of complexity to measure each KPI from an imaging facility's perspective.

METHODOLOGY

An extensive literature search was performed to identify relevant indicators and associated methodology to measure impact. The members of the Global BioImaging societal impact of imaging infrastructures working group performed several rounds of evaluation of indicators, organized and ranked the indicators to determine which were most appropriate. The work was reviewed and approved by the Global BioImaging Management Board.

Key Performance Indicators

INFRASTRUCTURE AND PERSONNEL

1 Personnel

2 Infrastructure

FACILITY PERFORMANCE

3 Facility users

4 Diversity of users / quality of training

5 User training

6 User satisfaction

7 Publications (facility staff and facility users)

8 Collaborative publications (facility staff and users)

FINANCIAL PERFORMANCE

9 Charge back revenue (user fees)

10 Grant funding

Legend

Relatively easy to measure or collect information.

Moderate difficulty to measure or collect information.

Difficult to measure or collect information.

INFRASTRUCTURE AND PERSONNEL

1 Personnel

Number of personnel

The people running the infrastructure including imaging scientists, image analysts, managers and directors are part of the infrastructure. Without expert operators, the infrastructure cannot be used to its full potential.

Measurement Example: number Full Time Equivalent (FTE) personnel etc.

Level of education / expertise of personnel

The quality and the level of experience of the personnel is directly related to the performance of the infrastructure.

Measurement Example: number of staff with a PhD, number of staff with an MSc, years of experience at an imaging facility etc.

Unique expertise of personnel

It is important to recognize unique knowledge or expertise available, whether directly related to the imaging facility mandate, or additional complementary skills that can be pertinent (e.g. computer skills, programming skills, involvement in professional societies).

Measurement Example: List of certifications received or courses completed by staff, list of unique/advanced training programs completed by staff etc.

2 Infrastructure

Number of instruments and growth / evolution of the infrastructure over time

Instrumentation is a key indication of the strength of a research infrastructure facility, therefore, measuring the capital value of the asset register, including instrument and upgrade costs is a fundamental KPI.

Measurement Example: number of microscopes, number image analysis workstations, value of capital equipment, number of software packages (custom or commercial) etc.

Number of unique / specialized infrastructure services (local / regional / national)

Uniqueness of the infrastructure/instrument is an important factor for funding agencies. It requires a good knowledge of what's available in the community.

Measurement Example: number infrastructure/instrument unique at the local/regional/national level, type of infrastructure/instrument, unique features/applications enabled by the infrastructure/instrument etc.

Utilisation of instruments

It is important to measure the operating capacity of a facility, the instruments need to be monitored across their life-cycle to ensure they are used efficiently, maintained and eventually decommissioned. Monitoring usage should be part of routine facility management.

Measurement Example: Average hours of instrument utilisation per month, percentage of utilisation compared to full capacity (e.g. 40 hours per week, 48 weeks per year) etc.

FACILITY PERFORMANCE

3 Facility users

User base

The main mission of an infrastructure is to give access to users. It is essential to evaluate the evolution of their usage over time. Regular monitoring helps anticipate future planning challenges such as access allocations when use increases or forecasting financial issues should usage decrease.

Measurement Example: number of users month/instrument/service, % of usage per user/time/instrument, number or different types of users (PIs/industry users/graduate students) etc.

Progression of user base

It is important to measure how the facility changes/progresses over time.

Measurement Example: measured annually, number of internal academic users (PIs/researchers/graduate students), number of external academic users (PIs/researchers/graduate students), number of industry users (trained on equipment or full service projects) etc.

4 Diversity of users / quality of training

Scientific area of study (departments, institutions, programs)

This will measure the internal visibility, the interdisciplinary collaboration, the inter-university collaboration and collaboration with industry. The variety of institutional and departmental origin of users is a powerful indicator of the recognition, visibility and quality of the infrastructure.

Measurement Example: Distribution of user base university/faculty/department, Distribution of users (map) local/regional/national etc.

Diversity of facility users, demographic information

This measurement is key to evaluate diversity and inclusivity in the facility environment. It is important to keep in mind though, the ethical and confidentiality and privacy considerations related to this type of information.

Measurement Example: % women, % culturally diverse background, origin and distribution of users etc.

Jobs facility users find based on the influence of facility training / experience
Despite being an important metric, it remains very difficult to evaluate how much influence a given core facility has on a particular individual career path. Nevertheless this kind of data can be the basis for a strong argument and indication of the broader core facility impact.

Measurement Example: % users using imaging in their current job, testimonies from users etc.

5 User training

Workshops and training courses
This is one of the activities that bring high value to users. The diversity of the researchers attending workshops and courses reflects the scope and reach of the facility.

Measurement Example: number of workshops, number of training courses, average number of applicants, demographics of attendees (age, gender, cultural background), participants' satisfaction, etc.

One-on-one training from facility staff
This is typically a routine activity for an infrastructure which brings high value to the users. The training can also be tailored to individual user needs.

Measurement Example: number of generic training sessions/user category (student/professional) /month, number of tailored training sessions/user category (student/professional) /month etc.

6 User satisfaction

User surveys
User surveys are an essential tool to obtain feedback for continuous improvement. It is important to survey the normal operation of the facility but also the supplementary activities (workshop, trainings, etc.). Surveys should be done in regular intervals.

Measurement Example: Ratings about quality of staff, quality of service, quality of instrument, waiting time to access instrument or service, general satisfaction etc.

Mechanisms in place for continual improvement.
Collecting information about user satisfaction in itself is not enough to ensure best practices. As the core facility evolves over time, a continuous improvement process will ascertain that the services provided will stay relevant and be delivered efficiently with the users needs in mind (present and future).

Measurement Example: Qualitative measurements such as user committee role description, Facility Executive committee role description, specific action item examples etc.

7 Publications (facility staff and facility users)

This KPI is a great way to measure the scientific impact of the core facility with a set of indicators that are most commonly used by the scientific community (granting agencies, publishers). It gives a point of reference. It is important to keep in mind that publications should not be the only way to measure scientific impact, especially for a core facility whose mission is fundamentally different than for an individual researcher. Access to publication information where facility staff are co-authors are relatively easy to find. However, it can be complicated and cumbersome for a single facility to track individual users publications and ensure the facility was used for the work. Including citations can help give more value to publication metrics but citations can vary significantly from field-to-field and some papers such as protocols and reviews are not highly cited but have a big impact.

Number of publications

Impact of publications

Number of citations

Measurement Example: number publications per year, H factor distribution (staff, users), relative citation index distribution, number reads (reviews), alt metrics (e.g. Twitter) etc.

8 Collaborative publications (facility staff and users)

Publications co-authored with different institutions / national / international

Impact of collaborative publications

Citations of collaborative publications

Measurement Example: Proportion of collaborative publications, relative citation index distribution, broken down by within institution, regional, national, international etc.

FINANCIAL PERFORMANCE

9 Charge back revenue (user fees)

A core facility is usually funded by public/government agencies (directly or indirectly), and is accountable for the way the funds are used. It is important to ensure good financial health in order to provide a continuous and sustainable portfolio of instruments and services.

Internal user fee collection

External user fee collection

Industry user fee collection

Measurement Example: % cost recovery of operational costs, % salary recovery from chargeback/user fees etc.

10 Grant funding

A core facility is usually funded by government monies (directly or indirectly), and can be a sign of success and dynamism, especially for direct funding opportunities. Access to indirect funding might be tricky especially for operations since the facility director is not necessarily aware of the source of funding from the users.

Infrastructure funding, direct or indirect (e.g. through key users of the infrastructure)

Measurement Example: number direct infrastructure grants, total amount awarded, list of instruments funded/purchased, list of funding agencies etc.

Operational funding, direct or indirect (e.g. through key users of the infrastructure)

Measurement Example: number direct operating grants, total amount awarded, % of annual operational costs coming from grants, list of specific operations funded, list of funding agencies etc.

SOCIO-ECONOMIC INDICATORS

INTRODUCTION

Research infrastructure enables high quality research outcomes that in turn have an impact on broader socio-economic factors. Assessing impact through Socio-Economic Indicators (SEIs) is a powerful way for imaging core facilities to demonstrate their value to key stakeholders such as funders, governments and institutions and maintain long-term partnerships.

The SEI list is structured to provide a definition and description of the SEI, along with an indication of the level of complexity to measure each SEI from an imaging facility's perspective.

METHODOLOGY

An extensive literature search was performed to identify relevant indicators and associated methodology to measure impact. The members of the Global BioImaging societal impact of imaging infrastructures working group performed several rounds of evaluation of indicators, organized and ranked the indicators to determine which were most appropriate. The work was reviewed and approved by the Global BioImaging Management Board.

Socio-Economic Indicators

RESOURCES

1 Open data sharing

2 Standards and quality management

3 Education resources for the larger community

4 Expert advice to support public policies

HIGHLY QUALIFIED PERSONNEL

5 Public education

6 Imaging scientists

7 Career / job creation

COLLABORATION

8 Collaboration with industry / intellectual property

9 Industry investments

PUBLIC VISIBILITY

10 Media

Legend

Relatively easy to measure or collect information.

Moderate difficulty to measure or collect information.

Difficult to measure or collect information.

RESOURCES

1 Open data sharing

In the open science world, especially in imaging, it is important to monitor to what extent one's open source data has been used. It is a work in progress to define procedures ensuring free access to some imaging data but also ensure proper credit tracking. Despite the difficulty, this type of validated and well defined data set will become critical.

Accession number for publicly available data.

Measurement Example: Support their users to publish openly accessible image datasets, number of time the data is accessed/used per year etc.

Use of data for training

Measurement Example: number of data sets used for training, number of people trained using datasets, types of usage/scope of use (e.g. local, national, global) etc.

Reuse of data for analysis / publication by the community

Measurement Example: number of publications using the data etc.

2 Standards and quality management

Considering the increasing collaboration with industry, clinical research or diagnostic labs and the global push for reproducibility in science the implementation of SOPs and certification are more in demand. Implementing a quality assessment policy will improve the quality of services provided.

Standard operating procedures / protocols (SOPs)

Measurement Example: number of SOP in place, type/scope of SOPs, usage of SOPs, published/cited SOPs, field of application of SOPs (specific project, general usage) etc.

Certification (e.g. ISO)

Measurement Example: Type of ISO certification, number of ISO certifications etc.

3 Education resources for the larger community

Contributions to the larger science community, in particular with protocols or educational material is rarely monitored nor acknowledged, except when it is published in peer reviewed (e.g. journals) or some non peer reviewed formats (e.g. books, book chapters).

Protocols, training guides and educational materials

Measurement Example: number protocols/training guides/educational resources developed by the facility and made publicly available, number of facility resource downloads, location of downloads or who is accessing and using the facility generated materials (local, national, international) etc.

4 Expert advice to support public policies

This aspect of impact is usually forgotten in facility (self) assessments but can be an important if not an essential factor of contribution to society. It can be very difficult to monitor when the resources are not used by the infrastructure scientists and there are sometimes no way of knowing how or to what purpose the resources are being used for.

Resources provided in support of public policies (direct)

Measurement Example: Stories about specific public policy influenced by results provided by the imaging facility, e.g., public reports etc.

Facility users use their data from the facility to contribute to public policies (indirect)

Production of experimental, observational data that supports public policies (direct)

5 Public education

The entire scientific community is facing a major challenge with the spread of misinformation especially on controversial topics. In order to alleviate the sometimes dramatic effects of such misunderstandings, research infrastructure can play a major role in showcasing the high quality and rigour of scientific discovery. In addition, competition for limited funding is high. Improved communication that shows the general public how publicly funded science has a positive impact on society will lead to further investments in science in general and imaging facilities in particular.

Seminars open to the public

Public facility tours

Workshops for community groups

HIGHLY QUALIFIED PERSONNEL

6 Imaging scientists

Imaging scientists play a central role in their respective communities. They can be scientific directors, managers, post-doctoral fellows, engineers or technicians. For more specific examples of who imaging scientists are see www.imagingscientist.com. In general they are highly trained scientists and their role and career evolution needs to be reported and tracked over time since their careers reflect the quality of the facility and provides insight into the types of high quality jobs that the economy wants to promote.

Number of highly trained imaging scientists

Professional development of imaging scientists

Measurement Example: Advanced training courses, membership in professional societies, attendance of international conferences, teaching or organizing courses and workshops etc.

Imaging scientist career progression and future job opportunities

Measurement Example: Continued advanced training courses, continued professional society involvement, jobs they move into from imaging scientist positions etc.

7 Career / job creation

Jobs facility users end up securing, influenced by training/experience in the facility.

Measurement Example: Testimony, ability to track users, movement at the local/national/global scale etc.

COLLABORATION

8 Collaboration with Industry / intellectual property

Any activities in partnership with industry including new spin-off companies are strong markers of economic vitality that basic scientists are not used to monitoring. This aspect of economic impact is strongly related to the management of intellectual property (IP) and the possibility for innovation to translate into new market share or new product development. In certain instances the mission of the infrastructure pushes such partnerships, in other cases it is simply not part of the core mission.

Number and scope of industry partnered projects

Measurement Example: number of industry partners local/national/global, dollar value for the industry, testimonies from researchers and corporate partners etc.

Number of local/national/global industry partners

Research/development/innovation

Measurement Example: number of innovations, stories, testimonies etc.

Patents / co-patents with industry partners

Measurement Example: number of patents, number of co-patents, scope/diversity of developed innovations etc.

Licensed patents

Measurement Example: Revenue generated by licensing, impact case studies, stories etc.

Spin-off or start-up companies coming from the imaging facility

Measurement Example: Testimony, scope/diversity local/national/global of startup, number of employees, revenue/profits etc.

9 Industry investments

Industry investment in the facility shows facility value. Giving access to infrastructure and expertise gives industry a competitive advantage that is valuable for the economy. Sometimes the funding is indirect (via a researcher) and might be difficult to monitor.

Number of industry funded projects in the imaging facility

Measurement Example: number of projects, total amount invested, investment per project, stories, testimonies etc.

Number of industry funded imaging scientist and/or post doctoral, technical positions

PUBLIC VISIBILITY

10 Media

Scientific media content, interviews, journals, websites

Public media, interviews in news outlets, websites

TV Interviews or documentaries

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CHAN ZUCKERBERG INITIATIVE

NSERC CRSNG

GLOBAL BIOIMAGING

Global BioImaging is an international network of imaging infrastructures and communities, which was initiated in 2015 by a European (Horizon 2020) funded project. Since 2020, Global BioImaging activities including its annual Exchange of Experience workshops and training activities are funded by Chan Zuckerberg Initiative.

Recognizing that scientific, technical and data challenges are universal rather than restricted by geographical boundaries, Global BioImaging brings together imaging facility operators and technical staff, scientists, managers and science policy officers from around the globe, to network, exchange experiences and build capacity internationally.