# Strategy for Karolinska Institutet's research infrastructure 2021–2024

## Collaboration and sustainability for groundbreaking research

Karolinska Institutet

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Translated from Swedish

**Ref. No 1-305/2021**

# Contents

# 1. Introduction

Karolinska Institutet (KI) is an internationally renowned medical university with a prominent position in Europe. In recent years, KI has made a number of strategic recruitments, especially of international researchers, developed new research fields and established new research methodologies. It is important for KI to offer relevant infrastructure for research and education to reach their full potential. KI has invested heavily in premises and research infrastructure, a process that culminated in 2018, when 80 per cent of the experimental research relocated into new premises designed and equipped to meet the needs of the future.

This strategy has 2024 as its target year, but will be subjected to an updating annually or whenever it is deemed warranted. The accompanying action plan describes a number of activities, which are to be allocated the necessary time and resources, as well as responsibilities for ensuring that the strategy is implementable.

The implementation of the activities defined in the action plan will be followed up annually, with goal fulfilment measured quantitatively and qualitatively through surveys and interviews with KI researchers, research infrastructure representatives and outside parties.

## 1.1 The purpose of the strategy

An effective and shared research structure is essential to modern research and to the collaboration with the healthcare and commercial sectors that is required for the development of the Life Science sector and the uninterrupted supply of skills.

The purpose of this strategy is to provide guidelines on the development of KI's research infrastructure by identifying ways to:

- ensure the availability of research infrastructures of the highest quality and relevance for KI researchers
- capture current and future research infrastructure needs
- create the best possible conditions for operating research infrastructures
- prioritise targeted initiatives in research infrastructure over the coming years
- ensure that KI's digital research environments comply with the FAIR-principles and GDPR.

## 1.2 Relationship to Karolinska Institutet's Strategy 2030

Strategy 2030 points to how KI has made exceptionally large investments in new buildings and research infrastructure over the past few years. KI should derive the maximum benefit from these investments to strengthen its role as a pioneering medical university. The strategy highlights the importance of cooperation and consolidation and of paying attention to higher costs. The reason why this strategy is aimed at 2024 is the rapid pace of technological development.

***From Strategy 2030:***
*In recent years, KI has made exceptionally large investments in new buildings and infrastructure. By using these investments in the best possible way, KI can strengthen its role as one of the world's leading medical universities. These investments create unique opportunities for realising our vision: to break new ground in our understanding of life processes and disease mechanisms and make significant contributions to improving health for all. KI must ensure that increased research costs are managed in a way that is consistent with our ambitions regarding continuity, sustainability, and predictability.*

**KI's vision "We are advancing knowledge about life and strive towards better health for all"** requires an ever closer adaptation to cutting-edge technology and functional research infrastructure. Together with the healthcare sector, KI will develop clinical research and take full advantage of the new environments for clinical and experimental research that have been built up. KI's ability to provide analyses etc. at short notice to help with the Covid-19 response has shown just how important its research infrastructure is to research and diagnostics.

## 1.3 Background

As modern research infrastructure grows more extensive, advanced and expensive, the universities are finding themselves less and less able to self-finance local research infrastructure. Additionally, external financing for such infrastructure is hard to recruit. Streamlining, greater coordination and co-utilisation of advanced research infrastructure is therefore becoming increasingly necessary.

KI has an Infrastructure Council, the task of which is to propose strategies, launch initiatives and set priorities in the field of research infrastructure. The Council also monitors and follows up ongoing projects. The infrastructure council is organised under the Committee for Research.

### Definitions

The term "research infrastructure" refers to scientific facilities and resources, such as equipment, instruments, apparatus, experimental facilities, laboratories, research vessels, knowledge banks, databases, software resources and services, including related staff competence. (https://samsynwiki.su.se/wiki/Research infrastructure).

However, in this strategy, the term is limited to equipment, competence, services, IT, specially designed buildings (e.g. animal facilities) and adaptations/conversions of premises.

"Core facility" refers in this strategy to research infrastructure that primarily supports research at, and receives financial support from, KI and Region Stockholm.

"Service" refers either to access to the research infrastructure by researchers capable of handling instruments, or to services performed by the facility staff. A facility can also be digital (e.g. a data portal).

There is considerable variation in services provided and user numbers for research infrastructures, which can be anything from international to local. There is also a wide range of financing solutions.

At KI, core facilities are organised within the departments or within Comparative Medicine.

### E-infrastructure

E-infrastructure is a field that intersects with other research infrastructure and that is critical to its functionality. It is a field in a phase of very rapid growth and development.

E-infrastructure is increasingly important for KI. In its budget documentation for 2022-2024, KI identifies secure and effective data management as essential to successful research and innovation.

The Swedish Research Council and the Association of Swedish Higher Education Institutions have jointly produced a policy proposal for the organisation of Swedish research e-infrastructure.

The document proposes a merger of five actors in the field and is now being reviewed by a specially appointed commissioner (https://www.regeringen.se/pressmeddelanden/2020/05/research infrastructure-pa-nationell-niva-ses-over/ – in Swedish only).

KI has produced a strategy for information management (https://medarbetare.ki.se/media/44865/download), which is an important source document in the production of a strategy for research infrastructure.

The trend is towards ever greater data volumes (Big Data) from an increasing number of sources, including patient material. To fully exploit the research potential of these data, the data need to be transferred between principals (e.g. regions and universities). Principals must be able to guarantee data security and compliance with other data management rules and regulations. For reasons of security and the efficient use of resources, this type of data management should be provided and quality assured at university level rather than at research group/departmental level.

## 1.4 Different levels of research infrastructures

Research infrastructures can be divided into:

- International research infrastructures
- National research infrastructures
- Regional research infrastructures
- Local research infrastructures and individual equipment

KI researchers are users of international research infrastructures, such as EATRIS, to which the drug discovery and development platform at SciLifeLab is to some degree the national analogue. Within the EU collaboration is a pillar for infrastructure in Horizon Europe and an infrastructure plan (the European Strategy for Research Infrastructure – ESFRI) that indicates the target areas where large-scale analyses should be combined in a European perspective. This plan interacts with national plans, in Sweden with the Swedish Research Council's (VR's) Guide to research infrastructure. It is important that researchers at KI engage in the development of these plans via workshops and technical inventories.

In recent years, VR has supported shared, semi-permanent *national* infrastructures, part-funded by the universities, which also help to identify priorities. Such infrastructures include the Swedish National Infrastructure for Computing (SNIC – for large-scale calculations), National Bioinformatics Sweden (NBIS – for bioinformatics support) and the Swedish National Data Service (SND – for metadata). VR invites the universities in biennial cycles to apply for funding in selected areas. National infrastructures coordinated by KI include the Swedish Twin Registry (STR) and the National e-infrastructure for Aging Research in Sweden (NEAR).

There are also national infrastructures financed by foundations, primarily the Knut and Alice Wallenberg Foundation (KAW). Universities around the country also run national research infrastructures under Science for Life Laboratories (See 1.5) and have established a common body, the Universities' Reference Group for Research Infrastructure (URFI), for collaborating on prioritisations and interacting with VR.

KI is in need of *regional core facilities*. They can be advanced facilities, resources and competence organized within the university, at nearby hospitals or within network healthcare, and are mainly intended as support for researchers active at KI and Region Stockholm. They generally receive financial support from either organisation.

At local level, research infrastructure primarily refers to potentially sharable items of equipment plus associated competence.

### 1.5 The three main national research infrastructures in relation to research at KI

Science for Life Laboratory, SciLifeLab, is a national centre for life science research for which KI is one of four host universities. The scientific advances made in recent years in molecular biosciences, bioinformatics, imaging techniques, etc. have facilitated rapid developments in precision medicine and other fields. There are also considerable opportunities for the utilisation of research results in the form of clinical implementation and commercialisation.

MAX IV has, and the European Spallation Source (ESS) will be able to have, life-science applications. To prepare KI's researchers for the use of MAX IV and ESS, information and training will be needed on the potential in biomedical research. The Infrastructure Council will be running an information campaign in 2021 for these research infrastructures.

## 2. Strategy for research infrastructure

This strategy has been produced by a workgroup appointed by the Infrastructure Council. Preparatory activities included a workshop with the Council and with the Committee for Research, respectively. The strategy has been discussed at the ordinary meetings of the Infrastructure Council on 2 June, 22 October and 15 December, 2020.

To structure the process, a number of thematic areas and conditions for effective infrastructure operations were initially defined. The proposed breakdown into thematic areas should be seen as a practical tool in the process to derive a strategy rather than a strict categorisation. During the process, it became clear that there were several general issues that the strategy had to deal with.

The strategy is therefore divided into three sections – general approaches, thematic areas and conditions. Each area has a number of activities defined in the accompanying action plan. The strategy aims to identify the need for specific initiatives over the coming years.

### 2.1 General approaches

#### More effective use of KI resources

At KI, research infrastructure in the form of equipment is spread throughout the university. This equipment is an important resource for KI and should be utilised to its full potential. The landscape of equipment comprises items that are specific to a research group or a department, or that are connected to a building.

To ensure the optimal use of KI resources, the equipment that exists must be exposed internally and any renewal or upgrade be subsequent to internal inventory and coordination. There is currently a lack of information about the equipment available at KI and of coordinated use. Shared utilisation of equipment is facilitated by appointing people responsible for its operation and maintenance and for training in its use. Competence must also be maintained and developed and there must also be incentives for making it accessible.

*Clarity is needed regarding responsibility for the purchase, maintenance, long-term finance and upgrade of equipment. Clear and predictable processes must be in place for how these resources are made more accessible. KI will probably need to set aside resources for this.*

### Measures to improve overview

KI's research infrastructure should be easily accessible for experimental and clinical researchers active at KI or Region Stockholm. There is considerable improvement potential, as it is difficult for many researchers, especially clinical, to know what methods they can access for their scientific problem and where they can be found.

Research infrastructure should be presented in such a way that the individual researcher has an overview of existing research infrastructure and guidance on finding the methods and instruments he/she needs. The 2018 national ALF evaluation highlighted the difficulties that clinical researchers have obtaining an overview of available research infrastructure. The clinical researcher should be given information about, and access to, experimental research infrastructure while the experimental researcher should be offered the same for the clinical research infrastructure. A management system, iLab, for core facilities is currently in effect. iLab was introduced principally to manage orders for core-facility services and the billing of services, but has the potential to help provide a better overview of what core facilities there are, where contact details for them can be found, and what is required for their use. iLab could be developed and used to contribute an overview of all of KI's research infrastructures and resources, but this is not enough. Guidance and overview can potentially, in the long run, also include the possibility of finding nationally, internationally and/or commercially available research infrastructure.

*The ability to offer an improved comprehensive map requires information and communication platforms. A "single point of contact" is proposed as a means of improving overview, to which researchers can turn with general questions about research infrastructure, along with an advanced database for identifying equipment, premises and competence.*

### A long-term perspective

Most research infrastructures are long-term investments that are the product of a gradual building of value or of large investments. These kinds of research infrastructure need sustainable and stable conditions to function optimally and without interuptions.

Research infrastructures in need of long-term financing include biobanks, animal facilities and investments in electron microscopy and imaging. In addition, there is infrastructure that is an essential prerequisite of research, such as buildings and data networks. As regards the latter. KI has invested hugely in recent years and is currently in a consolidation phase. However, renovations and conversions will be needed to create good conditions for research infrastructure going forward. KI and Region Stockholm are issuing a joint call for the financing of core facilities in three-year intervals.

*KI should examine whether calls are the best way to allocate resources to core facilities and if so, at what intervals; and should look into the possibility of using other processes for allocating resources to research infrastructures with high demands on long-term planning conditions.*

### Coordination internally (across campuses), regionally and nationally

Research infrastructure is resource-demanding and it is effective to raise the level of coordination and prioritisation with other parties internally at KI, with Region Stockholm, in Stockholm Trio (KI, Stockholm University and the Royal Institute of Technology), nationally (including SciLifeLab) and internationally.

One priority is to make clinical samples accessible to KI (and other universities) and to handle the information following such availability.

The healthcare sector carries out analyses that are also done as research analyses in other organisations. There is untapped potential for collaboration here.

Research infrastructure at KI is not properly recorded and there is no incentive for coordination, without which there is a danger of a doubling (multiplying) of operations. There can also be situations where KI chooses to rely on different national infrastructures, for instance, instead of building up and/or running operations internally. Coordination must, of course, be based on impact analyses for KI's research.

- *KI should examine the possibility of coordinating and co-locating some of the healthcare sector's production infrastructures with KI's research infrastructures, which are at the forefront through common leadership and premises structures. KI should produce minimum levels of research infrastructures on its campuses and generally.*

**Specific investments**

There has been and will be a need for specific investments in research infrastructure. The needs of current and future strategic research areas will govern future research infrastructures, while new strategic research areas can be developed in connection with new research infrastructure. In recent years, KI has invested heavily in electron microscopy and together with Region Stockholm has invested heavily in imaging. The investment in electron microscopy is the single largest strategic infrastructure investment of recent years. The Infrastructure Council should focus particularly on following up this investment and in doing so pay regard to possible synergies with other structure-biological platforms.

Examples of strategic areas include bioinformatics/biostatistics and artificial intelligence (AI). KI needs clear and transparent decision-making processes for strategic investments in research infrastructure. Since investments in research infrastructure need to be harmonised with investments on competence within relevant research areas, they must be coordinated with the Committee for Research.

Investments in research infrastructure must, where relevant, be made in collaboration with representatives of the healthcare sector.

KI should also ensure academic competence that keeps pace with technological developments so that new methods can be quickly applied.

Sweden is now investing heavily in the MAX IV and ESS research infrastructures. This includes investments by financiers in research schools and project funds for the utilisation of the research infrastructures. There is potential for greater utilisation by projects run within KI.

- *KI should develop a process for identifying, prioritising and managing new investments in research infrastructure.*

- *KI should ensure the presence of academic competence that keeps pace with technological developments so that new methods can be quickly applied.*

- *KI should build up knowledge of how MAX IV and ESS can be used for biomedical research.*

*KI needs to ensure that the investment in electron microscopy develops well in terms of scientific production and number of users.*

**Training assignment**
It is important to describe the knowledge and competence that will be needed to utilise the advanced techniques and equipment associated with research infrastructure and to analyse the vast data volumes that are often generated. All of KI's research infrastructures should have a training assignment and many already do. This assignment can take different forms and comprise education at all three levels.

*KI should clarify the research infrastructures' training assignment.*

## 2.2 Thematic areas

**Clinical research**
The concept of clinical research is broad and elusive, and includes the utilisation of research infrastructures (such as biobanks) and the use of biostatistics. Shared research infrastructure is essential to clinical research and there is great potential to further develop the collaboration in this respect between KI and Region Stockholm.

There is also a potential in more clinical core facilities where equipment, staff and competence are shared by all professions. The existence of different principals introduces obstacles and bureaucracy, but with this said, improvements and simplifications can still be made as regards the collaboration and the availability of data. Areas that can be developed are research support and clear guidelines for analysis and the withdrawal of patient material. Agreements between parties must support access to clinical samples regardless of whether they are available in the KI biobank or the Stockholm Medical Biobank (SMB) despite different organisations. More easily accessible and clear guidelines for the administration of Material Transfer Agreements and Data Transfer Agreements would also make data more easily accessible. A node to which the clinical researcher could turn for access to core-facility services and help with more practical issues would improve accessibility and effectiveness.

*A node able to provide an overview of research infrastructures, a "single point of contact", is especially important for support to clinical research. This node can be supplemented with support and guidance, including on agreements, rules and accessibility.*

**Animal operations**
KI's animal operations are of considerable strategic importance to the university and are pre-requisite to the performance of many projects. Region Stockholm and KI need to have animal operations that are resource-efficient and that meet the needs of the researchers. Both organisations have invested heavily in the relevant infrastructure, which is judged to be of a high standard.

However, there is considerable over-capacity as regards mice and rats at KI and Region Stockholm's animal facilities. Another challenge is that the two organisations have different customer fees and different administrative procedures. The large animal facilities on Campus Flemingsberg are run by Region Stockholm while the large animal facility on Campus Solna is run by KI. Work has begun to create ways for the animal operations within KI and Region Stockholm to collaborate more closely. Animal operations also include certain core-facilities for specific purposes, such as transgenic technology and the import of animals, that receive support in KI's regular process for funding core-facilities.

Animal operations at KI are funded primarily by the Faculty Board but the Infrastructure Council can assist by examining different issues that arise.

*In its collaboration with Region Stockholm, KI should document the supply of and demand for the housing of animals and forecast future needs. KI should also work towards fee harmonisation.*

### *In vivo* imaging

Imaging techniques such as magnetic resonance (MR) and positron emission tomography (PET) are used to study structural and functional components linked to physiology and pathology in live humans and animals (*in vivo*). Imaging operations at KI and within Region Stockholm are to be brought together into shared premises in BioClinicum. It has been a challenge to get everything in place and there is currently a transfer of leadership.

KI's and Region Stockholm's joint translational imaging platform for *in vivo* imaging from animals to humans has a prominent position at the international research frontline. The platform enables the development and validation of imaging biomarkers, which can contribute to individualised drug prescription and treatment.

When all imaging operations have been brought together in BioClinicum to form the Centre for Imaging Research (CIR) along with advanced radiochemistry, the CIR will be one of the most advanced research environments for imaging in the world. To attain the highest quality and capacity, it will be important to establish scientific competence and long-term leadership. The operations, which are extensive and expensive, can only be minimally financed through user fees and will be in need of sustained support from KI and Region Stockholm. Imaging operations have contact interfaces with, for instance, MedTechLabs (https://www.medtechlabs.se/sv), an interdisciplinary centre for medical technology research jointly operated by Region Stockholm, the Royal Institute of Technology (KTH) and KI, and the Jonasson centre (https://www.kth.se/jcmi/jonassons-centrum-for-medicinsk-avbildning-1.742222), a centre for medical imaging at KTH.

*KI should work together with Region Stockholm to ensure strong leadership and academic competence in the impending changes, including relocations involving several imaging centres.*

### Biosafety

Biosafety is about protecting people and environments from exposure to infection and genetically modified microorganisms (GMM) in the laboratory.

Researchers at KI work with risk category 2 (BSL2) and 3 (BSL3) pathogenic agents and with GMM. This research is done under regulations issued by the Work Environment Authority and must be risk-assessed and, depending on the type of research, reported to or given a permit from the Authority. Premises with a BSL2 classification and premises approved for work with GMM can be found at many KI departments. Premises with a BSL3 classification can be found at ANA Futura (Flemingsberg), Biomedicum (Solna) and at Comparative medicine Fagraeus (Solna). The importance of BSL3 operations for research has been made evident by the current pandemic. KI is to have biosafety operations that meet the researchers' needs and that fulfil the prevailing rules and guidelines. This type of operation requires proper management and control, an ability to comply with the guidelines, and good traceability. The same applies to ionising radiation and other such potential hazards.

*KI shall ensure that biosafety meets the established requirements through proper management and control, and a thorough overview of biosafety shall be ensured through improved digital infrastructure, amongst other measures.*

**Biochemical analyses**
Researchers are doing less and less analysis work in their own laboratories, instead purchasing services from core facilities and reference laboratories able to handle larger volumes and guarantee high quality and efficiency. These core facilities and reference laboratories are well-equipped to handle rapid technical developments in biochemical analysis. Increasingly so, the researcher's role is to coordinate analyses and compile results, which means that the work has become successively more administrative.

Administrative research work can include the analysis and compilation of results generated in well-functioning and sometimes accredited laboratories with access to modern equipment and expertise (e.g. SciLifeLab). It has therefore been possible to replace the broad arsenal of technicians previously used in the researcher's own laboratory with services that are often of a higher quality and lower cost.

Karolinska University Hospital (KUL) carries out a great many biochemical analyses in an accredited environment and there should be good opportunities for KI's researchers to use them. There are also commercial actors providing services in this field.

*KI should guarantee guidance for researchers on where a certain type of analysis can be performed.*

**e-infrastructure**
Information technology and e-health already have an important role in research and healthcare, and its importance is expected to increase. With its aim to be at the forefront of this development KI therefore needs to be able to offer a coordinated and professional research infrastructure within e-infrastructure.

The quality, transparency and effectiveness of research can be enhanced through the greater use of digital tools for data collection, reporting, safe archiving, permit administration, etc. KI's initiatives in this field will be harmonised with the FAIR (Findable, Accessible, Interoperable and Reusable) principles. An important component of maintaining research quality is the development and use of digital research environments (DREs). As regards the storage of research data, it is strategically important to decide the extent to which KI shall use external actors (e.g. SUNET) and whether KI is to collaborate with other universities, for example in the SNIC consortium.

KI's IT office has developed a storage system (S3), which will be used to store research data. Metadata and a link to data at KI will be on the SND's research portal, DORIS. KI should highlight and monitor issues concerning the handling of sensitive data within SNIC and SND so that KI researchers can use these resources effectively. The same applies to relevant international initiatives and collaborations, such as the European Open Science Cloud Association (EOSC Ass). KI needs to focus on taking part in different projects and processes in order to develop e-infrastructure.

KI also needs to ensure that the necessary biostatistics and bioinformatics expertise is available, as well as advice on regulatory and ethical matters. The matter of the storage and handling of sensitive personal data at KI is under investigation to ensure the existence of clear guidelines and recommendations on matters such as which systems can be used to share sensitive personal data.

*KI should investigate and identify a number of issues concerning e-infrastructure and then needs to decide on the development of e-infrastructure at KI, the use of external actors for data storage and collaboration within SNIC and SND.*

## 2.3. Conditions

### Sustainability/Lifecycle analysis

KI's core facilities possess important and high-level competence, and provide unique services to KI researchers.

A qualitative study with interviews of core-facility directors at KI shows that the culture surrounding core facilities is important to their optimal functioning (Reference 1). Many core-facility directors are alone in their work and feel that they have to re-invent the wheel. The study concludes that there is a need for leadership development amongst core-facility directors and that an organisation needs to have clear definitions, create structures in line with the desired culture and work with follow-ups and evaluations.

It is important to ensure solid leadership and transparent and clear career opportunities for employees working at KI's research infrastructures. Different forums, such as networks for core-facility directors, are vital instruments for competence and experience exchange.

It is important that the operations are continually developed in order to maintain "state of the art" standard and to remain relevant for KI's researchers. A model for this is proposed for implementation and described under "Management and control" below.

- *KI should try to create good career opportunities for employees in its research infrastructures and ensure opportunities for competence and experience exchange.*

- *KI should implement the suggestions in the report Management and control of KI:s research infrastructure" (Ref. No 1-1011/2020).*

### Steering and control

The operations must be continually developed in order to maintain a "state of the art" standard and remain relevant for KI's researchers. The three-year cycles that are still used for the resource allocation of core facilities cannot always handle updating in line with rapid technological developments. These cycles might need to be complemented with a more continual, clear and transparent dialogue between the Infrastructure Council and the respective core facility to identify, plan and allocate resources to, for instance, necessary new equipment. A new model has been produced for the Management and control of KI:s research infrastructure (Ref. No 1-1011/2020). The report proposes a dialogue-based steering based on agreements between the Infrastructure Council and head of department, following the allocation of resources to a given research infrastructure. Follow-ups are to take the form of annual dialogues supplemented by annual reports.

The summary of this report can be found in the box on the next page.

This report gives proposals for the management and control of Karolinska Institutet's research infrastructure. The report focuses on research infrastructure that recieves funding from the KI Infrastructure Council budget. Initially it is established that certain research infrastructures is a product of a gradual build up of value or large up-front investments, and that these research infrastructures need sustained and stable conditions and that this must be secured.

The project group proposes that the Infrastructure Council be given a clear mandate to allocate resources to research infrastructure and that this is linked to an explicit assignment to follow up investments in research infrastructure. This follow-up shall be based on agreements between the Infrastructure Council and head of department, following the Council's allocation of resources to a given research infrastructure. It is also proposed that this follow-up take place in the form of annual dialogues supplemented by annual reports that should ideally be harmonised with KI's comprehensive quality system.

The project group proposes that central scientific and economic administrative support is provided by FIR and STL respectively and that resources shall be allocated accordingly.

As important as having clear, transparent and predictable processes for initiating and maintaining resources for operating research infrastructure is having corresponding processes for when resources are discontinued. The project group give proposals in this regard.

The proposals mean that the Infrastructure Council must have a budget for handling financial challenges and the discontinuation of research infrastructure. Resources must also be set secured for central coordination in FIR/STL.

The work going forward should focus on the implementation of the proposed activities.

*KI should implement the proposals in the report "Management and control of KI:s research infrastructure" (Ref. No 1-1011/2020).*

**Quality system**

KI has a comprehensive quality system with common procedures and tools to be used for quality work throughout the university, as described in "A comprehensive quality system at KI – guidelines" (Ref. No 1-865/2018).

Here it states that quality work is to be done systematically and continually in a cyclical process towards constant improvement and supported by effective quality assurance. Taking a systematic approach involving planning, implementing, following-up and adjust creates conditions for continual operational development. KI can consider whether any research infrastructure should be ISO accredited.

*KI should therefore describe research infrastructure more clearly in terms of quality work within research.*

**Financing**

Over the past decade, there has been a shift of financing responsibility for expensive equipment from the research financiers to the universities. Previous important financiers of expensive equipment such as VR and KAW no longer grant instrument support to the same extent as before but primarily finance national research infrastructure and inter-university collaborative initiatives.

KI's infrastructure is currently financed mainly through KI's state funding for research and doctoral education, VR or via SciLifeLab. A given research infrastructure can be financed jointly by multiple financiers and/or receive support as a core facility and/or national infrastructure (See fig. 1 below, data from 2019).

*Fig.1. Financing diversity among KI's core facilities*

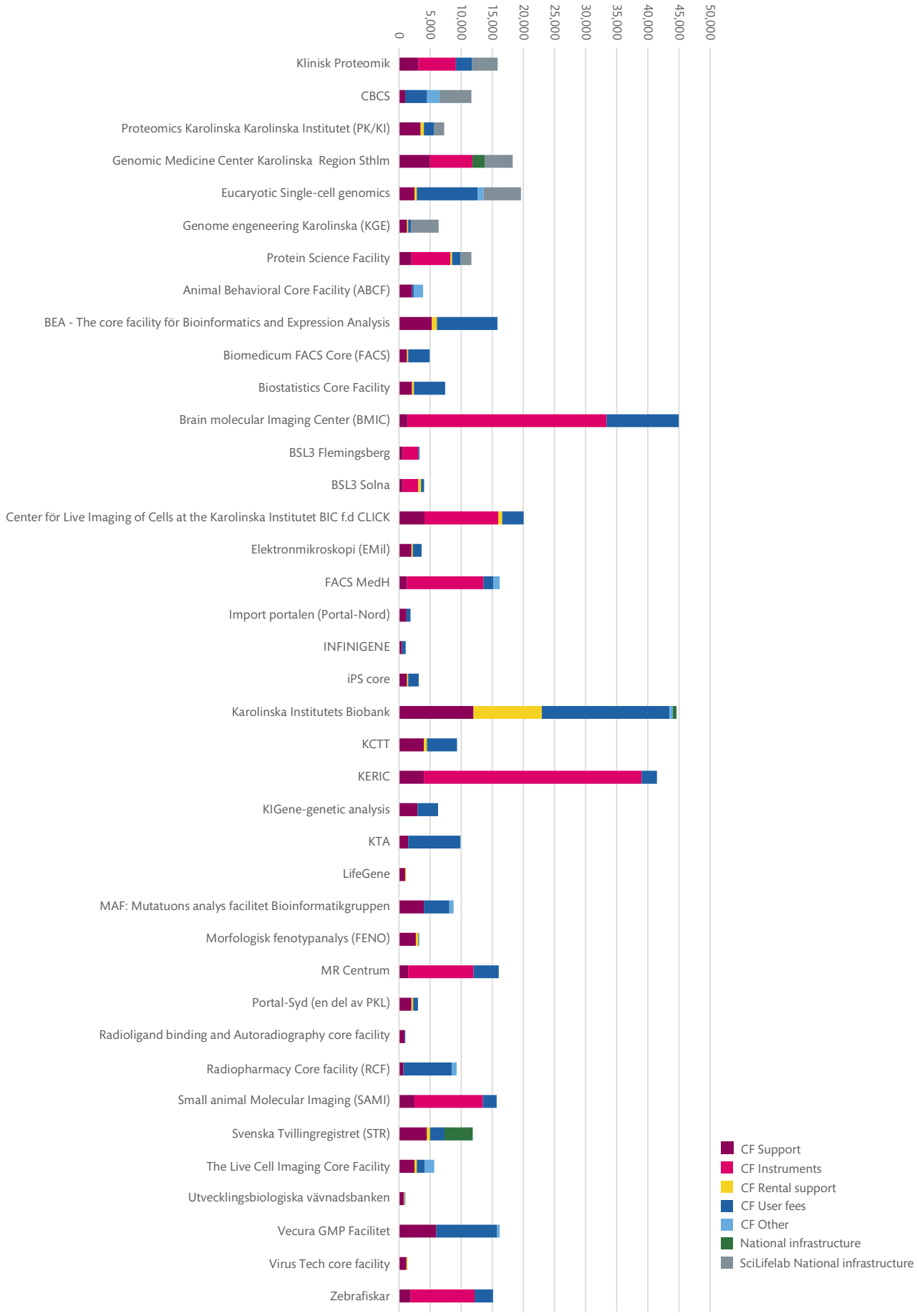
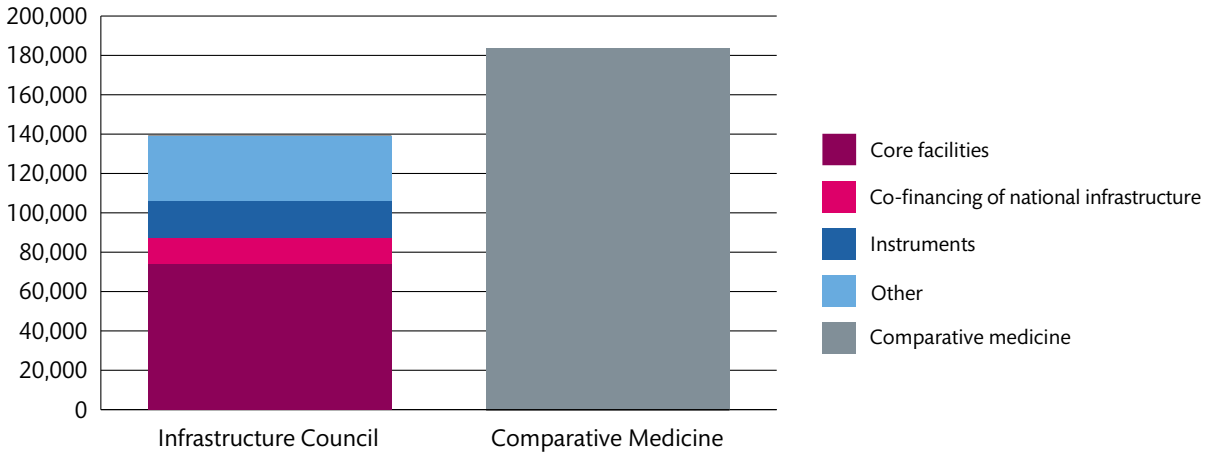


*Fig. 2. Resources for KI's research infrastructure break down as shown below (2020).*




KI regularly advertises funding for the operation of core facilities. An analysis should be done of the core facilities that this type of call is appropriate for. If it is found that not all core facilities are suited to this format, alternative processes should be developed for allocating resources to certain core facilities. Region Stockholm also sets aside considerable sums for infrastructure, including buildings for laboratories, cyclotrons, radiopharmacy, biobanks and animal facilities. It also contributes financing in the core-facility calls. KI applies for, and receives, grants to take responsibility for national infrastructures. KI should ensure the availability of professional support in the application process, where applications must be optimised in terms of content, structure, language and layout.

*KI needs a long-term financing plan for its central research infrastructures and be proactive in recruiting external funding.*

**Priorities/Accessibility**

Accessibility to KI's total research infrastructure is to be characterised by clarity, transparency and predictability. This shall also apply, for instance, to issues relating to the authorship of articles containing data generated within such research infrastructures. KI's research infrastructure shall also be available to the commercial sector. There are a number of questions that need clarifying as regards how the research infrastructures should be offered to companies, such as fees, contracts, how use is to be prioritised vis-à-vis the needs of the university, and incentives for making the research infrastructure accessible broadly to the commercial sector.

*KI should investigate the conditions for collaborating with the commercial sector and seek to remove obstacles and regulatory ambiguities while protecting the conditions and interests of KI researchers and KI as an organisation.*

**Communication**

Communication about KI's research infrastructure is important. Through proper communication, KI's research infrastructure can help to strengthen the KI brand and contribute indirectly to financing and increasing the number of external customers. Good communication helps to raise internal and external awareness of KI's research infrastructure and the resources available,

which in turn promotes a high degree of utilisation. The communication shall be professional, coherent and proactive. KI's research infrastructures are exposed via internal and external channels, and there is a general need to refine communication channels at local and central level, where ki.se should be the primary channel, supplemented by iLab for established users.

*KI should continue to develop and simplify the information provided on research infrastructure for better accessibility and greater utilisation.*

## 3. References

1. Case study "Managing Culture in Core Facilities", Juhlin-Dannfelt and Sandmark KTH

ki.se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