

REPORTCross-panel report, research
infrastructure**Date**

October 2021

Panel chair:

Max Lemme

Cross-panel report, research infrastructure

KTH's Research Assessment Exercise (RAE) 2021

Panel chair:
Max Lemme

Table of Contents

Introduction	3
Part A: Summary of the panel	4
1. Feedback on the formulated visions and strategies, both on central level and for the individual KTH research infrastructures	4
2. Ideas and recommendations for essential steps.....	5
Part B: Report on specific questions	6
1. The eleven established KTH Research Infrastructures	6
2. Research infrastructure and research at KTH.....	11
3. Internal organisation within KTH.....	12
4. Overall reflections on research infrastructure based on the nine panel self-evaluations	12
5. Research infrastructure and research areas	12
6. National and international infrastructures	13
7. Examples of excellence.....	13
8. Final remarks	14

Introduction

This cross-panel report is part of the Research Assessment Exercise (RAE) 2021 at KTH Royal Institute of Technology. The report is based on parts of self-evaluations from nine research panels, self-evaluations from eleven KTH Research Infrastructures, other documents and interviews. The report aims to provide recommendations and feedback to KTH, and when motivated involved departments.

Experts in the cross-panel on research infrastructures:

- Prof. Max Lemme, [RWTH Aachen University](#) and [AMO GmbH](#), chair
- Director Christine Nellemann, [National Food Institute](#), [Technical University of Denmark](#)
- Prof. Viktor Öwall, [Lund University](#). Pro Vice Chancellor for research infrastructure and digitalization

The three experts have also had discussions with one representative from each of the nine research panels looking especially on issues related to research infrastructures within their respective panel:

- Panel 1: Prof. Eleni Chatz, ETH Zurich
- Panel 2: Prof. Janna Saarela, University of Oslo
- Panel 3: Prof. Annick Hubin, Vrije Universiteit Brussel
- Panel 4: Prof. Ellen Zegura, Georgia Tech
- Panel 5: Prof. Jos Vander Sloten, KU Leuven
- Panel 6: Prof. Lis Nanver , University of Twente
- Panel 7: Prof. Doriana d'Addona, Università di Napoli
- Panel 8: Prof. Veronique Doquet, Ecole Polytechnique
- Panel 9: Prof. Olga Botner, Uppsala universitet

Coordinators for the cross-panel on research infrastructure:

[Malin Hedengran and Susanna Pehrson](#), KTH Royal Institute of Technology

Part A: Summary of the panel

1. Feedback on the formulated visions and strategies, both on central level and for the individual KTH research infrastructures

That can lead to increased quality of research at KTH related to research infrastructure

The cross-evaluation team acknowledges the huge effort done by the KTH presidency to form a structure for core infrastructures at KTH. A lot has been accomplished since launching this central initiative only few years ago. The inclusion of KTH Research Infrastructures (**KTH RI**) as part of the 2021 Research Assessment Exercise (RAE) for the first time is a clear sign of the appreciation of the **KTH RIs** by the President's office. It was very well received by the core infrastructure directors.

The central support for the KTH RIs shows the vision and understanding of the President's office of the importance of leading-edge infrastructures for leading edge research and innovation. This became quite clear in the discussions with Deputy President Prof. Östling. The initiation of the **KTH RIs** is clear evidence of this vision. Nevertheless, the further development of KTH RIs could benefit from a clearly formulated alignment with the vision and strategy about the development of KTH as a technical university as a whole. Thus, the panel finds it important that KTH describe strategic areas to support in the future based on the strong-holds of today with the vision of the future. One director described this striving for a long-term overarching strategy with the question: "What should KTH be known for in 100 years"?

In this context, the panel suggests developing a clearer vision on what are the benefits for both KTH in general and for the individual labs of being a **KTH RI**. When asked, various reasons were given such as access to internal funding, which is rather limited, and visibility. The panel believes that the idea of central RIs is a strong tool to create international and internal visibility that can have a unifying function, but that this aspect is currently underutilized.

The panel acknowledges that the decisions on initial funding of a core infrastructure as well as its sustainable maintenance and operation are complex. It appears that the initial choice of setting up the different KTH RIs tended to be based on available external funding as well as very motivated internal researchers. The latter is part of what drives a university, but it is also vulnerable to changes in research groups, funding opportunities and central staff. In addition, the scope of strategic development of the KTH RIs is severely limited by the absence of a national funding scheme for large instruments. The KTH-internal program is commendable, but very limited (see also section B8). National funding seems available in unpredictable ways, which means that future developments are opportunistic rather than strategic. KTH-internal investments beyond the current program may be a way out and could be sustainable if the investments can be utilized in future grants (depreciation-based refunding). In summary, the panel came to the conclusion that **the process of becoming a KTH RI is currently primarily bottom-up**. If KTH wants to utilize its RIs for branding, a top-down process may be very suitable to also identify labs with a great potential to gain visibility for both the lab and KTH.

The **building rent of facilities** was seen in several cases as a major obstacle, and we believe KTH should join forces with other universities to look at this issue. Otherwise, several infrastructures at KTH or other universities requiring large numbers of square meters could be threatened to close down, which would be detrimental for the whole of Sweden as a research and innovation leader. One has to consider that many labs were built when rent was not part of the cost structure, and this is now falling back on the Universities. Of course, this is a general political issue that all Swedish Universities face.

2. Ideas and recommendations for essential steps

To be taken to strengthen KTH's work with research infrastructure

Collaboration between schools, departments and research groups using a core infrastructure is a mean to leverage research quality and internal collaboration. However, for KTH to achieve the most, the **KTH RIs should be visible and branded both internally and internationally**, for example by creating a visible and common web-portal for all KTH RIs. Also, central communication competences could be used in creating publicly understandable web content on each infrastructure as well as content targeting experts and scientists. The content should be consistent: some infrastructures are situated in departments; others are regional or national infrastructures. This can be confusing for users or others coming from outside or not knowing the history of the facility. To increase transparency in the structure and funding scheme a **centrally orchestrated presentation format could help** substantially.

A **transparent fee structure** could be implemented at all core facilities to make it easier for users to understand. The different KTH RIs enjoy the flexibility they encounter when initiating a facility, but the researcher tend to get disappointed when they find that they must pay more than anticipated. The panel understands that the different infrastructures are very different in the way they look at user fees. We understand that this is natural since they come from very different backgrounds, where for instance Electrum comes from a research area with a long tradition of user fees while PDC comes from a HPC background where user fees are traditionally not used. However, the panel believes that everybody would gain from a common understanding, which would also help new directors to understand issues at hand. For example, the labs have to deal with insurance and contract issues, which may not be ideally handled by the individual labs. We believe KTH should develop a common framework which allows flexibility when needed but draws some lines so that “customers” know what to expect.

Sustainable funding is essential for a long-lasting and successful infrastructure. To become a successful KTH RI, the RI Directors need to align with and support the overarching KTH strategy, be able to do long-term planning and to continuously develop the KTH RI. It would be beneficial if each of the infrastructures received a limited amount each year for maintenance and operation. All directors seem very keen in running and developing their facility. However, user fees and external funding fluctuate, and it should be openly discussed how to cover the cost for the most essential personnel (see also comment B8). KTH should reflect upon a **model for sustainable operation and renewal** of the KTH RIs and develop a clear plan. This should take into account that research projects are mainly funded through national and European funding schemes, with sometimes different funding rates and/or rules. Since the user fees are partly funded through these research projects, it is important to consider the respective rules.

Nearly all of the non-national infrastructures have clearly indicated that it is hard to find resources to finance staff to actually run the infrastructure, i.e., funding equipment is hard but funding long-term staff is even harder. As we understand it the KTH funds are devoted primarily to instrumentation, but we believe the funding of staff should be seriously looked into.

Part B: Report on specific questions

1. The eleven established KTH Research Infrastructures

How well does each RI comply with the criteria set for KTH RI? Discuss and evaluate the quality of the individual RI. Reflections on the visibility and knowledge of the RI within KTH and among relevant external actors? Suggestions to strengthen the RI in terms of collaborations, organisation and management and financial sustainability, etc. What is your view on the levels of access, support and fee structures? What are your reflections on the collaboration of the RI with other research infrastructures within KTH, nationally and internationally?

Below the RIs are listed in alphabetical order.

Molecules and Materials at Interfaces Laboratory (2MILab)

- Newly founded, and the collection of equipment in one location is commendable.
- Implementation of a common booking platform (e.g., LIMS) is commendable. However, how is the interaction with other users of LIMS and the continued development of LIMS taking place?
- AlbaNova NanoLab seems to have overlap in terms of topics and instrumentation (maybe due to small distinction between physics (ANL) and physical chemistry (2MILAB)).
- 2MILAB was set up to provide a sustainable format for providing advanced methods, with expert staff and maintenance, but still looking for the financial model to realize this.
- Fully owned and controlled by KTH.
- Long term planning not fully established (for lack of programs).
- Director is 50% part-time, or not paid by infrastructure at all.
- Three departments started out interested in the common infrastructure. This developed into interest from the whole region. However, boundaries and collaboration with other infrastructures at KTH need to be elaborated.
- It is interesting to follow a newly planned infrastructure. They have received a suggestion to a fee structure and a financial model, but they did not have the impression that they had to follow these suggestions. Again, if KTH has a preferred model for different systems it would be best to tell so transparently from the beginning.
- They think that it would be hard to become economic sustainable without a much larger company user group.
- 2MILAB does not currently seem to have plan for an advisory board. This should be discussed and developed, preferably with international presence.

AlbaNova NanoLab (ANL)

- A nano-fabrication facility open to start-ups and many other users with a need for more flexible and low-cost facility compared to Electrum.
- For outsiders/foreigners the name AlbaNova does not explain what it is about.
- Established tool booking system (LIMS).
- Complementary to Electrum but the interaction could be clearer.

- Interesting access model with a (almost) flat rate that is very affordable. On one hand, this creates a commendable low entry barrier for Junior Faculty and enables increased scientific output. On the other hand, access should be somehow in line with access cost for other KTH RIs. In particular, the panel believes that a closer interaction with Electrum would be beneficial to KTH even though they have very different business models. There should be a possibility to explore how equipment and expertise can be shared to a larger extent.
- Continuous expansion of total booking times over many years, may hit “full capacity” soon, expansion difficult due to room and rent constraints.
- Is there a plan for renewal of equipment?
- What is ANL’s view of industrial use? Could this be developed in cooperation with Electrum?

Advanced Light Microscopy (ALM)

- ALM operates predominantly in the life science area.
- “We are engineers building microscopes” and they do that for users all over Sweden as a node of the national initiative. The director sees them as service-minded.
- They collaborate with Jonasson centre that has substantial collaboration with the medical world and close localization to Karolinska Hospital.
- Could cooperation with the national synchrotron facility MAX IV be exploited?
- Interaction with the WASP program (Wallenberg AI, Autonomous Systems and Software Program) is not mentioned in the text but during the interview. Could this be exploited further, especially with the new Data Driven Life Science program from the Wallenberg foundation?
- ALM is a Swedish national infrastructure and part of SciLifeLab but the relationship towards KTH researchers looks like it could be strengthened.

Electrum

- Very mature facility with professional management and established operating procedures.
- Electrum is together with AlbaNova part of the national infrastructure Myfab and there are structures that are common to the nodes. Therefore, it is somewhat surprising to find such different business models. This likely needs to be explained much clearer to users, both existing and potential ones. Electrum mentions such an effort in their report, and a coordinated follow up should be pursued from the KTH management.
- Electrum is more professional and commercially oriented than ANL. AlbaNova is more research-based, flexible and cheaper. Only few users use both facilities. However, it should be easy to communicate to the users what to get at the two different facilities. To ensure maintaining the two different profiles and optimal communications to users it would be beneficial to have a mutual advisory board or alike. An increased cooperation between the two would be beneficial to both of them and to KTH.
- Despite the economy from users, if they could get more support to finance staff would be beneficial for the long-term sustainability of the infrastructure.
- The Director feels that the status as a KTH RI gives visibility and shows the appreciation of the infrastructure by the KTH President’s office.

- An advantage is seen in the internal funding, in that it can happen much quicker than external funding.
- In their report they take up that Kista has changed significantly since the establishment and there are questions regarding Health & Safety regulations, e.g., if some of the gases and chemicals that are used will be allowed in the future. KTH needs to look into this issue seriously!

Hultgren Laboratory

- This infrastructure appeared to be well-led and was professionally presented in the self-evaluation and video presentation.
- The laboratory receives its basic funding from the founding department. They are constantly looking for external funding for equipment. Being a KTH RI gives visibility according to the director and it is “nice to be under the KTH umbrella and not having to invent the wheel again”.
- Boundaries between adjacent KTH infrastructures seem to be formed by what equipment the different facilities have. This can make sense internally, but it is hard to interpret seen from outside users. Increasing the transparency and developing a uniform presentation of the KTH RIs may help.
- The Hultgren laboratory does not currently seem to have a plan for an advisory board. This should be discussed and developed, preferably with international presence.
- In the interview and in the report, cooperation with the Odqvist laboratory was mentioned but seems to be limited to procurement of instruments. If so, could this cooperation be extended?

Jonasson Centre for Medical Imaging

- Being central to the life science area, the lab has extensive collaboration with medical schools in the region. The lab has good collaboration with Karolinska Institute (KI) and its hospital, and it sounds like they differentiate themselves and do not invest in the same equipment as KI which is beneficial for the region and the collaboration with these organizations. However, with being so close to other universities, it may be worth discussing how to increase the branding as a KTH RI.
- Development of the facility is dependent on the research in the groups using the facility.
- The facility has commendable visions in the area of artificial intelligence and pattern recognition that could be interesting to follow up. Here, a KTH strategy on the development might help the facility. Possible interaction with the Wallenberg WASP and DDLS programs should be investigated.
- Has interaction with SciLifeLab been sought after?
- Collaboration with e.g., the electron microscope facility appears to be dependent on the users of the facilities. We reckon that the Centre could prosper from more collaboration with the other KTH RIs for internal development but also to be able to tell users what research they can take elsewhere and what research question they can get answers to here.

National Genomics Infrastructure (NGI)

- Benefits from being a national infrastructure, but also the connection to KTH is essential for its engineering strength to develop methods.

- Steering Board beyond KTH is established.
- Mainly university users, not limited to KTH but all Swedish universities with life science. Swedish research is prioritized but there are also international users. The percentage of international users did not become clear to the panel.
- Users contribute 50% of the budget, which is comparably high.
- Collaboration with AML, PDC is established.
- High quality facility with competent and enthusiastic management.
- Half of the approximately 80 employees are working in the labs and users can get help in the whole process from handling a sample, to analyses by bioinformaticians to getting the results.
- Collaborators seem to be nationally based within computing and microscopy. Interlinks to other infrastructures at KTH as well as nationally might be beneficial to users as well.
- KTH could support NGI in achieving their ambitions at the European scene. This is partly outside the area of KTH RI but NGI could play a role internationally.

Odqvist Laboratory

- Many research areas are covered in the Odqvist Laboratory. However, the development of the facility is dependent on the research groups and users.
- The fusion of the lab 10 years ago has been successful, also following the merger of the departments originally housing the different labs.
- There seem to remain a sense of “belonging” to the former departments. The RI is mainly used in the former department.
- Industrial use could be increased.
- User fees are not sufficient to cover running cost, the high rent and strategic investments.
- Some of the activities going on at this laboratory are overlapping with other schools or departments even though they try not to actively duplicate activities according to the Director. The Hultgren laboratory mentions the Odqvist laboratory but not the other way around, which might indicate different levels of understanding of the cooperation. Here, discussions between Directors, Schools and the KTH Deputy President may help to clarify.
- RI has a scientific board, and it is planned to expand this, including industry.

Center for High Performance Computing (PDC)

- Widely used infrastructure, but University-agnostic by definition as a national infrastructure.
- PDC appears to be of strategic importance for several existing and future KTH research directions.
- Long-term planning difficult due to mixed signals from central government about SNIC funding. The HPC situation in Sweden is currently changing and the situation must be closely monitored.
- About 2/3 of staff not funded through SNIC, which gives some independence.

- Well established as part of the European supercomputing community.
- The infrastructure is happy with being imbedded in KTH with strongholds in important areas for the infrastructure. However, even more interaction and collaboration with users on the development of the facility would be beneficial.
- Traditionally HPC centers were more focused on equipment but there is a shift towards services and user support especially when large HPC clusters are being formed. The balance between large and small users as well as the balance of how PDC reaches out to potential users while still supporting the experienced ones is an important open question.

Sustainable Power Lab

- This is a solid facility with a fine incremental strategy, which has potential to be developed in a more ambitious fashion. Today, the development of the facility follows the research groups and users. 80% of their users are from two departments at KTH. These were the founding departments. 20% are external users. It could be worth to discuss increasing this external percentage.
- The facility is happy with being a KTH RI, because increased visibility is perceived by the Director. In addition, the potential for internal funding is seen as an advantage. Approximately 60% of the activity is teaching in some form which supports the entire facility and shows true benefit and impact for KTH. However, as discussed in section B.2, it is important to balance responsibilities in basic education with running a world class research lab.
- As it is a younger KTH RI (2 years), the fee structure is not fully established and the economy is not fully negotiated with KTH central. KTH could encourage and help new facilities to transform into the preferred type of structure quicker. We strongly believe this lab could benefit greatly by interacting with other KTH Infrastructures in organizational and governance issues (see also comments in section A.2 and B.3).
- The Director points to communication as one of the areas to develop. He thinks of both communicating to scientific users as well as the public. There is a wish for KTH to centrally help with this and maybe establish a common communication platform for all the infrastructures (see section B.3).
- From the report it seems like the lab has good contacts with industry, but it seems like the industrial use of the lab resources is rather low (the figure 10% was mentioned in the interview). It would be beneficial to try to increase this figure, not primarily for short-term financial gains but for establishing increased and long-term cooperation (see also comment on VIC, next).

Visualization Studio VIC

- With all the data generated in many areas and the need for being able to analyse and visualise the data, the panel feels that this facility may increase in importance in the future, and in many existing and new areas.
- KTH has a goal of initiating a full digital twin of the campus which this lab is involved in. Research areas could prosper from this experience in introducing digital twins with many purposes including sustainability. However, the panel on Architecture and Built Environment was not aware of this → may be a(nother) sign that internal communication needs to be improved.
- It would be beneficial to establish an advisory board, both a scientific one and an industrial one. There is an informal industrial advisory board and we believe it could be good to

formalize this since the lab has a very big industrial user base, 200 companies were mentioned in the interview.

- The lab is heavily involved in academic education, and we are quite amazed with everything they seem to be able to do with the limited resources. The lab is also heavily involved in commissioned education. Do they get support to handle commissioned education from KTH? Their experiences should be very valuable to KTH.
- According to the Director, there is excellent reach towards industry leaders through training of high-level management (CEOs, CTOs, etc.) in questions of digitalisation. This could be leveraged by informing during those trainings also on the other KTH RIs. Often, high-level management can easily facilitate cooperations when they KNOW about opportunities. This could be developed into a strong synergy for other KTH RIs.
- Very skilled and enthusiastic staff. However, vulnerable as there are only 1½ employed! This seems to be much too little and we believe KTH should find ways to increase this number (see general remark in section B.8).
- In addition to their main tasks, the Director and the research engineer have to handle user fees and bookings for the RI, which seems to be quite counter-productive. VIC may benefit from centralized organization of some of these issues (see remarks in B.3).

2. Research infrastructure and research at KTH

How are the different types of research infrastructures balanced in the overall portfolio of research at KTH? How is the relationship between the research infrastructures and the Schools/departments? Are the research results generated at our RIs visible and thereby contributing to long-term impact?

The KTH RIs seemed to be **more embedded in some areas than others, and completely absent in some**. This may be improved with increased visibility and branding. However, if more KTH RIs are established, the level of funding must be increased, and the criteria defined to become and remain a KTH RI must be applied rigorously.

Teaching is seen by some infrastructures as a means to co-fund operation in terms of staff and even equipment. This is borne out of a dire shortness of basic funding. Ideally, the main concern of the Infrastructure Management should be to provide world-class Infrastructure, with teaching or research grant applications of much lower priority and duty. However, for the KTH infrastructures to be responsible for running laboratories for basic education can be problematic and lead to conflicts of interest. The panel understands that it might even be useful for the same persons to do the teaching and running the KTH RIs, but the roles should be clearly defined and the money flows separated. For example, for the Sustainable Power Lab we understood that more than 50% of the budget comes from education, and this can be a problem when prioritizing. On the other hand, we see it as very beneficial if the labs have connections to education and that students get exposed to world class facilities. This issue on teaching should best be discussed between the KTH RIs and the Schools.

The **research generated in the majority of the KTH RIs is clearly visible internationally** and contributes strongly to the excellent international reputation of KTH, reflected in international rankings.

3. Internal organisation within KTH

How well is the overall support for research infrastructures from the university management working, including how to promote and keep competence within research infrastructures? What are your suggestions to strengthen the internal processes and the central strategy for research infrastructure in order to secure long-term availability of research infrastructures needed for state-of-the-art research?

The organization of the core infrastructures is a matrix organization that the panel felt needs more communication from central KTH's side. A detail is that the names of the infrastructures are not unified nor evident. Some are probably based on funding body and some on the functionality (e.g., some have "nano" in their name). It may be discussed if this is the best way to present each area. A common understanding on how this should be handled would be beneficial. For example, the panel observed that sometimes the full names are used when presenting the KTH RI, and sometimes abbreviations. During the interviews there were sometimes other abbreviations used than in the text provided for the RAE. This is an example of how people from the outside and inside easily get confused.

We recommend a strongly centralized approach and/or support to a web presence, the branding and the internal and external communication. However, this should be done in close collaboration with the Directors, because KTH cannot afford to lose these highly motivated enablers in the process. Such centralized support should be a SERVICE to the KTH RIs, not an additional administrative burden.

4. Overall reflections on research infrastructure based on the nine panel self-evaluations

What is your view on the needs and requirements of the research infrastructures? Are they met and how involved are the Schools leadership in their respective research infrastructures? What are your reflections on the overall visibility and knowledge of research infrastructures within KTH and among relevant external actors? Do you think that research infrastructure at KTH is functioning as entry levels for collaboration and are the means of access sufficient? If not, what are your recommendations? Do you have suggestions on smaller labs/equipment specified in the department's self-evaluations that could be incorporated in established KTH research infrastructures? Do you find research areas that lack infrastructure or research areas where the infrastructure should be upgraded to established KTH RI?

Here, we refer to the points raised about internal and international visibility and awareness. The cross-panel discussion showed that the members of the nine panels were largely NOT aware of the difference between a KTH RI and (just any) infrastructure. Where people are aware of the KTH RIs, they often use them, but it cannot be generally said that all KTH RIs act always as nucleation sites for new research.

We cannot make recommendations for new or smaller labs to be incorporated in KTH RIs. The time and depth for discussions was not sufficient.

5. Research infrastructure and research areas

Do you have suggestions on how to strengthen collaborations and connections between the research infrastructures at KTH, within the same research area in order to increase user numbers and offer a wider range of services? What are your reflections on research infrastructures at KTH and the research platforms?

The panel understands that four research areas have been chosen to run **KTH RIs**: ICT, life science, nanofabrication and materials. However, it remained unclear why and how these were selected. For example, one expert from the panel covering architecture and civil engineering did not understand why no core infrastructure was chosen from that area. Also, the panel has not identified infrastructures to change from KTH RIs to more "standard" lab-infrastructure under a specific department. This

raises several questions: **What happened and what will happen to other areas? Why have they not been chosen (yet)? How clear is the existing procedure to become a KTH infrastructure? How to stop supporting an already chosen infrastructure? How to evaluate that?** These are important strategic questions that should be discussed at the President's office and with the heads of schools and eventually also with KTH RI directors. We clearly encourage KTH to think about refining transparent means on how to initiate KTH RIs and, just as important, how to close KTH RIs, and how to use this instrument strategically in the future.

6. National and international infrastructures

What are your reflections on the relationships with other universities and research funders in governance and funding of infrastructures? Does KTH make sufficient use of national and international research infrastructures? Do you have suggestion on the KTH strategy for MAX IV, ESS and Petra III?

The current KTH RIs are a mixed set of local, regional, national and even international (European) facilities. In addition, some national infrastructures led by KTH have not applied to become a KTH RI. This raises the question whether KTH would like to brand these national infrastructures also into KTH RIs and thus enhance the visibility of the infrastructure and the research area on a high level at KTH. For example, a suggestion from the KTH management for these national infrastructures to become KTH RIs may be seen as recognition of their research quality.

The strategy towards the large, decentralized infrastructures became clear in the discussion and the efforts towards making these visible among KTH researchers is commendable. However, the flow of information about their availability and their access schemes would benefit from central support, possibly in the context of generally establishing a central and unified communication strategy.

7. Examples of excellence

Mention areas where you have identified that KTH is exceptionally strong within research infrastructure, as well as areas where KTH could improve.

It is hard to precisely single out one KTH RI from another, because the level of detail of the discussions was too limited. However, we have tried to show two clear examples here, which does not mean that other KTH RIs do NOT perform excellently, both as a RI and in support of excellent research.

Electrum has established a sustainable model and has a very balanced user base. It enables excellent research, as evident from high impact peer reviewed publications, but it also fosters innovation because it acts as an incubator with several successful examples of start-up companies.

ANL is another example of a successful support. The model is different, as it focusses on low barrier access to research infrastructure. It provides the infrastructure for many funded research projects and its scientific output is excellent.

It is generally difficult in most cases to track the success of a KTH RI with respect to publications, because the author affiliation is typically with a School, and the acknowledgement contains research grants, but maybe not KTH RIs.

8. Final remarks

Finally, please indicate any other topic in relation to KTH existing or potential work with research infrastructures you find relevant.

Most infrastructures have **Advisory Boards** or Steering Groups, some of them including external stakeholders but many relying only on persons connected to KTH. Such Boards could be extended strategically to expand the reach and impact. The panel believes that an international advisory board should be a prerequisite of becoming a KTH RI.

The panel unanimously agreed that KTH RIs are essential for maintaining long term excellence in research and innovation. As one KTH professor stated in a private discussion: “KTH RI xxx is existential for groups like ours at KTH”. The current funding level from central KTH does not reflect this status. It should therefore be increased substantially. The criteria and the exact level of funding obviously needs to be discussed and decided by KTH, but the panel at least wanted to make a suggestion. We believe that there should be at least something on the order of **50 MSEK per year for all KTH RIs**. Obviously, that amount may be different for different KTH RIs, depending on the prices of equipment and specific needs. Maybe an amount similar to the average cost of the most heavily used equipment in each infrastructure could be used as a basis for discussion, while at the same time we recommend tying this support strictly to the criteria, once defined. Of course, national funding or Wallenberg funding may be available in some cases, which could offset discussions. One could also debate whether to treat the national infrastructures differently from the internal KTH RIs. Possibly, requesting co-pay by the infrastructure on the order of 10-25% could also be a good stimulus to ensure that only urgently needed equipment is purchased.

The panel thinks that it would be good to include users and PIs in the discussions for the RAE in the future. It would provide a more balanced insight into how the KTH RIs are viewed within the University. A visit would have been very useful, although the panel understands that it was not possible this time in the pandemic.