

**REPORT**

Cross-panel report Impact

**Date**

October 2021

**Panel chair:**Prof. Tim Bedford

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# Cross-panel report, impact

KTH's Research Assessment Exercise (RAE) 2021

Panel chair:

Professor Tim Bedford

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## 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, other documents and interviews. The report aims to provide recommendations and feedback to the involved departments and KTH.

### Experts in the cross-panel on impact:

- [Professor Tim Bedford](#), Associate Principal (Research and Innovation) University of Strathclyde
- [Professor Tamer Basar](#), University of Illinois Urbana-Champaign, USA.
- [Director Jakob Fritz Hansen](#), Technical University of Denmark

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

- Panel 1: Dag Björklund, Chairman of the Association of the Swedish Professionals for the Built Environment
- Panel 2: Nicole Borth, Professor of Cell Biology and Cytometry at the Department of Biotechnology, University of Life Sciences Vienna (BOKU)
- Panel 3: Rasmita Raval, Professor Chemistry, University of Liverpool
- Panel 4: Raouf Boutaba, Associate Dean Research, Faculty of Mathematics and Professor of Computer Science - University of Waterloo
- Panel 5: John Clarkson, Professor of Engineering Design at the University of Cambridge and Healthcare Systems at Delft University of Technology
- Panel 6: Tomas Gomez, Professor of Electrical Engineering at the Engineering School of Universidad Pontificia Comillas in Madrid, Spain
- Panel 7: Jan-Ola Strandhagen, Centre Director Sintef, Professor Mechanical and Industrial Engineering, NTNU Norway
- Panel 8: Salla Franzén, Chief Data Scientist SEB, Sweden
- Panel 9: Horst Vogel, Professor Emeritus of Physical Chemistry at the EPFL

### Coordinator for the cross-panel on impact:

[Johan Blaus](#), KTH Royal Institute of Technology

A list of the meetings conducted during the visit week is provided in the annex.

## Part A: Summary of the panel

### 1. Feedback on the formulated visions and strategies

*That can lead to increased quality of research at KTH and increased impact*

The panel was very impressed with the impact that KTH has demonstrated that it can develop, in collaboration with societal partners, from its research. KTH has particularly strong partnerships with industry and a number of other organisations that provide pathways to impact. However, the panel believes nevertheless that the “impact system” as a whole at KTH can be further enhanced, and indeed that this will be necessary as other universities and research institutes continue to invest and improve in their own efforts.

KTH has a number of different visions, strategies and mechanisms related to impact, but no consolidated strategy. These include:

- A broad concept of societal impact which is embraced across the university and which includes teaching-based societal impact.
- The Strategic Partnerships with major companies, public sector organisations and research institutes.
- The initiative for Impact leaders, based in Schools, and with resources and priorities which vary from one School to the next (and one of a number of initiatives proposed from the Impact 3C project, for initiatives supporting staff to Create, Capture and Communicate).
- The Research Platforms.
- KTH Business Liaison and the Research Support Office.
- KTH Innovation.
- Its institutional commitment to the Sustainable Development Goals, demonstrated by the appointment of a Vice President for Sustainable Development the explicit inclusion of the SDGs and the appointment of a cross-panel within this RAE2021.

Despite the existence of these mechanisms and strategies, impact is not explicitly mentioned in the current development plan. Collaboration is highlighted strongly there. A consequence of the reshaping of the appointments and portfolios at Deputy and Vice President level has been that there is no clear institutional level “owner” for impact, and this in turn has meant that responsibility for impact sits mainly at schools and department level, except where a particular impact mechanism (such as strategic partnerships) provides cross-institutional support for impact. The reshaping of schools since the last RAE has also meant many changes in the schools, and taken attention of the leadership there.

The above mechanisms are good and contribute to the long-standing culture of collaboration with industry in particular. However, there is an opportunity for the University to develop an interconnected impact system that “joins the dots”, bringing together the various impact mechanisms and enabling them to work in a connected, and indeed synergistic, way. One which focuses capacity and knowledge about creating societal impact from research through a smaller number of key pathways to impact, and which has a good balance of oversight from the different levels of KTH organisation.

## 2. Ideas and recommendations for essential steps

*To be taken to renew KTH's work with impact*

During its work, the cross panel was interested in understanding the expectations of the Swedish Government for university work in impact. We were particularly struck by the statement given in the Higher Education Act which describes the main mission for universities as follows:

*“As the accountable authority, the Government shall establish higher education institutions for the provision of:*

- 1. courses and study programmes based on scholarship or artistic practice and on proven experience, and*
- 2. research and artistic research as well as development work.*

***The mandate of higher education institutions shall include third stream activities and the provision of information about their activities, as well as ensuring that benefit is derived from their research findings.” (Italics added.)***

The explicit inclusion of third stream and of ensuring benefit of research in the legal mandate of Swedish institutions gives a clear basis for research impact work at the university. The word “ensuring” implies a responsibility to be active in developing impact. Yet while KTH is undoubtedly developing much impact from its research, we found that the systems to support impact are still in development, both at institutional and School/Department levels. There is some confusion about what is expected in terms of impact from academic staff, and there was a lack of clarity about how impact as a whole is addressed within the Deputy and Vice President portfolios and at School level.

We also noted that KTH describes the scope of societal impact very broadly, with 18 different pathways to impact (derived from analysis of RAE2012) identified, including the impact of the graduates of KTH. While we agree that education is a source of impact, the Higher Education Act mission explicitly requires ensuring benefit of research. Hence, from the point of view of evaluating how the institution meets this part of its mandate, education impact should be considered only in as much as it enables further research impact.

We recommend as essential steps:

- Develop an overarching institutional (or university wide) strategy for impact that:
  - Builds on and links the key impact support mechanisms in the University and in the Schools to make a joined up and synergetic system that can amplify the efforts of staff and further enhance engagement with external partners, both existing and potential.
  - Provides clearer incentives through pay or promotion for academic/researcher work that develops impact, including potentially a career path for those who wish to specialise in knowledge exchange/impact.
  - Supports specialisation to key pathways to impact for individual departments based on either institutional mechanisms or local support mechanisms allowing follow up from the centre through the schools to reinforce the importance of timely activity in this area, and allowing the sharing of experience and resources across research groups.

- Makes systematic use of research infrastructure and collaboration space across the institution for impact development with external partners.
- Encourages academics to make use of collaborations with others at KTH and partners outside to achieve impact of reach and significance, and celebrates their success.
- Clarifies the role of SDGs in driving impact.
- Clarify more clearly what is expected of staff based at each level of the organisation in terms of contributing to the impact part of the mandate. At KTH Board level the responsibility for impact (either as a whole or in key sections) should be more clearly structured to align with relevant portfolios, ensuring that impact is understood to be a priority and there are drivers at all levels of the organisation to improve impact further.
- To ensure that impact related work is systematically improved across the university it should become an explicit part of the KTH quality and audit system.

These recommendations and those given in section A3 are discussed and expanded upon in Part B.

### **3. Recommendations applicable to the whole of KTH**

#### *Focus on Societal Impact from Research within the Institutional Mission*

KTH has a strong institutional commitment to societal impact and an integrated vision that encompasses both education impact and research impact. We recommend that education impact and research impact are seen as equally important, but complementary and essential aspects of the university mission.

#### **Impact Support Mechanisms**

Impact support mechanisms are both efficient and collaborative ways to support academics and researchers in developing impact from their research. KTH has a number of different support mechanisms mainly at central level.

While reviews have taken place of strategic partnerships and impact leaders, there is a need to take a holistic view of all the mechanisms that support impact – or could support impact – including also research platforms, KTH Business Liaison, the Research Support Office, Communications Dept and KTH Innovation, so that these mechanisms can more clearly be aligned to provide an impact support system.

The university should evaluate and prioritise its key pathways to impact and ensure that there are support mechanisms in place at the appropriate level of the organisation. For example, this may include strategic partners at School level, or clear roles for University strategic partners at School level.

There is an opportunity for KTH to consider other mechanisms that complement the existing ones. For example, there appears to be an opportunity to create systematic engagement with the cluster of high growth technology SMEs in the region around Stockholm.

The purpose of these impact support mechanisms is to enable academics and researchers to be more effective in developing impact, to share good practice and collaborate, and for the university to be efficient in using resources, and become better able to measure activity and success.

### Impact Leaders

We broadly support the Malmberg recommendations on impact leaders. In particular, we recommend that there should be formal roles for impact, reflecting the legal mandate for ensuring society benefits from research.

### Incentives

A recurring message has been that there is a gap in terms of rewards and recognition for those working on impact, that it is often not recognized in workloads, and that it has a weak influence on promotion prospects. This appears to be a key factor in making staff exchange difficult.

We recommend a review of the structural incentives for impact in workload, appointment and promotion and to search for new approaches to structure and incentivise staff exchange with partners.

### Understanding performance

At the moment it is quite difficult for the university to assess its overall performance in developing impact from its research, and equally difficult to monitor the “health” of the KTH impact system. While there is no easy solution to this, we recommend some steps to make progress:

- The 18 pathways to impact developed after RAE 2012 can be simplified to smaller number of pathways, enabling their use for monitoring activity rather than classifying impact cases. The impact mechanisms can be cross linked to these simplified pathways giving a means to monitor projects making use of these impact mechanisms.
- The UK REF programme uses the concepts of reach and significance as qualitative measures of impact cases. These concepts are useful not only to assess what has been achieved, but also to assess what potentially can be achieved with the right support and collaborative partners.
- Using the above approaches, societal impact can then become a fully integrated element of the KTH quality system with data that describes the health of the overall pathways to impact on an annual cycle.
- Such an approach would put the university in a stronger position with respect to its mandate of “*ensuring that benefit is derived from their research findings*”.

## Part B: Report on specific questions

### 1. Further development, university perspective

*Which are the most obvious areas for further development at KTH, in relation to increased societal impact?*

The key areas for development discussed in this report are:

- Greater focus on societal impact of research as an essential element of the institutional mission.
- Development of impact support mechanisms (of which strategic partnerships and KTH Innovation are examples) at all levels of the organisation to provide efficient and collaborative ways to support academics and researchers in developing impact from their research.
- An overall institutional impact strategy.
- Formalisation of the role of impact leaders.
- Development of ways to measure and support the development of reach and significance of impact across different domains of impact, including as part of the KTH Quality Cycle.
- Greater incentives, through recognition and reward, for staff developing impact from research.

Recommendations are made in various sections below.

### 2. Priorities within KTH

*Are issues related to impact, in your view, prioritized in the everyday work within KTH?*

Impact is embedded in many activities, and certain key aspects (such as strategic partnerships and KTH Innovation) are high on the agenda at Deputy President level, but impact is less visible on the agenda at Vice President (VP) level.

Much of the impact generated at KTH is the outcome of outstanding in-house research activities linked to commercialisation or to research and development activities that take place in collaboration with industry. These naturally happen at the department and division levels, driven by individual faculty, and are prioritised in the everyday work by those involved when they attract R&D funding. Indirectly, these activities also lead to prioritization of impact.

There appears therefore to be a strong reliance on what is effectively “bottom up” activity, as evidenced by the investment in impact leaders (to be discussed further below) which are supported often through key university-led mechanisms. School leaders we spoke with understood the importance of impact and were aware of Impact leaders. However, there is a big variation in what the Impact leaders do and the proportion of time for which they are appointed.

A recurrent message from many of those we spoke to, from Malmberg’s report on Impact leaders and the UIIN staff survey is that there is still a gap in terms of rewards and recognition for those working on impact. Linked to this is the implicit priority for teaching and basic research created by the lack of basic funding for impact (except where this is part of an externally funded project).

There is also some confusion about what is meant by societal impact. We noted comments in the RAE documentation which stated that the greatest impact was created by the students. The latter point was



made in previous institutional documents about societal impact. However, there is a risk that this is taken as a justification for weaker effort in developing societal impact from research, which would be to the detriment of the institution and its mandate to develop social benefit from its research.

### 3. Individual perspectives

*How are efforts for increased (societal) impact valued at individual level within KTH?*

The success of KTH in impact clearly depends very much on the way this is valued and driven by individual staff and teams within the university. Our evidence on this issue comes from the impact leaders and the UIIN survey of 191 KTH staff.

From the limited evidence we have though (UIIN survey and impact leaders' discussions, as well as the RAE documentation) it seems clear that many staff at KTH are highly motivated to work on developing impact from their research.

These sources indicated clear interest amongst staff, especially in collaboration with industry through R&D. The "Identification Criteria" slide (p11) of the UIIN Survey shows that the main motivation in identifying partners is the potential to improve the quality of research, chosen by 77.5% of respondents. The potential for social/societal impact was only highlighted by 42.9%, but it was the fourth most popular criterion. This would seem to indicate that the goal of achieving impact is widely shared but that partnerships are primarily seen as a mechanism for improved research rather than impact.

The outcome of the survey in terms of motivations gives "Provides new insights for research" as the top outcome, though "Addresses societal challenge and issues" was in fourth place and clearly in the top group of motivations. More significant here was the position given to motivations reflecting the implicit priorities set by the institution: all three motivators ("It is expected of me"; "Improves my reputation within the university" and "Increase my chances of promotion") were in the lowest scored cluster, and were scored very significantly lower than other potential motivations.

Our meeting with impact leaders was consistent with the survey outcomes when we talked about individual staff impact. There is interest and engagement from staff, and many good examples of impact, but they feel there are few incentives.

The lack of incentives at individual level is significant. Points raised included the following:

- Impact is generally not recognized as part of workload, meaning that it is often a "spare time" or even an "own time" activity.
- Impact performance has only a weak influence on promotion – far less significant than research and teaching performance – and seen as something that should be integrated into career pathways of researchers.

The UIIN results also indicate that the greatest activity related to impact is in collaborative R&D. This activity generates resources for research and academic staff so is relatively easy to resource and grow. Many other forms of impact generation are not resourced directly but could be supported. A key example is that of KTH Innovation which provides strong support to researchers and academics in the commercialisation and spinout area, removing barriers for impact. KTH Innovation was praised in the meeting we had with impact leaders, as an excellent example of a central initiative.

The University Strategic Partnerships aim to stimulate staff mobility, and it has been recognised that outward mobility (staff from the university going to work at the partner for long or short term secondments) is not easy to arrange. There are many aspects to this, but two stand out: 1) the lack of

career incentive – this period in industry is likely to reduce production of research papers and potentially have a negative effect on promotion, with little or nothing to make up for it; and 2) the additional Equality, Diversity and Inclusion challenges.

Given the degree to which exchange of staff with partners is encouraged (in both directions) there was less discussion of this in the self-evaluation than we had expected, and almost no discussion of the strategic value of these roles. Adjunct roles appear to be mainly inwards and with major partners. Where there is mention of part-time work in industry, this appears mainly in those fields where professional practice naturally fits with such a pattern, and not necessarily because it drives research and impact collaboration. The above points lead us to a strong recommendation to review the structural incentives for impact in workload, appointment and promotion and to search for new approaches to structure and incentivise staff exchange with partners.

#### **4. University management perspective**

*Recommendations for the university management, related to increased impact?*

KTH already works closely in partnership with other stakeholders and end-users, which are likely to be groups who help to achieve impact from research. As in most cases the impact is not created directly by the academics and researchers themselves, the achievement of greater societal impact is something that is not wholly in the hands of the university. It can, however, still be influenced through effective impact mechanisms in order to create a higher likelihood of reach and significance. This is where institutional strategy is required.

Driving impact requires a clear top-down strategy to enhance effect of bottom-up activity and initiatives and it is notable that the present development plan 2018-21 for KTH does not mention impact explicitly. KTH management could introduce impact more clearly in the quality system with an audit circle which also could develop relevant datasets for societal impact.

KTH's existing managerial structure has great opportunities to create impact. There seems especially to be potential through the VPs: The focus on societal impact could be more visible across the VP portfolios with joint and individual impact roles. The responsibilities within impact should be more clearly defined, in particular for the VPs for research and sustainable development and also for digitalisation. KTH used to have a VP for collaboration & Innovation, but some of these responsibilities came to the Deputy President, giving a high profile, but amongst a wide range of other tasks of the Deputy President.

Because of the very diverse forms that impact can take, it is difficult to develop metrics that are applicable or useful across the board to measure the overall quality of impact. However, the UK REF programme uses the concepts of reach and significance for impact. These are helpful concepts that are widely applicable, and which enable academics and universities to develop their thinking about what ambitious impact outcomes could be, and hence to make choices about the strategies required to achieve those outcomes.

Another aspect of the diversity of impact is the challenge of classifying either it, or the impact pathways. The analysis of RAE 2012 produced 18 different pathways to impact. This is useful as an illustration of the diversity of impact but less useful as a management tool. There may be merit in a rougher classification, for example as simple as industrial collaboration, spinouts, science and policy advice, standards, and public outreach, within which the concepts of reach and significance of impact can be used. The Innovation Readiness Level Framework developed by KTH and widely internationally used for coaching commercialisation ideas could be further developed in the impact work at KTH and in a revised form more widely used as an instrument for impact readiness and hence supporting the

development of an impact culture. One of the strengths of the IRL Framework is that it quite simply shows development through time.

We make the following proposals to further increase societal impact from KTH research:

- KTH's next development plan could include impact and set a clear focus, route and direction for its development.
- Consider ways to address the lack of incentives for staff to work on impact development. These could include
  - Clearer inclusion of impact as a significant factor in staff appraisal and promotion.
  - Workload allocation for prioritised impact activities (see below for further discussion of priority).
- Stronger strategic focus on key delivery mechanisms for different impact pathways, building on and synergising the existing structures including strategic partnerships, KTH Innovation, platforms, and impact leaders.
- Ensure that societal impact is a fully integrated element of KTH quality system and develop a set of data that describe and measure impact on an annual cycle.
- Celebrate successful impact in key areas, for example through awards and through highlighting research centres that have societal impact with strong reach and/or significance, using them as role models.
- Continue the Impact Leaders scheme (see Section B6).
- Consider a new impact initiative to link KTH to small but rapidly growing technology-based companies based in and around Stockholm. This initiative would fill a gap between KTH Innovation and the Strategic Partnerships.
- Consider whether the Research Platforms can support mission focussed cross disciplinary research initiatives, thereby providing further mechanisms to societal impact.
- Consider how best the different mechanisms for societal impact can be strategically led within the senior leadership team.
- It is also worth considering whether other central supported impact mechanisms could be effective, particularly around high growth technology SMEs, or around outreach to industry, society or the public. While concern was raised in our meetings about the high overheads at KTH, there was recognition that KTH Innovation is effective, and its position at the centre is not questioned. This shows that there could be space for one or more other highly focussed central impact initiatives where central expertise and delivery is more efficient than a distributed model in which effort is duplicated in multiple centres. For example, at the University of Strathclyde the Research Office supports a major annual outreach event, *Engage with Strathclyde*, aimed at present and future collaboration partners. Similarly, a highly focussed initiative aimed at links with SME digital tech companies in the Stockholm area could create the analogue of a strategic partnership with a cluster of SMEs.

## 5. Recommendations at various levels within KTH

*What should KTH, at various levels, do to increase the societal impact?*

In this section we will go through some, but not all, of the levels and programs. The strategic partnership program is elaborated upon, as it is seen as a beacon in KTH's ambition to deliver impact.

KTH has a good understanding of the pathways by which research impact is developed in wider society. Overall KTH could develop clearer descriptions of the impact responsibilities and opportunities in both the line organisation and in the matrix organisation of KTH.

The role of the line-organisation (KTH leadership and School heads) is to

- a. Define strategy and development plans for the whole university
- b. Set the organizational structure for impact support and dialogue
- c. Develop incentive structures for both entities and individuals
- d. Qualify and further develop/prioritise the 18 impact pathways (or groupings of them)
- e. Develop a systematic feedback system (audit/quality system)

In the matrix organisation (VPs, Impact leaders, programs, KTH Innovation, etc.) focus should be on

- a. Defining and pursuing impact within responsibility areas
- b. Ensuring close involvement of and support to academics and researchers who have the specialist knowledge of research being translated.

We have listed recommendations for top-management in Section B4. However, several of these apply at School level, where expertise may be best provided at School rather than departmental, or research group level. This includes e.g.;

- Support greater recognition and reward for impact related work and show a developmental route for staff on impact.
- Extend the Impact Leaders scheme, with a stronger focus on a smaller number of impact pathways for research that are particularly relevant to the work of the school.
- Consider whether shared resources across the school can be used to support these impact pathways.

The 18 different pathways to impact identified by KTH from previous RAE evaluations are good descriptors based on actual KTH practice. However further analysis could be carried out to understand how these pathways are best supported and where in the organisation they should be driven. In some cases, multiple pathways can be supported by the same mechanism, KTH has some clear mechanisms linked to some of these pathways. For example:

- KTH Innovation provides a (central) mechanism for Commercialisation and Exploitation
- Strategic partnerships can be seen as a mechanism for multiple pathways to impact, including *Identifying key bottlenecks in the future for industry and society...* and *“Carrying the industry frontier forward...”*

Platforms were not introduced to us as an impact mechanism, but these could potentially evolve further to support mission-oriented cross-disciplinary research themes linked to external stakeholders, and hence play such a role. This might apply for other programs and entities at KTH and is also why we suggest that KTH develop an overarching institutional strategy.

At department and research group level, academics and researchers should be involved in the pathways to impact as they have specialist knowledge of the research being translated. As discussed elsewhere there is a need to introduce incentives for individuals on working with impact, which can also make the researchers more engaged in the broader impact ecosystem of KTH.

#### Strategic partnerships

KTH has a strong set of Strategic Partnerships with industrial and public sector partners which have been the subject of a study with the support of UIIN and which has been reviewed also by Erik Fahlbeck.

Strategic partnerships were referred to on many occasions in meetings with KTH colleagues. They were highlighted in the self-evaluations (specific strategic partners were frequently cited where a research group had ongoing work) but not frequently in the *Structures for increased impact* section or elsewhere as a collective as opposed to mentioning specific partners in the context of a project. This suggests both that the group of strategic partnerships do contribute well to the generation of impact at KTH, as one would expect, but also that the existing strategic partnerships system is not clearly seen as one that is geared to provide new opportunities for accelerating impact of research.

A real strength of the strategic partnerships system is the strategic engagement between university senior leadership and company senior leadership. This constrains the number of organisations with which the university can have a strategic partnership, a problem which can be resolved if that responsibility for strategic engagement is placed at School or other levels. However, the bigger issue is to ensure engagement and the constant renewal of engagement between academic staff and staff in the partner organisations. That renewal must emerge from regular identification, selection and delivery of *mutual opportunities* (either bottom-up or top-down).

As the institutional level strategic partnerships have very broad ambitions, there is a risk that the purpose is less clearly understood within the university (there is some evidence for this in the UIIN data). Hence the models of strategic partnership at school or department level would need to be much more clearly defined, and the link to institutional level partnerships clarified. For example, the institutional strategic partners could be expected to become (where appropriate) anchor partners in more “local” focussed research partnerships. Such partnerships would enable different parts of the (institutional) strategic partner organisation to participate in, and help drive the vision of, a range of projects with different partners and funders, whilst operating under the overview of the institutional strategic partnership board.

KTH needs to consider carefully what the goals would be of strategic partnerships at school level and what the potential unintended consequences would be – for example whether this would potentially hinder collaboration with other schools, and how well this fits with the idea of restricting focus to 3-5 challenge areas. There is no reason why strategic partnerships at school level should not work, but they would still need to fit a common model for being suitably “strategic”, they still need strong coordination

and there needs to be widespread understanding of how to engage with them – ideally using a single approach across the university to ensure that they can benefit from capabilities in other schools. Another possibility is to use the structure of the research platforms instead of schools, but these appear strongly focussed on stimulating cross disciplinary research and extending their role to partnerships might distract from the current mission.

The partnership model, as currently operated and as described in the UIIN document, focuses very strongly on mobility of staff between university and industry. It has been noted that mobility tends to be one-sided, that is from industry to university rather than the other way around. From both the responses to the UIIN survey and our own discussions with university staff, it is clear that there are no strong career incentives and little formal recognition for academic staff wishing to be promoted. Without a fundamental reappraisal of incentives and rewards for academic staff it is unclear why the creation of further strategic partnerships would solve the issue. We are recommending in this report that greater incentives and rewards for staff to work towards societal impact are considered, and suggestions made in the UIIN report are useful more broadly for encouraging societal impact. Notwithstanding this recommendation however, because of the combination of career, work and family issues around outward staff mobility, our view is that outward staff mobility for academics is a particularly difficult nut to crack. At the moment, KTH appears to see this as a goal in itself. It may be beneficial to see it *also* as a means to achieving other goals and to understand what else can be done to achieve those goals.

Ultimately the success of partnerships will depend on teams identifying and delivering on the mutual opportunities that we mentioned above. Missions and the broader sustainable development goals give a strategic context (and often government funding) to partnerships. Delivery of successful outcomes from mutual opportunities, however, will increasingly rely on dynamic collaborations with changing groups of collaborating organisations focussed on specific questions.

Within this picture of dynamic research collaborations and delivery, the Strategic Partners of the university should be able to help focus on the bigger picture and the longer term goals. While not rated the most important criteria by the UIIN academic survey (p11) the clear criteria for long term strategic partners should surely include:

- Existence of shared goals
- Strategic fit to the university's strategic priorities, and
- Alignment of values to those of the university.

More broadly KTH should consider what makes a strategic partner different to any other partner. The capacity and commitment to be an active anchor research partner of the university may be one such feature. We make a recommendation elsewhere about ways to engage strategically with SME's and start-ups.

## 6. Impact leaders

*What are your general observations of the evaluation? In what way does the panels and the KTH schools related to the initiative with impact managers? In what occasions and under what circumstances can you see interaction between the impact managers?*

The structure with impact leaders was introduced in 2015. Having a decentralized role close to the different subjects and pathways to impact is sound and well thought, especially having faculty in the role as impact leaders.

Having the impact leader close to the researchers is key and without impact leader's focus from the individual researcher on working with impact would most likely decline. The Impact leader plays an important role to nudge and develop an impact culture at the schools. The approaches are diverse across schools and departments and the primary role is awareness raising and capacity building with heavy emphasis on skills and best practice.

The role does not seem to be so visible and integrated as one might expect, since few of the external evaluators from the nine research panels looking especially on issues related to impact had heard or was introduced to the impact leader role. The Impact leaders concept has undergone an external evaluation in 2021, conducted by Anders Malmberg, Uppsala University. The evaluation concluded that the impact leaders have increased the focus on impact in the schools, but also that the role is defined and practiced quite differently across the schools and carried out. It is notable that the resource allocations differ from school to school from 0.1 – 0.5 FTE.

The impact panel can second most of the recommendations from the external evaluation.

*The 10 recommendations from the external evaluation of the Impact Leaders:*

| Recommendations from evaluation   | Panel comments   |
|---|--|
| 1. <u><i>Retain the Impact Leader function but in a form that strengthens the schools' and school management's ownership of the initiative.</i></u>   | Yes, ensure a clearer contract between leadership and school management with feedback loops in yearly development plans  |
| 2. <u><i>Make a President decision that the schools should have such a function as an integral part of the school's broader leadership and support organization. Funds for this can be allocated separately or considered to be included in the regular resource allocation to the schools.</i></u> | Yes, a formal, mandatory role across the university is required  |
| 3. <u><i>Set an overall KTH job description for the role that corresponds to other academic leadership functions (FFA, GA, FA...).</i></u>  | Yes, and include descriptions on the merits of the role  |
| 4. <u><i>Establish that the impact leader function should be time limited and have a clearly defined scope, but let the schools determine the detailed scope based on their needs.</i></u>  | This may depend on the setup. If it is part of school management, it could be a permanent position. If it is seen as part of a career path for researchers it could be time limited (maybe for a |

|   |   |
|---|---|
|   | 2-4 yr time frame), which would enable new energy and perspectives to be brought to the role on a regular basis.  |
| 5. <u>Assign responsibility for KTH joint coordination, follow-up and support to the most appropriate support unit (one or more designated support unit.)</u>   | Yes, this is important to ensure the cross-disciplinary organizational dialogue on impact. The VP level should be included in this  |
| 6. <u>Refine the role of Impact Leader to deal with the societal impact of research only. (Make a separate effort to strengthen the education's working life and societal connection, suggested to be linked to the work of developing educations for lifelong learning.)</u> | We agree. However we note that there are still potential spin-off benefits for students of being involved in research impact activities. These include developing an entre- and intrapreneurial mindset, supporting extra-curricular activities and engagement with industry. If divided into two different paths a special focus on how to organize impact around education, LLL should be clearly defined and connected to the research impact. |
| 7. <u>Formulate overall goals at KTH level for how the societal impact of research is to be strengthened over a five-year period.</u>   | This is consistent with our report.   |
| 8. <u>Request that each school establish strategies for how to achieve the overall goals.</u>   | Yes, prioritise the pathways to impact relevant to school level.  |
| 9. <u>Do not include societal impact indicators in models for internal distribution of the basic grant for research and postgraduate education.</u>   | Yes, the pathways to impact are many and often difficult to measure and might drive unwanted behavior. Focus on organizational dialogue instead, but still gather data around societal impact to measure progress and scale.  |
| 10. <u>Make successful contributions in popular science, public education, consulting, expert and advisory activities meritorious in employment, promotion and salary setting.</u>  | Yes, but broaden it to also include industry collaboration (beyond research) and entrepreneurship   |

There is no formal governing document describing the Impact leaders. A clear recommendation is to ensure such a common ground and supplement it with specific school-relevant paths of impact. Then the central funding of the impact leaders becomes a strategic dialogue between central management and the School heads in the development plans. Even the impact leaders themselves are asking for clearer structures and the need for a quality control system. This could be at school or institutional level.

Among the impact leaders, there appears to be good dialogue on impact, but less on planning and concrete activities. Their roles in the hierarchy should be revisited and redefined. Even though the



impact leaders are funded centrally, there is a huge potential in defining career development and incentives (incl. a reward mechanism) for being an impact leader. This would make the role more attractive for researchers to pursue. At the present stage impact leadership is too dependent on personal commitment.

The concept of Impact Leaders is a very positive step towards developing an impact culture. We suggest that the impact leaders program continues and that the role develops in line with the above recommendations.

## 7. Impact cases

*Do the impact cases reflect which pathways the departments have (as they are mentioned in its strategy)?*

Input was collected from KTH faculty leaders, such as department heads, organized into 9 panels, representing 29 departments (along with their divisions), who have reported on 106 impact cases. The reports provided by the department heads and their associates were very well organized, following a consistent format, addressing all aspects of “impact” from the perspectives of individual departments, with “impact” interpreted in a broad sense. The impact cases carefully selected were by-and-large very well described, and they were impressive in terms of the benefit they have provided to the society. Even though the reports did not make any explicit reference to the 18 “KTH pathways to impact”, one can say that each one of these 18 pathways found relevance in at least one of the 106 impact cases described, and each of these impact cases involved at least one of the pathways.

An absolute driving element of societal impact of research is the high quality of research work linked to the development of new researchers in an environment where they can develop and understanding of societal relevance of needs of their knowledge, and KTH faculty have unquestionably demonstrated excellent performance on that front, with their multi-faceted activities. The quality of the research itself will be judged by the individual panels. We note though that at KTH there is a full range of research from that which is purely curiosity-driven with the potential for longer term impact, to research motivated both by researcher curiosity and perceived societal needs, whether of industry or around challenges for our citizens. KTH seems to be doing very well on both fronts, with some departments’ output more heavily tilted toward the former whereas some others are toward the latter. This provides a good balance across a broad spectrum at the university level.

Naturally, not all divisions or even departments are expected to cover the entire portfolio of possible avenues of impactful contributions to society through their activities, but it was impressive to see that as an institution KTH has been successful in establishing presence in all these domains. As it has been very well articulated in one department’s report, which applies to all others as well: “Increasing impact is a process of finding the right venues, the right contacts, spreading [our] research results in [the] various forms that make most sense depending on the content. It may be through spin-off companies, policies, standards, direct contact with an industrial or societal partner, or through the general media.” Hence, finding the right balance among multi-fold possibilities, based on the composition and academic mission of an individual division or even department, is a crucial factor in maximizing impact at the University level, and for this different units will need enhanced infrastructure support from the administration in their navigation from excellence in research, education and teaching to major societal impact.

## 8. Examples of excellence

*Mention areas where you have identified that KTH is exceptionally strong within impact.*

As we have mentioned in Section B7 of this report, there are various types of activities undertaken by faculty, research staff, and students that would lead to societal impact on different timescales, and overall, as an institution, KTH has excelled in all these domains, as also attested by the 100 plus case studies submitted as part of self-evaluations. An essential driver of impact is naturally the high quality of the work conducted, and one metric for this is the quality of the venues where research output is published (high impact factor journals) or presented (high quality conferences). Some of this research is driven by competitive funding received from national research agencies and can be viewed as internal (to KTH) activity, and some through collaborative research with industrial partners. Through such dissemination, research finds an outlet to broader scientific community as well as brought to the attention of different sectors (e.g., industry, government, education) who could take the knowledge created to its next phase of being brought to a form of direct use by general public (such as development of a product). Some of this transition from initial knowledge creation to a product could be undertaken by a company that was not involved in the initial phases of the research, but picks it up after it appears in the scientific media; some by an industrial partner that was involved in the research phase from the very beginning; and some through start-ups of faculty (and possibly other research staff) who were responsible for creation of the know-how. In some cases, the government would be in the receiving end of the research output which could drive and impact the creation of new policies for societal benefit. We list below some salient examples (precisely, nine) of the different paths knowledge created at KTH has taken, drawn from the impact cases that were included in the self-evaluation document.

1. *Research paper leading to implementation by companies not involved in the initial research (Panel 5, RPL Impact Case 5):* A PhD student at RPL during the period 2011-2014, along with his supervisor, developed a machine learning (ML) based algorithm for facial landmark detection in images, and published it in the Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (2014). The authors provided in the paper a clear and full description of the algorithm, which enabled others (researchers as well as relevant industry) to write their own implementation. As a result, because of also its superiority over other competing algorithms, in terms of speed, performance accuracy and robustness across faces, ML-based algorithm was included in Google Research's code base, in SnapChat's facial animation apps, in Oxford University's VGG group's "automatic lip-reading from video" software, and Nvidia's research to align faces in their FFHQ dataset.
2. *Research leading to a start-up (Panel 4, HCDT Impact Case 5):* A doctoral student and a professor in Media Technology, MID, worked during a period starting in 2008 on human motion analysis and gestural interaction, proposing shifting the interaction space from 2D touch screen to 3D space, being highly inspired by the advancements in big data, visualization technologies and advanced displays / smart glasses for AR / VR applications. The technology their research led to won several innovation competitions in Europe, and received significant recognition from the academy of science and engineering in Sweden as one of the promising technologies for the future. And, as culmination of this activity, they founded the successful start-up *ManoMotion*, in 2015.
3. *Research with significant potential impact but not necessarily in the short term (Panel 9, Impact Case 1):* The discovery of the Higgs boson in 2012 was the first of the major breakthroughs in fundamental science (particularly in physics) in this millennium, making the headlines in media all over the world, and creating a surge of interest among young people in basic science. In the years following the discovery, there was a doubling of the number of students selecting courses in particle physics at the master level. With regard to impact, it was

not only that KTH was directly involved in the analyses that led to the discovery (and in fact the only university in Sweden to do so), but also that following the discovery the affiliated KTH faculty found this an opportune moment to educate the general public on our understanding of the subatomic world, through various outreach activities, including open lectures around the country. One of the immediate outcomes of these activities was the noticeable increase in applications to student programs at CERN from Sweden. There is no question that a direct impact of the discovery of the Higgs boson to the society at large will be felt down the road, but not in the short term, as all other basic science discoveries driven initially by curiosity have shown.

4. *Action and policy-development through teaching and research (Panel 1, Impact Case 1):* Teaching and research on gender and social inclusion and its relationship with architecture has been an ongoing activity at KTH since about 2005, having inspired and influenced many institutions around the world. Three distinct outcomes of this development can be identified as: 1) Gender equality assessment and implementation with the architecture program, an educational development work. 2) A book derived from coursework at KTH in collaboration with international scholars, which has reached notable international acknowledgement; 3) *Action Archive*, a research project and non-profit organization, started out as a student master thesis collecting and documenting a suburb of Stockholm.
5. *Research driving new legislation (Panel 1, Impact Case 9):* A particular research activity at KTH has addressed the environmentally important issue of reducing greenhouse gas emissions linked to construction, for which no policy existed to incentivize the sector in that direction. This is about to change, with legislation now being prepared by the Swedish Government, named “*Climate declaration of new buildings*”, to be in effect from 1 January 2022. The fact that this legislation is now being put in place is largely the result of work carried out at KTH-SEED for many years in the field of life cycle assessment (LCA) of buildings, often in close collaboration with researchers from other institutes in Sweden and internationally, as well as with the construction industry in Sweden. In addition, KTH-SEED has also contributed to the content of the upcoming legislation.
6. *Software with major utility, leading to several start-ups (Panel 2, Impact Case 3):* The software *Percolator*, developed by a professor at KTH, is a cornerstone of the analysis of mass spectrometry data for protein analysis and is currently considered to be the reporting standard for proteomics data. It is the dominant software for analysing spectrum identifications produced by tandem mass spectrometry for proteomics. It solves the problem of how to tell correct from incorrect identifications of peptides in experiments. The program takes as input database search results produced by any one of a variety of search tools and then applies a semi-supervised machine learning approach to rank the identified spectra based on an assessment of the statistical significance of the peptide-spectrum matches. A related International Working Group for Antibody Validation (IWGAV) has been formed with representatives from several major academic institutions, and the program has led to eight start-up companies from the KTH group (Atlas Antibodies, Atlas Therapeutics, Atlas Intressenter, Abclon (South Korea), ScandiBio Therapeutics, ScandiEdge Therapeutics, AO5 Diagnostics and ProteomEdge) with pharmaceutical candidates which are now in five human clinical trials (as of March 2021).
7. *Active involvement in governmental policy development (Panel 4, Impact Case HCDT-2):* Under the leadership of one of its professors, and through efforts since 2012, KTH has made major impact on the development of the Swedish Digitalization policy. The initial charge to Sweden’s Digital Commission for the Ministry of the Enterprise was to analyse and propose policy decisions within the broad area of digitalization, covering a diverse set of areas such as

digitalization of the public sector, eHealth, digital inclusion, digital trust, security and safety, digital skills, development of the education system and lifelong learning, artificial intelligence and machine learning, digital innovation and transformation, and digitalization and gender equity. KTH played a major role in helping draft the current strategy for Digitalization, which was adopted by the Swedish Government in 2016, with one by-product being the formation of a new advisory group, *Digitalization Council*, within the Minister of Digitalization, where KTH has presence.

8. *Platforms to facilitate academia-industry collaboration (Panel 6, Impact Case ET-5)*: KTH has developed a unique cross-disciplinary platform, *Live-in-Lab*, for accelerated innovation in the built environment, and for collaboration between academia and industry. The testbeds in KTH Live-in-Lab are operated in real environments for testing and researching new technologies and new methods, with the goal of reducing the lead times between test/research results and market introduction for new technologies. In this way, KTH Live-in-Lab aims to facilitate the advent of the sustainable and resource-effective buildings of the future by accelerating the rate of introduction of new competitive products and services for the construction and real-estate sectors. The Live-in-Lab has impacted both industry and academia by providing them with an open platform for collaboration, a database for storing and sharing data and results, and physical infrastructure for running and scaling up tests and projects.
9. *Product development in partnership with industry (Panel 9, Impact Case 9)*: In partnership with industry, KTH researchers have developed and pioneered fluorescence-based super-resolution microscopy (nanoscopy) for cellular diagnostics. Through nanoscopy, differences in spatial distribution patterns of specific proteins within individual cells can be uniquely resolved, as a basis for early cancer diagnosis, and to reveal central mechanisms for bacterial virulence and invasiveness. This is naturally an important step toward early cancer diagnosis, which is key to successful treatment. KTH researchers have shown that nanoscopy analyses from a few sampled cells, from e.g., a small early tumour, can be used to identify cancer cells, and that nanoscale protein distribution patterns in platelets can reveal early-stage tumor-platelet interplay, which can form the basis for new diagnostic and therapeutic procedures. For pneumococci bacteria, a major global killer, they have shown by nanoscopy that the distribution patterns of their specific surface proteins provide important clues to their virulence and invasiveness, which also opens new paths for diagnostics and treatments. These exemplary findings clearly indicate that nanoscopy will have major impact on healthcare, and thus benefit the society, not only in Sweden, but worldwide.

We recommend that existing initiatives are drawn closer together, in an effort to strengthen pathways to impact. The mix of initiatives are broad at KTH and two of them stand out as excellent:

- KTH Innovation is a strong central entity, which is well known and used throughout the university, and an important bridge for KTH to the vibrant entrepreneurial ecosystem of Stockholm. The KTH Innovation Readiness Level Framework is globally renowned and bringing KTH Innovation closer to the impact strategy of KTH could improve the impact agenda of the university
- The strategic partnerships are strong and an excellent platform for developing societal impact. They illustrate that KTH's research and students are of high quality for industry. They also provide an important strategic engagement between university senior leadership and company senior leadership.

## 9. Final remarks

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

It is unquestionable that KTH is delivering strong societal impact. The RAE process clearly illustrates this with excellent cases and relevant structures in place. It has been interesting to see how KTH is focusing on an impact mindset through recurring organizational dialogue rather than setting up clear goals and institutional KPIs for impact. This is most likely the best way to work with impact (though in particular areas KPIs can be useful, and could help local impact leaders in establishing a sustained body of impact practice within their areas), however it requires also strong supporting structures, definitions and leadership to develop impact culture and to encourage its prioritization – especially in a context where there is no clear internal funding stream, incentives or overarching strategy.

The fundament for delivering societal impact is strong research output. Impact work should not be seen as an appendix to the research process, but rather an embedded element. Close research collaboration with industry, hospitals, etc., which KTH clearly excels in might be one of the best pathways to ensure societal impact. However, an impact approach and mindset should also secure a feed-back loop in developing the research activities and hence improve the return on time invested in research applications. And no less important, being able to clearly show government and the public that KTH delivers solutions, candidates and knowledge to society in general should ensure national support and funding.

KTH has a track record of success in developing impact from research. However, as we have noted, there is a mandate in the Higher Education Act to do this, and furthermore other Higher Educational Institutions are copying some of the successful practices of KTH and of other international exemplars. Indeed, KTH along with the other universities has benefited greatly from funding through the Strategic Research Initiatives (and other special innovation initiatives), which have the specific intent of funding research across TRL1-6, to accelerate the creation of societal impact from research, and for which continued political support is necessary. A key question for the KTH leadership is whether it wishes to be seen, in the future, as the leading Swedish HE institution in delivering on this mandate. In doing so, it will not only maintain its leading position but also stimulate the rest of the sector to make further efforts, thereby demonstrating that the societal investment has delivered the expected benefits. Such leadership requires a greater degree of investment (above all in ensuring that the proper recognition and reward structures are in place for staff), a greater focus on external funding sources that include funding for impact, and a greater degree of strategic oversight that “joins the dots” and gets maximum value from the different impact mechanisms of the KTH system, some elements of which are outstanding.

Finally, we understand that KTH is turning 200 years in 2027. As one element in celebrating this, KTH could set up an impact activity/event/report to clearly illustrate the importance of universities in the 21<sup>st</sup> century to deliver solutions and pathways to societal challenges.

## Annex 1

Meetings Cross-panel Impact during Visit week.

### August 24<sup>th</sup>

Vice Presidents:

- Annika Stensson Trigell, Vice President for Research
- Leif Kari, Vice President for Education
- Anna Wahl, Vice President for Gender equality and values
- Stefan Östlund, Vice President for Global relations and overall international cooperations
- Per Lundqvist, Vice President for Sustainable Development
- Jan Gulliksen, Vice President for Digitalization

Head of Schools:

- Mikael Lindström, Head of School of Engineering Sciences in Chemistry, Biotechnology and Health
- Sonja Berlijn, Head of School of Electrical Engineering and Computer Science
- Muriel Beser Hugosson, Head of School of Architecture and the Built Environment

### August 25<sup>th</sup>

Sustainable development:

Per Lundqvist, Vice President for Sustainable Development together with Cross-panel Sustainable Development.

Strategic Collaboration, Strategic Partnerships and Research Infrastructures:

Mikael Östling, Deputy President

Impact Leaders (together with Cross-panel Sustainable Development)

- Johan Silfwerbrand, ABE
- Wouter Metsola van der Wijngaart, EECS
- Robert Lagerström, EECS
- My Hedhammar, CBH
- Bertil Guve, CBH
- Zuheir Barsoum, SCI
- Hatef Madani Larjani, ITM

**August 26<sup>th</sup>**

KTH Research Platforms, Platforms directors (arranged by Cross-Panel Sustainable Development):

1. Energy, Lina Bertling Tjernberg + Christophe Duwig
2. Transport, Peter Göransson
3. Digitalization, Tobias Oechtering + Ricardo Vinuesa Motilva

Strategic Partnerships:

1. Hitachi ABB – Lina Bertling Tjernberg
2. Vattenfall – Annika Engström
3. Scania – Louise Dellström
4. Skanska – Johan Silfwerbrand
5. Saab – Malin Åkermo
6. Stora Enso – Josefin Illergård
7. Region Stockholm – Joakim Jaldén
8. City of Stockholm – Jenny Paulsson

KTH Innovation:

1. Lisa Ericsson
2. Gustav Notander

Subject panels RAE:

1. Dag Björklund
2. Nicole Borth
3. Rasmita Raval
4. Raouf Boutaba
5. John Clarkson
6. Tomas Gomez
7. Jan-Ola Strandhagen

8. Salla Franzén
9. Horst Vogel

**August 27th**  
KTH University Board