

KEF Metrics

KEF metrics technical advisory group

Submission from the Royal Academy of Engineering

February 2018



About the Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

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1. Introduction

- 1.1. The Royal Academy of Engineering is pleased to respond to the initial call for evidence issued by the KEF metrics technical advisory group. The Academy believes that knowledge exchange is of fundamental importance to ensuring that the UK captures value, both economic and social, from its investment in research, much of which is publicly funded. The introduction of the KEF has the potential to highlight and address some of the long-standing constraints in the UK's research and innovation system, such as the relative impermeability of the interface between industry and academia.
- 1.2. Rewarding, recognising and incentivising activities which facilitate the delivery of benefits from research are central to the Academy's programmes, both UK-based and internationally, and are core to the expertise of our Fellows. The KEF also presents the opportunity to take forward some of the recommendations made in the Dowling Review of Business-University Research Collaborations.¹ Furthermore, last year, the Academy, in partnership with the Academy of Medical Sciences, the Royal Society and the Wellcome Trust, published Transforming UK translation.² The document sets out commitments that the organisations collectively make to improve the UK's ability to commercialise and translate ideas and discoveries from its world-leading research base.
- 1.3. The introduction of impact in REF 2014 has been instrumental in encouraging universities to articulate and ultimately improve the translation of their research into social, environmental and economic benefits. While the inclusion of impact was broadly welcomed by the engineering community, there has been frustration among engineers that activities which support and enable the delivery of impact are not currently sufficiently captured, recognised or rewarded.³ The development of the KEF presents an opportunity to redress this situation.
- 1.4. Nevertheless, clarity on the role of the KEF in relation to REF, specifically the impact element, is required. The Academy firmly believes that the KEF should not be considered as an alternative for the impact element of the REF. The two measures should be complementary but distinct. The REF captures the demonstrable impact of research, while the KEF will provide insight into institutional performance of knowledge exchange, which will include mechanisms that support the delivery of impact from research.
- 1.5. Furthermore, the REF, due its role in the allocation of funding, is a powerful mechanism to drive behaviour in the higher education system. In contrast, it is not yet

¹ [Dowling Review of Business-University Research Collaborations](#), 2015

² [Transforming UK translation](#), Academy of Medical Sciences, Royal Academy of Engineering, the Royal Society and the Wellcome Trust, 2017

³ [Royal Academy of Engineering's submission to Lord Stern's Review of the Research Excellence Framework](#), 2016

clear how the KEF will incentivise improvements in knowledge exchange performance. As the KEF is in the early stages of development the lack of clarity is understandable, however, it will be important to provide clarity soon, even if at a high-level.

- 1.6. The Academy believes the KEF should endeavour to capture and evaluate the full breadth of knowledge exchange - the sharing of knowledge, expertise and other assets for the benefit of the economy and society.⁴ Knowledge exchange can and should occur in all Higher Education Institutions (HEIs) and across all disciplines, although the approaches taken to knowledge exchange and the resulting outcomes will vary considerably. Similarly, a broad approach to defining excellence against the wide variety of approaches to knowledge exchange should also be taken. However, this response, having been informed by the Academy's Fellowship, which represents some of the nation's best engineering researchers, innovators, entrepreneurs, and business and industry leaders, largely reflects knowledge exchange from an engineering perspective.
- 1.7. Designing a metrics system to provide comparable and benchmarked information across the full range of universities' knowledge exchange activities is a challenge. Measuring the effectiveness of knowledge exchange activities through metrics is arguably a greater challenge, but the Academy believes that this should be the ultimate aspiration of the KEF metrics system, particularly if the KEF is to provide information which is of use to business. Such an approach will require extensive engagement with businesses and other external 'users' of research, to increase understanding of the effectiveness of knowledge exchange approaches, as has been recognised in the call for evidence. Greater understanding of the user perspective will also complement the work, led by Professor Trevor McMillan, the KE framework champion, and his steering group, on best practice in knowledge exchange from the perspective of university leadership.
- 1.8. The Academy, and its sister Academies, the Academy of Medical Sciences, the British Academy and the Royal Society, are working together to develop a better understanding of the ways in which research and innovation in the UK generates social and economic benefits. Two evidence syntheses, to be completed by summer 2018, will gather evidence on how to measure the benefits of research and innovation, and the conditions needed to translate research and drive innovation. The findings may also usefully inform future developments of the KEF.

2. What approaches and data need to be used to ensure a fair and meaningful comparison between different universities, taking into account factors that might impact individual institution's knowledge exchange performance (such as research income, size or local economic conditions), whilst allowing identification of relative performance? How should benchmarking be used?

- 2.1. Numerous factors, both external and institutional, affect the volume and range of knowledge exchange activities undertaken by HEIs and will need to be taken into consideration when benchmarking HEIs. The factors that are chosen should be selected and weighted according to their evidenced impact on the metrics selected. The factors selected for benchmarking are likely to have variable impacts on the different metrics

⁴ [HEFCE KEF press release](#), 2017

chosen, therefore consideration should be given to allowing the KEF metrics to be interrogated by different combinations of benchmarking factors. For example, by allowing comparisons to be made by geographical location or volume of income. While income will be an important factor for benchmarking, total income is more relevant than research income as knowledge exchange arises from a broader range of activities than those funded solely by research income.

- 2.2. HEIs have different institutional strategies, which include different strategic approaches to knowledge exchange. HEIs' strategic approaches to knowledge exchange will have a significant influence on the volume and range of knowledge exchange activities they undertake. The KEF should be designed such that it does not penalise a HEI's ability to take a strategic approach to knowledge exchange, but this needs to be balanced against the KEF having the ability to assess HEIs' performance. Consideration should be given to how HEIs' knowledge exchange strategies could be factored into the KEF. One approach would be to present key elements of HEIs' knowledge exchange strategies as part of the final visualisation of the KEF metrics. The work HEFCE has already undertaken in assessing long-term knowledge exchange strategies in relation to the Higher Education Innovation Fund, may be able to inform thinking on this approach. Similarly, the Scottish Funding Council Knowledge Transfer Metrics framework may be useful in the consideration of the most appropriate and effective metrics.
- 2.3. The approach to, and volume and outcomes of, knowledge exchange vary significantly by discipline. The KEF approach to benchmarking should therefore account for the disciplinary mix of institutions. Furthermore, designing the KEF metrics system so that information can be inputted and extracted by discipline would increase its usefulness to HEIs, as well as businesses and other users of research. However, it is not yet clear if this approach would be feasible to implement by Autumn 2018.
- 2.4. The Academy recommends grouping metrics of related knowledge exchange activities to create a 'balanced scorecard' approach. Consideration should be given to using distribution of activities by group when benchmarking HEIs. Groups could include: technology transfer and commercialisation; collaboration & mobility; people; business growth and competitiveness; international; regional engagement, and societal and cultural engagement and impact.
- 2.5. Consideration should be given to how to ensure consistency of approach, such that the outcomes of the KEF are not undermined by perceptions of gaming, inconsistent approaches to data collection or similar inconsistencies across institutions. Allowing interrogation of the KEF metrics by individual benchmarking factors could be of benefit.
- 2.6. Thought will need to be given to the timescales of the activities the KEF metrics will capture. In many cases a long-term lens will be more indicative of the success of the outcomes of knowledge exchange activities. For example, when considering spin-outs, the company survival rate or number of jobs created after three or five years is more informative than the number of spin-outs formed in a single year.
- 2.7. It is intended that the KEF will create a constructive competitive dynamic between HEIs, however it should be designed so that it will not act as a disincentive to collaborative approaches to knowledge exchange. As noted in the McMillan Review, there is evidence of widespread use of collaborative approaches to knowledge

exchange in the UK, particularly in technology transfer.⁵ Examples include the SETSquared Partnership and the awardees of HEFCE's Connecting Capability Fund.

2.8. As noted in the commissioning letter, the framework will be focused on HEIs in England, with the other UK higher education funding bodies having the choice to utilise the framework if they choose to do so.⁶ Nevertheless, it will be important to give due regard to the incentives implemented by the UK higher education funding bodies in Scotland, Wales and Northern Ireland which already shape HEIs' approaches to knowledge exchange, such as the University Innovation Fund in Scotland. Close consultation between the UK higher education funding bodies is required.

3. Other than HE-BCI survey data, what other existing sources of data could be used to inform a framework, and how should it be used?

3.1. The quantitative element of the HE-BCI survey data is a relatively robust basis for measuring the volume of and income from a relatively wide range of knowledge exchange activities. By its very nature the qualitative element of the HE-BCI survey data is less robust, but is still crucial to measuring HEIs' knowledge exchange activities. Finding ways to increase the robustness and evidencing of the qualitative element could assist with the development of the KEF metrics system. The KEF metrics system should seek to identify metrics that reveal the nature, and ideally also the effectiveness, of the knowledge exchange activities underpinning the data HEIs submit for the HE-BCI survey.

3.2. As outlined in paragraph 2.4, the Academy recommends taking a 'balanced scorecard' approach by creating groups of metrics of related knowledge exchange activities. The Academy believes the following groups and metrics should be considered for inclusion in the KEF metrics system.

3.3. **Technology transfer and commercialisation.** While the UK clearly has many strengths in research commercialisation, the overall perception in the UK engineering community is that there is still room for improvement.⁷ The development of the KEF metrics system offers the opportunity to recognise the strengths of HEIs' approaches to knowledge exchange and to potentially incentivise improvements in practice.

3.4. KEF metrics could capture the number and value of competitive awards held by HEIs and their staff to support commercialisation and entrepreneurship. The Royal Academy of Engineering's Enterprise Fellowships, the Enterprise Fellowships run by the Royal Society of Edinburgh, and the Innovate UK ICURe awards are all examples of competitive awards that could be included in the KEF metrics system.

3.5. Through its experience of running the Enterprise Hub, the Academy believes that if HEIs' could increase the transparency of their commercialisation operations it could improve the processes involved, as well as the outcomes.⁸ Levelling the information

⁵ [University Knowledge Exchange \(KE\) Framework: good practice in technology transfer](#), McMillan Group, 2016

⁶ [Letter from the Universities Minister to the Research England Executive Director Designate](#), 2017

⁷ [Royal Academy of Engineering submission to House of Commons managing intellectual property and technology transfer inquiry](#), 2016

⁸ [Royal Academy of Engineering submission to House of Commons managing intellectual property and technology transfer inquiry](#), 2016

asymmetry between academics engaged in commercialisation activities and the university, particularly during the formation of spin-outs, should result in an improvement for all parties involved. Whether a university has its IP policy publicly available should be considered as a KEF metric. Similarly, provision of publicly available guidance regarding the spin-out process should also be considered as a KEF metric. Consideration would need to be given to what level of granularity would be appropriate for inclusion as a KEF metric. The work Professor McMillan and his steering group are undertaking may be able to inform development of such metrics. It is important to note that an increase in transparency does not necessitate standardisation. Greater public awareness of how universities approach research commercialisation could have a bearing on where entrepreneurial researchers and businesses choose to work and collaborate.

- 3.6. **Collaboration and mobility.** Collaboration between HEIs and businesses, as well as other external organisations, such as local councils, hospitals and charities, is a well-established and effective mechanism of knowledge exchange. As noted in the Dowling Review, strong, trust-based relationships are at the heart of successful collaboration.⁹ At the system level, one of the most effective ways of catalysing the formation of these relationships and promoting mutual understanding between academia and industry is to increase the permeability of the interface, and the flow of people, between these two domains.¹⁰ People who can work in both business and academia and who excel at collaborative and translational activities need to be valued and recognised. For an academic, gaining experience in industry should be considered career enriching and a mark of distinction, analogous to gaining international experience. Therefore, metrics that can identify the type and effectiveness of collaborations, and that can measure mobility between HEIs and industry, as well as other organisations, should be a priority for inclusion in the KEF metrics system.
- 3.7. KEF metrics could capture the number of CASE studentships, and other comparable schemes, which are part funded by industry and require the PhD student to spend time in industry, as a proportion of total PhD studentships. Broadening the metric to account for all PhDs where there is a financial contribution from industry or where a student spends time in industry should be considered. Data should also be collected on the number of Knowledge Transfer Partnerships staff are involved in and the types of businesses involved. The number of academic/corporate co-authored publications could also be included as a KEF metric.
- 3.8. There are a number of competitive schemes that exist to promote mobility between business and academia, such as the Academy's Visiting Professor and Industrial Fellowships schemes and the Royal Society's Entrepreneur in Residence scheme. The KEF could seek to capture the number and value of schemes, as well as the type of industry partner e.g. SME or non-SME. There would also be value in capturing the volume of mobility between academia and industry in HEIs, even when not facilitated through a competitive funding scheme, however it is not clear to what extent universities hold this information in a standardised way.
- 3.9. It seems probable that there will be some areas of overlap between metrics relevant to the KEF and those that will be captured in the revised environment template for REF

⁹ [Dowling Review of Business-University Research Collaborations](#), 2015

¹⁰ [Dowling Review of Business-University Research Collaborations](#), 2015

2021, which will have an explicit focus on the approach taken to support collaboration with organisations beyond higher education.¹¹ While some overlap is to be expected, as outlined in paragraph 1.4, the REF and KEF have different yet complementary purposes and excessive duplication should be avoided.

- 3.10. **People.** There is a perception in the engineering community that one of the most significant and substantial impacts generated by academia is the 'impact of people' associated with introduction of skilled graduates and postgraduates to the workforce, who transfer knowledge and facilitate translation.¹² Therefore, Destinations of Leavers of Higher Education (DLHE) data could be used to support the KEF if appropriate metrics can be identified. However, DLHE data needs to be treated with a degree of caution as there are many factors that need to be considered such as subject area, and location of HEI. Care should also be given to not unnecessarily duplicate or encroach on the Teaching Excellence and Student Outcomes Framework. Furthermore, there may also be a role for the KEF in capturing the successful outcomes of those who have left HEIs but, building on the training they received, have gone on to establish companies, but which do not have any formal links via IP or licensing to the university. The Cambridge Computer Laboratory has generated many companies via this approach.¹³
- 3.11. **Business growth and competitiveness.** HEIs can play important roles in helping small businesses access support, networks and facilities. For example, through the provision of incubator space, accelerator programmes and partnerships with science parks. In the first instance, it would be valuable if the KEF metrics could capture the number and value of these activities, with a long-term view to developing metrics that capture the scope and effectiveness of these activities.
- 3.12. **International Development.** Engineering research is increasingly delivering international development impacts. The introduction of the Newton Fund and Global Grand Challenges Research Fund, part of the UK's Official Development Assistance (ODA) budget, has supported engineers to undertake cutting-edge research to address the challenges faced by developing countries. There has been concomitant growth in the knowledge exchange activities that support international development, usually in partnership with institutions within the partner countries. KEF metrics should be able to capture the knowledge exchange activities that promote economic development and social welfare of partner countries, and avoid excluding or disincentivising this important activity, although the variety of contexts and levels of maturity of activity will certainly complicate measurement.

4. What new (or not currently collected) data might be useful to such a framework?

- 4.1. **Technology transfer/commercialisation.** The *University Knowledge Exchange (KE) Framework: good practice in technology transfer* report, published by the McMillan group in 2016, suggested that key performance indicators (KPIs) for technology transfer should include qualitative measures.¹⁴ Suggested measures included levels of engagement and satisfaction of key stakeholders (including entrepreneurial faculty and

¹¹ [Initial decisions on the Research Excellence Framework 2021](#), 2017

¹² [Royal Academy of Engineering's submission to Lord Stern's Review of the Research Excellence Framework](#), 2016

¹³ [The Hall of Fame – companies started by Computer Lab graduates and staff](#)

¹⁴ [University Knowledge Exchange \(KE\) Framework: good practice in technology transfer](#), McMillan Group, 2016

fundings) and repeat business (such as with investors and industry). The Dowling Review suggested that universities that are confident with their technology transfer performance should publicise similar metrics, including the time taken to agree contracts, to highlight their efficiency and effectiveness.¹⁵ The McMillan report also noted that many university research and knowledge exchange or technology transfer units already adopt qualitative, 360 degree and stakeholder reviews. Understanding if any of those measures could be sufficiently standardised across HEIs, such that they could be incorporated into a KEF metrics system should be considered. The particular value of these measures is that they capture the 'user' perspective.

- 4.2. Knowledge exchange staff play a critical role in supporting knowledge exchange in HEIs. However, as noted in the Industrial Strategy white paper, universities sometimes lack the resources and skills to fully develop commercialisation opportunities.¹⁶ Measuring the number of staff dedicated to knowledge exchange activities, compared to research and teaching staff could be considered for a KEF metric. However, as a volume measure it lacks the ability to account for the experience of the staff. The UK benefits from the work undertaken by PraxisAuril, the national professional association for public sector knowledge exchange and commercialisation practitioners, which delivers training to those involved in knowledge exchange and technology transfer, and facilitates sharing of best practice. Consideration could be given to measuring the number of knowledge exchange staff who have received formal training in knowledge exchange or who have accredited Registered Technology Transfer Professional status.
- 4.3. Training is an important part of commercialisation. The Dowling Review recognised the importance of training and recommended that universities should ensure that all PhD students in appropriate subjects should receive IP awareness and wider business skills training.¹⁷ Data should be collected on the provision and uptake by staff and students of relevant training opportunities, such as entrepreneurship education, IP awareness training and business skills.
- 4.4. **Collaboration and mobility.** As observed in the Dowling Review, co-location of academics and industrialists can generate a vibrant environment that fosters knowledge exchange.¹⁸ Consequently, the KEF should consider capturing data on the proportion of HEI staff co-located with industry. Similarly, recording information on the number and value of HEIs' institutes and facilities that receive financial contributions from industry should be considered for a KEF metric.
- 4.5. Public Sector Research Establishments such as the Met Office and National Physical Laboratory, as well as other Research and Innovation Organisations such as the Catapult Centres, form a crucial part of the UK's research and innovation landscape, and many work collaboratively with universities. The KEF should seek to capture the type, volume and value of these collaborations.
- 4.6. Not all business-university collaboration will involve the receipt of competitive funding, or possibly even the involvement of finance at all, however it would still be valuable to capture these relationships as part of the KEF. As part of the Dowling Review, research active universities were asked to provide an overview of their current long-term

¹⁵ [Dowling Review of Business-University Research Collaborations](#), 2015

¹⁶ [Industrial Strategy, Building a Britain Fit for the Future](#), HM Government, 2017

¹⁷ [Dowling Review of Business-University Research Collaborations](#), 2015

¹⁸ [Dowling Review of Business-University Research Collaborations](#), 2015

research collaborations with industry.¹⁹ One of the notable outcomes of this exercise was a realisation that universities varied enormously in the method by and extent to which they captured this information, with some finding it near impossible to provide a ready answer to the question posed. While universities are required to submit data on their income from business collaboration to the HE-BCI survey, they are not asked to provide information on which companies they collaborate with or the nature of these collaborations. It would nevertheless seem advisable for universities to be able to understand their own collaboration landscape, and the KEF could be a useful tool to incentivise this behaviour.

5. How should KEF metrics be visualised to ensure they are simple, transparent and useful to a non-specialist audience?

- 5.1. The Academy welcomes the proposal that the way the KEF metrics will be visualised should be simple and transparent. A 'dashboard' approach, displaying the key performance metrics visually, on one page, or screen, should be taken. The main dashboard will need to allow for interrogation, including by individual benchmarking factors, discipline and groups of metrics, so that differential performance against different measures can be viewed. The Academy would encourage an ambitious approach to be taken, with the potential to utilise data analytics.
- 5.2. How the KEF metrics should be visualised depends to a considerable extent on the intended audience. Non-specialists, university management, businesses and policy makers are all likely to have slightly different requirements. Greater clarification on the purpose of the KEF should help inform the best visualisation approach to take. However, if sufficient interrogation of the data is available, the challenges of adapting the visualisations for different audiences may be overcome.

¹⁹ [Dowling Review of Business-University Research Collaborations](#), 2015