Advancing Translational Research

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Foreword

With a new Labour Government in place, universities have a crucial role in supporting public policy development and enactment. The Prime Minister, Keir Starmer, particularly welcomes evidence-based policy development and evaluation. The higher education sector needs to ensure that it plays its part in providing evidence and support to politicians. This should be seen as a core part of their civic responsibilities. There are excellent examples of researchers engaging with policymakers. Researchers must respond to the needs of public policymakers by showing pragmatism in their approach, embracing problem-solving alongside broader blue-sky thinking and completing their research in a timely manner to meet the pressures politicians face to take decisions. With a mission-driven government focused on growth, opportunities and the green economy, research designed to solve knotty problems will help demonstrate the value of higher education institutions and maximise their civic impact.

The Rt Hon. the Baroness Hodge of Barking DBE, Former Minister of Lifelong Learning, Further and Higher Education

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Executive summary

This Policy Note explains the crucial role of translational research in bridging the gap between scientific discovery and real-world application and underscores its potential to enhance interdisciplinary collaboration, foster innovation and commercialisation and translate research into policy, practice and products. While translational research originated in applied medicine, other disciplines can adopt and benefit from its approaches and mindset.

Key findings

- **Definition and importance:** Translational research involves turning basic research knowledge into practical applications to improve human health and well-being or adopting a 'goal-orientated' approach from the initial research design stage to solve specific problems. It encourages cross-disciplinary collaboration and can significantly impact societal challenges.

- **Challenges:** The field faces numerous barriers, including scientific, regulatory, financial, infrastructural and cultural obstacles. These challenges require innovative solutions and collective efforts to overcome.

- **Role of publishers:** Publishers can support translational research by making scientific knowledge more accessible, fostering cross-disciplinary collaboration and promoting the translation of research findings into actionable insights.

Recommendations

For academia and research institutions:

- Develop a comprehensive framework for planning, delivering and assessing translational research.
- Offer training and mentoring opportunities for researchers and staff.
- Incentivise and reward researchers involved in translational research.

For funders and decision-makers:

- Diversify funding support for translational research, especially in early and intermediate stages.
- Align funding strategies and policies among various types of funders.
- Develop funding programmes that are adaptable to the challenges of translational research.

For institutions:

- Improve structures, facilities, and equipment crucial for research translation.
- Foster stakeholder and end-user participation in the research process.
- Recognise team science contributions in academic evaluations.

For publishers:

- Create new formats to engage researchers with different audiences more easily.
- Develop platforms and networks to facilitate interaction across academia, industry and the public.
- Adopt standards and tools to improve the access, visibility and impact of translational research.

Introduction

Translational research is a goal-oriented approach that aims to bridge the gap between scientific discovery and real-world application. It involves change, transdisciplinarity (integrating the natural, social and health sciences beyond their traditional boundaries) and collaboration across multiple domains and stakeholders.[1] Translational research can enhance interdisciplinary collaboration, foster innovation and commercialisation and translate research into policy, practice and products. However, translational research also faces many barriers that hinder its progress and impact. These include scientific, regulatory, financial, infrastructural and cultural challenges that require collective efforts and innovative solutions to overcome.

Publishers can play a crucial role in supporting translational research: by making knowledge more accessible, fostering cross-disciplinary collaboration and promoting the translation of research findings into actionable insights. This Policy Note outlines the challenges and opportunities of translational research. It makes recommendations on how to support research translation effectively. This is based on the findings from a co-convened workshop in Brussels, where we brought together a diverse group of topic experts, research policy influencers, funders and decision-makers. This meeting discussed how translational methods, approaches and mindsets could be leveraged beyond specific research fields to foster interdisciplinary collaboration. The Policy Note also showcases an effective translational research case study from different disciplines and institutions.

What is translational research?

For this paper, we have very simply defined research into two categories:

1) theory-based, discovery-orientated or basic research; and

2) translational research.

Translational research can turn basic research knowledge into practical applications to enhance human health and wellbeing.[2] This approach looks at what happens to research in its transition from knowledge to application to provide a real-world solution. Translational research can also adopt a 'goal-orientated' approach at the initial research design stage. The translational model originates in the biomedical sciences and clinical practices but it is not exclusive to this research.

In both models, translational research utilises transdisciplinarity and collaboration and can lead to a more substantial research impact.[3]

From an early stage of the research process, translational research design must consider: future dissemination; accessibility; exploitation; safety monitoring; and the potential reuse of results. In the biomedical field, this would mean planning a project's regulatory strategy at a very early stage, ensuring that requirements for commercialisation (for example, compliance with regulations and standards) are met from the outset. Society is the starting point of the investigation for the humanities and social sciences, and translational research means the direct involvement of those affected by a study to create a 'social license to operate' among the stakeholders. In other words, a deep understanding of citizens' needs and

for companies operating in an environment of mutual trust within a community. The social licence is built over time and foresees the engagement of those impacted by the research outputs, including the patients directly impacted by medical trials or communities affected by green energy pilots. A participatory approach to development or public policies is critical for successful outcomes. Translational research also requires a 'team science' mindset, entailing collaborative efforts across disciplinary boundaries, extending across multiple research projects and involving various stakeholders over time.

This 'team science' mindset typically fits with biomedical sciences, where there are clear pathways from scientific breakthroughs, trials, regulatory approval and streamlining to market access.[4] The journey of translating discoveries into treatments, spanning many years and diverse research expertise, offers a set of foreseeable stages and timelines. This helps guide the planning of steps needed to advance early-stage scientific breakthroughs into practical treatments and their real-world application. However, the same process does not often apply to many other disciplines undertaking basic research as the research does not necessarily have a clear target user, audience or beneficiary.

Why is translational research important?

Translational research can accelerate scientific discovery and address pressing societal challenges. Big science requires large multidisciplinary teams, which differs from the approach a single researcher running a subject-based research project might take. The key benefits of adopting a translational research mindset include:

- **Promoting cross-disciplinary collaboration:** Translational research encourages researchers from different disciplines, sectors and institutions to work together. By combining diverse views and skills, translational research can tackle complex and multidimensional problems with interdisciplinary solutions. Translational research is goal-oriented, involving all the subjects needed to solve a problem.

- **Fostering innovation and commercialisation:** Translational research can enable knowledge and technology transfer between academia and industry. By matching research goals and outputs with market demands and opportunities, translational research can speed up the creation and uptake of new products, services and methods to enhance health, wellbeing and quality of life. Translational research can also foster entrepreneurship and economic development by creating new markets and industries, generating jobs and incomes and improving growth and productivity.

- **Solving complex and pressing health and societal challenges:** Large multidisciplinary translational research teams can set more ambitious goals to solve some of our most complex health and societal challenges. These may include a cure for cancer, ending neurodegenerative disease, new approaches to diabetes mellitus care and even new approaches to health equity.

- **Making research useful for policy and practice:** Translational research can connect research, policy and practice. By working with policymakers, practitioners and end-users from the beginning of the research process, translational research can ensure that research findings are useful and digestible for decision-making and implementation. Translational research can also shape and inform policy priorities as well as policy evaluation. In addition, translational research can increase the impact of research by providing evidence-based solutions and recommendations for solving societal challenges and needs.

Challenges for translational research

Translational research has many possibilities, but it also faces difficulties that hinder its development and influence. These include scientific, infrastructural, financial, cultural and regulatory aspects, from the difficulties of complying with regulatory requirements to obtaining funding support. To overcome these challenges requires collaborative actions and creative approaches.[5] Challenges to successful translational research include:

- **Lack of education and training:** Translational research involves various stages and phases that require different expertise, methods and structures. The combination and organisation of these elements can create difficulties for translational research, such as ensuring the quality, accuracy and reliability of research outcomes, solving ethical and legal problems and managing data and information. This

lack of education and training can lead to a lack of capabilities among scientists to translate scientific research into applicable insights, as well as a lack of trained staff to organise and manage the complex transitional research cycle.[6] Institutions can also develop a role for facilitators of translational research, who manage the process alongside scientists.

- **Lack of career incentives to perform translational research:** Individual research output, such as high-impact publications, is still the primary criterion (as required by the Research Excellence Framework) for career progression.[7] Researchers involved in translational research may not be able to produce an adequate publication record to meet the requirements of career promotion since translational projects generally take longer to complete. Researchers are also more likely to be part of a cross-disciplinary team, which could make it challenging to evaluate their contribution to the research outcome since they may be working outside their recognised disciplines.

- **Lack of sufficient infrastructural support:** Translational research requires effective and efficient management and coordination of the various resources, activities and stakeholders involved in the translational process, which can encounter practical issues, such as the lack of adequate and accessible facilities and equipment and the difficulty of recruiting trained interdisciplinary staff to support investigations throughout the translational research cycle. Better established research workflows across the translational process would help to counter this challenge.

- **Lack of financial resources:** Translational research needs significant and long-term funding to enable the lengthy and expensive process of turning scientific findings into real-world solutions. However, translational research often lacks funding, especially in the initial and middle stages of the research pipeline, where the chance of failure is high, and the investment outcome is unclear. Furthermore, due to a lack of collaboration among funders and their different standards and requirements, translational research may face challenges in obtaining various types of funding, such as public, private and philanthropic funds. For example, in social sciences and humanities, translational research is rarely considered an option, as the translational approach is rooted in medical research. While funders encourage the narrative around the impact of research, they fail to identify the potential of translational research at the design stage (for example, the need for a multidisciplinary team or the clear involvement of interest groups). There is a lack of funding dedicated to these disciplines because it is only sometimes obvious who the target audience is.

- **Regulatory barriers:** Translational research must follow different rules and norms that control how new products, services and processes are developed, tested, approved and sold. These may cover many complex elements, such as ethics involved in human research, tissue banking and material transfer regulations, intellectual property rights and agreements and toxicology and manufacturing regulations. Similarly in the humanities, for example, there are privacy issues on the exchange of artefacts, or intellectual rights for performance and images, and social sciences in data collections. These rules and norms can change depending on the country or region, so translational research needs to adapt and match the changing requirements of regulators and stakeholders.

The role of the publisher in translational research

Publishers can boost translational research by making scientific knowledge more accessible, encouraging interdisciplinary cooperation and supporting the translation of research findings into actionable insights. By providing platforms for peer-reviewed research, scholarly journals serve as an intermediary for knowledge exchange and dialogue among researchers, societies, funders, policymakers, industry stakeholders and the broader public. Steps that publishers can take to support translational research include:

- **Making knowledge easier to access:** Publishers can make translational research more accessible, visible and impactful by using open research models, which let people freely access and reuse research outputs.[8] By following standards and tools for data sharing, metadata and linking, publishers can also make translational research easier to find and use. This can include using:

- the FAIR principles (guidelines to improve the Findability, Accessibility, Interoperability and Reuse of digital assets);

- the DOI (Digital Identifier of any Object) system; and

- the ORCID (Open Researcher and Contributor ID) registry.[9]

Assisted by AI tools (guided by policies and best practices), publishers can create new forms of content such as visualisations, translations and annotations to reach more diverse audiences with translational research.[10]

- **Encouraging cross-disciplinary collaboration:** Publishers can curate interdisciplinary journals, special issues and collections highlighting the broad and deep range of research that connects different fields to promote and help researchers from various disciplines and institutions work together.[11] Publishers may also help review and assess interdisciplinary research by using new standards and measures, such as how relevant and impactful the research is for society. Publishers also have a better sense of the 'consumption' of research and can target citizens' needs and demand for knowledge from both public and private audiences.

- **Publishing well-designed studies with negative results:** Negative data and refutations form a crucial part of the scientific process.[12] Publishers should provide avenues and clear policies for researchers to publish negative results, which inform the scientific community about what does not work and prevent costly and time-consuming repetitive negative studies.

- **Supporting the translation of research findings into actionable insights:** Publishers can help turn research findings into practical solutions by bringing together researchers and the people who use and benefit from their work, such as policymakers, practitioners and other end-users, from the beginning of the research process. Publishers can also offer ways to create and share research jointly, such as stakeholder workshops, key policy highlights and plain language summaries, encouraging communication and collaboration among researchers and the beneficiaries of research.[13]

Effective translational research – a case study

The following case study illustrates how translational research can address complex and multifaceted problems, generating significant benefits for health, society and the economy.

Delivering affordable reductions in CO_2 from vehicles sold in high volumes in the UK and abroad

- Researchers: Professor Sam Akehurst, Dr Colin Copeland, Professor Chris Brace, Professor Jamie Turner

How do you link academia with industry?

Researchers at IAAPS (a world-leading centre of excellence supporting the transport industry in the transition to net zero) at the University of Bath have a long-standing relationship with the advanced engineering and research team at Ford's research centre in Dunton, Essex. Like many enduring relationships, the initial connection was through the presentation of work at conferences and subsequently grew through sponsorship of student and postgraduate projects. This led to industry and government-funded research collaborations spanning several decades.

Throughout the relationship, our task was to understand the key challenges our industry colleagues face, identify how we could contribute our research capabilities to solving these issues and jointly develop a research programme. In this way, the impact of our research is baked in from the start; this is the key aim of our collaboration. This process was repeated throughout the relationship and the work described here is a typical case study.

What was the goal of the research?

While electrified propulsion will eventually replace internal combustion engines, it will take decades to work through the fleet. Therefore, every engine built must be as efficient as it can be. Ford wanted

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to make its best-selling petrol engine more efficient by introducing an advanced control strategy, including the use of a larger turbocharger which can drive more air into the engine when needed. However, if launched without sufficient research, these new technologies can introduce unwanted interactions that can degrade their benefits and reduce consumer acceptance. To understand and carefully control such complexities, Ford needed a laboratory-based approach.

What research did your team undertake?

To test and improve the new turbocharger, Ford collaborated with the Bath research team. The Bath team developed a new experimental approach that could precisely emulate the real-world behaviour of the engine and the turbocharger across all operating conditions. The results of the experiments helped Ford to improve the design of the turbocharger and control system, leading to lower CO_2 emissions and better customer satisfaction.

How did this research translate into real-world use?

The insights gained through the research were incorporated into the engine design and control system by Ford engineers. The new engine allowed the CO_2 emissions of the most popular engine variant of the latest generation Fiesta (at the time, the UK's biggest selling passenger car) to be reduced by 9%. Engines have been fitted to the Fiesta, the Focus (the UK's second best-selling vehicle) and seven other Ford models.

What was the impact of this translational research?

Around 1.4 million new Ford vehicles each year emit less CO_2 and pollutants because of this work, delivering an annual cumulative CO_2 saving equivalent to taking 109,000 average cars off the road every year. The impact will continue to accrue for a combined design life and in-service life estimated at a total of approximately 20 years, with the benefits continuing into next-generation engines through the incorporation of the knowledge into future designs.

Why translational research?

Translational research is business as usual at IAAPS. Much of the funding for our work comes through The Advance Propulsion Centre and Innovate UK and specifically targets the application of research into real world problems. In the Automotive industry, this means reducing fuel consumption and emissions. This provides research and development funding to 'accelerate the transition to a net-zero automotive industry'. Funding like this can only be won in collaboration with industry and is therefore driving more translation research.

What challenges do you face when undertaking translational research?

There can be a tension between discovery-orientated research and translational research. If your work aims to solve a problem, you can sometimes solve this problem (and meet your goal) without fully discovering new knowledge. If you are no longer pursuing new knowledge, you are arguably not undertaking research. This can be problematic when getting translational research published in the highest-impact journals and achieving four-star papers for REF submissions. However, translation research underpins great impact case studies for the REF.

How are you building translational research capabilities at IAAPS?

The goal-orientated approach of translational research is evolving, with researchers now having to identify clear goals that may have previously been straightforward. For IAAPS this is a direct result of the technological uncertainty that exists within the automotive and propulsion industries. The internal combustion engine is now just one option among many technologies to provide mobility, while the merits of a society built on individual car ownership are also being fundamentally questioned. Instead of simply selling petrol or diesel cars, the industry is grappling with a complex set of energy options, infrastructure obstacles and the broader challenges of sustainability. Researchers need to work in a less siloed, more agile manner to identify and solve these complex issues. The translational approach requires and embraces these skill sets.

In 2019, recognising this shift, IAAPS created an EPSRC Centre for Doctoral Training.[14] The centre is training 70 PhD students in cohorts that include engineers, behavioural scientists, mathematicians, chemists and business and management researchers. The students are being taught to undertake a systems approach and to seek in collaboration the research goals that sit on the boundaries between conventional disciplines. This approach combines transdisciplinarity with the industry-focused translational approach.

Recommendations

Based on the findings from the co-convened workshop in Brussels and the examples of effective translational research, the following recommendations are proposed for different stakeholders on how to better support translational research:

1. **For academia and research institutions:**

   - Develop and implement a common and comprehensive definition and framework (for instance, a translational map) that sets clear and coherent standards for training, planning, delivery and assessment of translational research. The framework should recognise and encompass the diversity and complexity of translational research across different disciplines and domains of research.[15]

   - Create active centres for in-house translational research.

2. **For funders and decision-makers:**

   - Diversify the funding and support for translational research, especially in the early and intermediate stages of the research pipeline. This may include ring-fenced funding from within existing funding sources.

   - Align the funding strategies and policies of different funders, such as public, private and philanthropic funders.

   - Develop funding programmes and tools that are customised and adaptable to the challenges of translational research.

   - Create opportunities to regularly share academic findings to inform policymakers and / or interested parties.

3. **For institutions:**

   - Improve the structures, facilities and equipment that are crucial for research translation, such as clinical trial units and data repositories.

   - Offer training and mentoring opportunities for researchers and staff, such as translational research courses, workshops and fellowships.

   - Incentivise and reward researchers involved in translational research, for example by recognising this work in promotion or recruitment criteria.

   - Work with stakeholders and end-users, such as patients, consumers and communities, through approaches and methods that let them participate, co-design and co-create.

   - Incentives should recognise team science contributions in all aspects of academic life, including technology transfer. Team science contributions should be included in promotion and recruitment criteria as well as the REF.

4. **For publishers:**

   - Focus on translational capability by creating new formats to enable different audiences to engage with research more easily. More accessible formats could include short summaries in plain English and syntheses of large bodies of research.

   - Provide venues to facilitate more significant interaction and coordination across academia, industry and the public. This can be done by developing and supporting platforms and networks that foster the exchange and dialogue among various actors and sectors involved in translational research, such as interdisciplinary journals, special issues and collections, stakeholder workshops and policy highlights.

   - These venues should enable the communication of research outcomes that cross disciplinary boundaries to non-academic audiences and make research outcomes applicable in real-world contexts.[16]

- Adopt standards and tools that improve the access, visibility and impact of translational research, such as open research models, data-sharing principles and indexing systems.
- Assemble articles or translated research output as a portfolio of different disciplines addressing single policy issues for non-academic audiences, including international organisations, think tanks and policymakers.

Conclusion

The translational research process is a relay race that requires different roles at different phases. The translational approach and mindset can be applied to other disciplines to enhance the relevance of research to society and the public. We can realise the full benefits of translational research for improving lives and creating a positive impact by recognising its difficulties and possibilities, systemising and rewarding it and using different actors' contributions to support collaboration and knowledge exchange.

Endnotes

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