REPUTATIONAL IMPACTS OF INTERNATIONAL RESEARCH AND INNOVATION

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Chapter 4: National enablement of international R&I generating reputational impacts

National enablement of international R&I collaborations includes policies, regulations, large infrastructure, and interactions with global bodies that support these collaborations. Additionally, the UK's ranking in global R&I indices generates reputational impacts for the UK. These national enablements enhance the UK's reputation as a safe, transparent, fair, trustworthy, attractive, resourceful, supportive, and competitive destination for international R&I. They also establish the UK as an R&I destination that offers coherent policy and regulatory frameworks to address the evolving needs of stakeholders, making the UK a thought leader, influencer, and committed member in global R&I. This positive reputation could lead to increased financial, relational, resource, research, innovation, political, social, and environmental impacts. This chapter discusses how each national enablement of international R&I generates reputational impacts, along with relevant case study examples. The categorisation of activities is based on the review of the literature conducted for the purpose of this study.

4.1: UK's regulatory and policy framework facilitating international R&I

The activities performed by the UK's regulatory and policy frameworks in support of international R&I include developing and enforcing regulations and policies to protect foreign investment in, and continuously improving these frameworks with a stable commitment towards, international R&I. Additionally, enhancing the alignment and synergy among local, regional, national, and international policy and funding frameworks is essential. Raising awareness of the UK's technology ecosystem and its associated strengths further solidifies its position on the global stage. These activities enhance the UK's reputation as a safe, transparent, fair, and trustworthy destination for investing in R&I. Additionally, the UK is recognized for offering coherent policy and regulatory frameworks that effectively address the evolving needs of stakeholders, further enhancing its appeal as a premier R&I destination. These dimensions of the reputation generate financial, relational, research and innovation impacts [Figure 4.1].

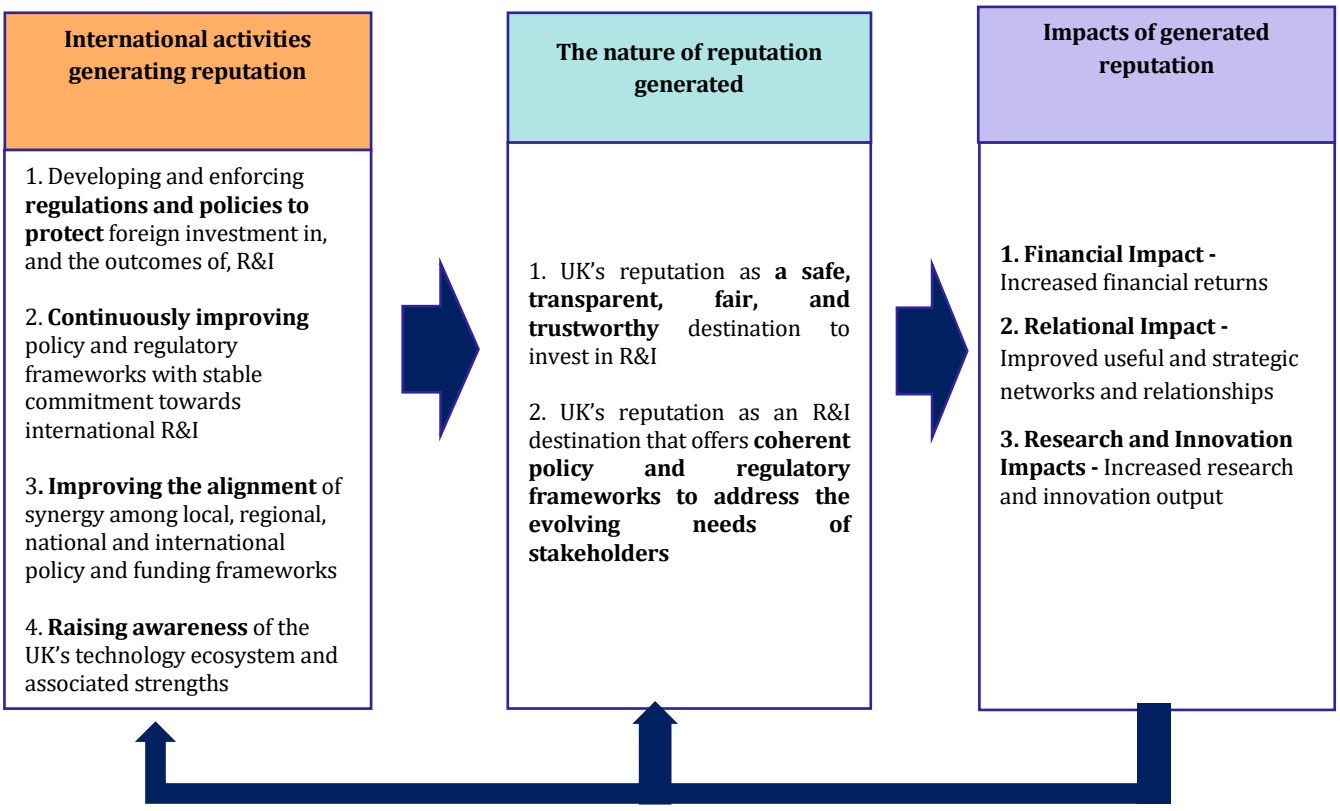

Figure 4.1: UK's regulatory and policy framework facilitating international R&I generating reputational impacts

4.1.1 International activities

Developing and enforcing regulations and policies to protect foreign investment in, and the outcomes of, R&I

The UK government has implemented measures through regulations and policies to protect foreign investment in, and outcomes of, R&I from potential abuse and threats. A key UK government initiative is the development of "Trusted research", which involves safeguarding the UK's intellectual property, sensitive research, people, and infrastructure from potential threats like theft or exploitation by hostile actors. Trusted Research guidance, jointly published by National Protective Security Authority (NPSA) and The National Cyber Security Centre (NCSC), offers advice and guidance to uphold the integrity of international research collaborations. Developed in collaboration with the sector, it provides researchers, university staff, and funding organizations with guidance to protect sensitive research and intellectual property from theft, misuse, or exploitation. In this context, UK Research and Innovation (UKRI) launched its Trusted Research and Innovation (TR&I) programme to provide guidance and support for safe and secure collaborations. This programme endeavours to minimise the risks associated with operating within the global research ecosystem while maximising opportunities for international R&I, by collaborating with partners to align policies and coordinate approaches across the sector. National Protective Security Authority (NPSA) and the National Cyber Security Centre (NCSC) also collaborate with government, police, industry and academia to reduce the vulnerability of the national infrastructure, secure innovation, and mitigate cyber security threats.

Continuously improving policy and regulatory frameworks with stable commitment towards international R&I

Establishing transparency and stability in long-term policy frameworks (BIO-TIC, 2015), by also addressing the evolving needs of the international R&I, that create clear, consistent, and predictable guidelines for R&I is important. It reassures investors, collaborators, and other stakeholders that the UK's R&I environment remains steady, allowing them to plan and invest with confidence. For instance, the Integrated Review Refresh 2023, which sets the UK government's foreign policy priorities, has mentioned that strengthening science and technology is one of four key priority areas. Such strong statements offer clear signalling of the government's stable commitment to international R&I collaborations. Similarly, the UK Science and Technology Framework emphasises international collaboration as one of the ten pillars underpinning the future of UK science and technology strength. The UKRI International Strategic Framework, that strongly signals the significance of global engagement, is an example of funder-level strategic support for international R&I. Having

coherence among different government initiatives and the UK funding landscape towards supporting and encouraging international R&I enhances the UK's reputation as a welcoming and conducive nation for engaging in international R&I.

Improving the alignment of synergy among local, regional, national and international policy and funding frameworks

The alignment and synergy among local, regional, national, and international policy and funding frameworks are important to enable international R&I. Mission-oriented policy framework suggests the need to achieve such alignment (Kattel and Mazzucato 2018). Especially considering the UK is a small landscape, the UK has the unique advantage of having a coherent policy landscape that further encourages international R&I. The success of the BIO (NISP) (the case study below) in the UK, the world's first national industrial symbiosis programme exemplifies this. NISP's nationally coordinated yet locally delivered structure allowed it to adapt to specific regional economic and environmental agendas effectively. This alignment enabled NISP to identify mutually beneficial transactions between companies, bringing underused resources into productive use, and involving a wide range of participants from SMEs to multinationals across various industry sectors. Such coordination not only maximises resource efficiency but also showcases the UK's ability to implement comprehensive and impactful environmental and economic policies supporting international R&I (Hodgson, et al. 2016).

Raising awareness of the UK's technology ecosystem and associated strengths

Targeted marketing initiatives such as "Unicorn Kingdom", launched in March 2023, aimed at improving perceptions of the UK and of its strengths in order to attract international investment. The campaign addressed investor awareness of the UK's technology ecosystem and empowered stakeholder strategy, which in turn improved perception of the UK and fuels investment, thereby securing the UK's future as a global science and technology leader. The UK's reputation as an attractive destination for international R&I, a hub for large-scale research support, and a leader in key sectors with competitive advantages has significantly increased its attractiveness for international stakeholders to collaborate with UK companies and research organizations.

4.1.2 The nature of reputation generated

UK's reputation as a safe, transparent, fair, and trustworthy destination to invest in R&I

The reliability and predictability of the UK regulations reduce uncertainty and perceived risks associated with investment in the UK. The UK's transparent and stable policy framework gives investors the confidence needed to view the UK as a potentially attractive and safe destination for R&I investments. The consistent emphasis on transparency and long-term policy stability reassures stakeholders about the UK's commitment to supporting R&I, thus building a robust and trustworthy reputation. The UK's proactive stance on supporting key enabling technologies, commercialisation, and providing business support further enhances its attractiveness for international R&I. These highlight the UK's dedication to supporting technological advancement and business growth, which act as magnets for international researchers and businesses looking for a conducive environment for innovation and commercialization.

UK's reputation as an R&I destination that offers coherent policy and regulatory frameworks to address the evolving needs of stakeholders

Constantly improving regulatory and policy frameworks by addressing the needs of investors and R&I stakeholders improves the UK's reputation as a destination that offers relevant support to address the evolving needs of stakeholders. The UK's ability to develop coherent, long-term, and aligned policies sets it apart from other international destinations (Taylor 2022). Programs like NISP, which integrate regional and national agendas, showcase the UK's strength in policy coordination and resource utilization. Clear coherence among different policy frameworks - such as the UK government's foreign policy priorities, the UK Science and Technology framework, and the UKRI International strategic framework - gives the UK a comparative advantage that potentially increases the attractiveness of the UK R&I environment for international researchers and investors.

4.1.3 Impacts of generated reputation

Table 4.1: Impacts of reputation generated through UK's regulatory and policy framework facilitating international R&I

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Improved access to international finance and investment
2. **Relational Impact** - Improved useful and strategic networks and relationships	Improved local, regional, national, and international sectoral networks, leading to the exchange of good practices, knowledge, resources, research, and innovation

3. **Research and Innovation Impacts** - Increased research and innovation output	Increased international collaborative R&I

Case Study: The National Industrial Symbiosis Programme (NISP)

The National Industrial Symbiosis Programme (NISP), the world's first national industrial symbiosis programme, is a pioneering initiative aimed at promoting resource efficiency through the collaborative use of materials, energy, and water among different industries.

International R&I activities:

NISP began as three pilot schemes in Scotland, the West Midlands, and Yorkshire & Humberside in 2003. Their success provided robust evidence to the Department for Environment and Rural Affairs (Defra), which in 2005 awarded International Synergies £27 million over three years to expand the programme across all nine English regions. Similar initiatives were also launched in Wales, Northern Ireland, and Scotland (SISP). A key factor in the programme's overwhelming success was its management and delivery. The programme operated with a nationally coordinated operational focus, supported by a local delivery structure. The NISP team's knowledge and insight into specific regional economic and environmental agendas enabled the program to have a substantial positive impact across the UK

International R&I activities supported by NISP include:

1. **Global Partnerships**: NISP collaborates with international organizations and governments to promote industrial symbiosis practices worldwide.
2. **Knowledge Transfer**: The programme facilitates the exchange of best practices, technologies, and methodologies between countries to enhance resource efficiency and sustainability.
3. **Joint Research Projects**: NISP participates in and supports international research projects aimed at developing new technologies and approaches for industrial symbiosis.
4. **Capacity Building**: The programme offers training and capacity-building initiatives to help other countries implement and benefit from industrial symbiosis.

The nature of reputational impacts generated:

To date, the model has been replicated in 20 countries at either national or regional levels. The programme's demonstrated success and the UK's stable policy framework have increased confidence among international investors. The substantial funding from Defra and involvement of over 10,000 companies, including 80% SMEs, and the creation of numerous sustainable business opportunities underscore its impact.

The NISP model has been successful due to its transparent and stable policy framework, that has attracted a wide range of participants, including SMEs and multinational corporations. NISP operates through 12 regional offices across the UK, each acting as a hub for local businesses to engage in industrial symbiosis. These centres facilitate the commercialization of technology and promote business growth by connecting researchers, businesses, and investors. NISP exemplifies the UK's ability to align policies and funding frameworks across various levels. The programme's nationally coordinated but locally delivered structure allowed it to adapt to specific regional agendas, maximizing resource efficiency and demonstrating the UK's ability to implement comprehensive policies. NISP's approach of integrating local, regional, national, and international networks has fostered a cohesive and stable R&I ecosystem, ensuring the exchange of best practices and resources. This has strengthened the UK's position as a leader in collaborative R&I and the global bioeconomy sector.

NISP as the world's first national industrial symbiosis initiative has received global acknowledgements including:

- Recognized by the European Commission as an Exemplar of Eco-Innovation through its Environmental Technologies Action Plan (ETAP) in 2007.
- Identified as a 'Best Practice' example in the European Union's Waste Framework Directive (2008).
- Featured as one of the 20 Worldwide Green Game Changing Innovations in a 2010 report commissioned by the World Wide Fund for Nature (WWF).
- Awarded the Best Carbon Reduction Project at the edie.net Awards for Environmental Excellence in 2010, and subsequently entered into the European Business Awards for the Environment in 2012.

Source: https://international-synergies.com/ourprojects/nisp/; Bio-TIC 2015; Hodgson, et al. (2016)

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4.2. UK's large-scale infrastructure facilitating international R&I

The UK's large-scale infrastructure is pivotal in facilitating international R&I. The UK government and funding agencies are investing in the establishment of large national and international infrastructure for use by both national and international researchers. This effort is complemented by agreements with other nations for the mutual use of these facilities and broad access to data produced by these infrastructures. Additionally, the UK is establishing hubs, centers, and networks to support technology commercialization, business growth, and investor confidence. Furthermore, there is a strong focus on developing capabilities, supply chains, and strategic technologies to maximize the effective use of these large infrastructures. The UK's reputation as an attractive destination for international research and innovation (R&I) is bolstered by its large-scale infrastructure support. Additionally, the UK is recognized for its competitive advantages in key sectors (where the infrastructure facilities are based), further enhancing its appeal to global researchers and investors. This reputation generates financial, relational, resource, research, and innovation impacts [Figure 4.2].

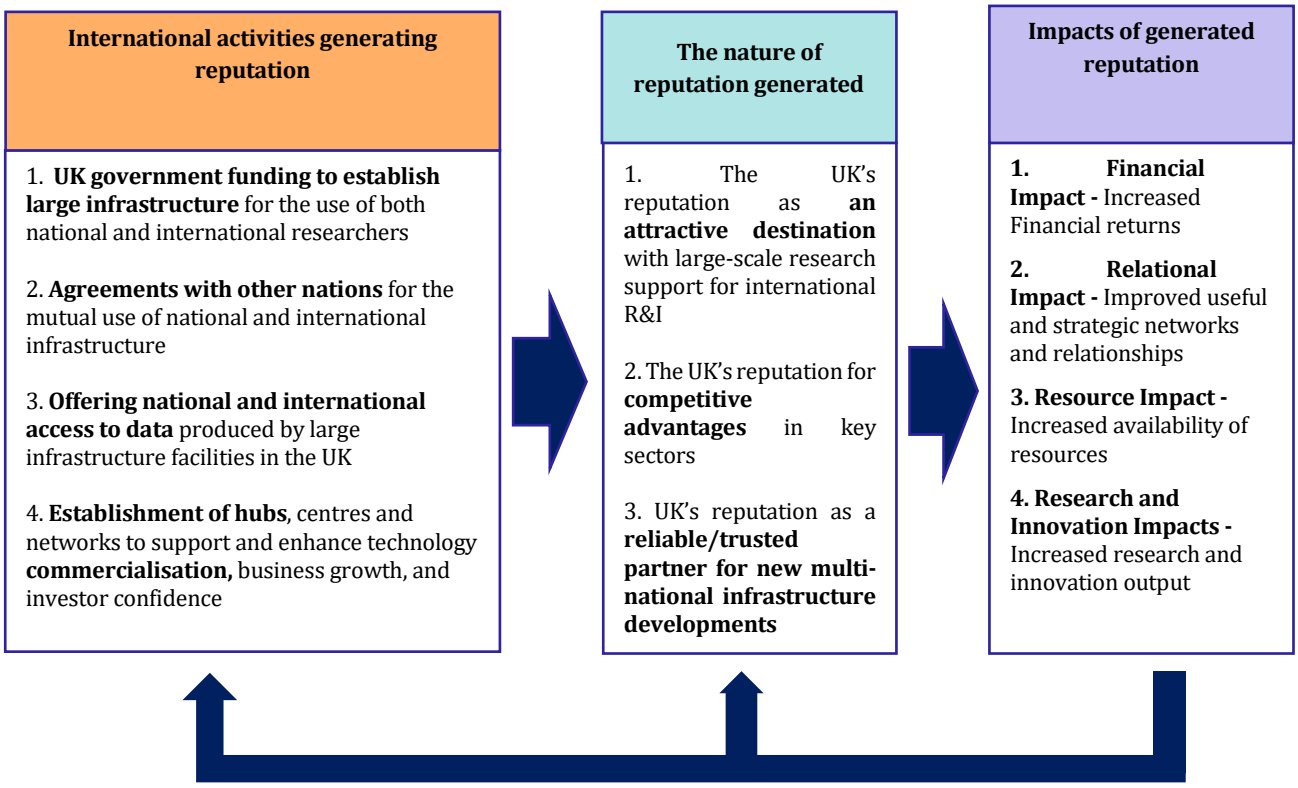

Figure 4.2: UK's large-scale infrastructure facilitating international R&I generating reputational impacts

4.2.1 International activities

UK government funding to establish large infrastructure for the use of both national and international researchers

UK government funding for establishing large-scale infrastructures accessible to researchers worldwide fosters a collaborative, international, and inclusive research environment. Following the announcement of the UK Association to Horizon Europe, the UK has re-joined the European Strategy Forum on Research Infrastructures (ESFRI), facilitating collaboration on the development of research infrastructure regionally and internationally (Science & Technology Framework, 2024). The ISIS Neutron and Muon Source, funded by UK Research and Innovation (UKRI), has been used widely by international researchers.

The UK has been upgrading and expanding its R&D infrastructure, such as the Diamond Light Source, the world's most powerful laser Vulcan 20-20 that enables the UK's world-class R&D base to test ideas, develop new materials and technologies, and make significant scientific discoveries, all of which contribute to achieving the UK's 2030 ambitions and delivering impactful outcomes (Knowledge & Technology Framework, 2024). Other UK research infrastructure investments include aerospace, life sciences, materials, and energy investments in cyber-physical infrastructure and national research data clouds.

The UK government's investments in large-scale advanced physical and digital infrastructures and computing capabilities such as a supercomputer in Edinburgh and the AI Research Resource (AIRR) in Bristol and Cambridge are other game-changing infrastructure initiatives with £1.5 billion investment package aiming to upgrade the UK's next-generation computing capacity, fuelling growth and transforming the future of UK science and technology. These infrastructure initiatives play a key role in linking UK and international scientists to generate synergies. Such linkages help build the UK's reputation as a destination with attractive, advanced, and up-to-date infrastructure that fosters international R&I linkages.

The UK supports partnerships between domestic research centres and those around the world to enhance scientists' access to cutting-edge facilities. For instance, the ISIS Neutron and Muon source has a number of long-standing agreements with overseas research funders to support their scientists' use of the facility. These not only support collaborations but also generate significant inward investment. For example, the agreement of ISIS Neutron and Muon source with Italy (during 2021-2027) is worth around £10m. Such agreements facilitate the establishment of common standards, promote openness and transparency in research, and support responsible research practices. It has also been reported that the use of ISIS by researchers from India has grown significantly over recent years. The UK Government's Newton funding has led to the use of ISIS by Indian researchers and providing

funds for instrument development through a partnership agreement with the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) for the Department of Science and Technology (DST) Nanomission project. This agreement supports Indian scientists' use of ISIS and provides funds for instrument developments (UKRI, 2023).

The evidence suggests that Portuguese researchers use ISIS for a wide range of science including fundamental and applied magnetics systems, photovoltaics, semiconducting materials, cancer-related studies, and other investigations which have led to two recent ISIS Impact Awards won by Portuguese scientists. ISIS as a member also funds members of the League of Advanced European Neutron Sources (LENS).

These collaborative agreements centred around infrastructure clearly make the UK an attractive destination for global researchers to conduct their research with UK researchers. Such partnerships enhance the mutual use of infrastructure between the UK and overseas reinforcing the reputation of the UK's commitment to advancing R&I and fostering international collaborations for this purpose.

Agreements with other nations for the mutual development of international infrastructure

The UK has a strong commitment to international scientific collaboration, investing significantly in multi-national infrastructure projects. For example, the UK is a founding member of CERN, contributing around £160 million annually to support its operations and research, including the Large Hadron Collider (LHC). This collaboration was instrumental in the discovery of the Higgs boson, a fundamental particle that explains why other particles have mass. The theoretical prediction of the Higgs boson by Peter Higgs and François Englert was confirmed by experiments at CERN's LHC, leading to their Nobel Prize in Physics in 2013 (Nobel Prize in Physics 2013).

The UK also plays a crucial role in the European Southern Observatory (ESO), which operates some of the world's most advanced ground-based telescopes1. Additionally, the UK is a key partner in the European X-ray Free Electron Laser (EU-XFEL) in Germany, which generates intense X-ray flashes for cutting-edge research in various scientific fields1. These investments not only advance global scientific knowledge but also enhance the UK's leadership and innovation in science and technology.

Offering national and international access to data

The UK strengthens its position as an active partner in priority international research infrastructure by offering national and international access to data. In some instances, data is produced by its large infrastructure facilities across borders and in other instances the data is produced by other mechanisms associated with gathering data (e.g. Biobank). The UK

has enhanced its reputation as a destination for large-scale research support through initiatives like the UK Biobank, large-scale biomedical databases, and research resources for global health researchers, funded by the MRC that provides a vast biomedical database and has facilitated numerous medical breakthroughs. T**he** UK Biobank has users from more than 90 countries and has influenced global advancement in the field of genetics. It has thus positioned the UK as a world leader in the field of genetics. Additionally, by reducing compliance burdens and modernizing regulatory frameworks, the UK ensures that researchers can efficiently utilize large-scale data for impactful studies through the Data Protection and Digital Information (DPDI) Bill reforms. This provides researchers with a clear legal framework for scientific research, streamlining the process of accessing essential data. For instance, these legal frameworks facilitated significant research in clinical and behavioural risk factors for COVID-19 and the long-term impacts of SARS-CoV-2 infection (Biobank UK, 2022). This open access to large-scale data develops the reputation of the UK as a conducive and collaborative research environment, making the UK a desirable destination for researchers worldwide and international R&I as a destination for large-scale research support.

Establishment of hubs, centres and networks to support and enhance technology commercialisation, business growth, and investor confidence

Creating hubs and centres such as the Centre for Process Innovation (CPI), which serves as the primary hub for industrial biotechnology business support in the UK, facilitates technology commercialisation (Hodgson, et al., 2016). Hubs and networks provide essential resources and support including connecting researchers, businesses, and investors in each sector. These institutional support schemes are important for establishing the UK as a nation with strong institutional support for international R&I for technology commercialisation and business growth. For instance, the CPI has established partnerships with international research institutions and companies to foster innovation and technology transfer. An example is their collaboration with the UK-India critical minerals partnership, which focuses on developing sustainable solutions for the extraction and processing of critical minerals This partnership not only enhances technological advancements but also strengthens economic ties between the UK and India. CPI's global impact on transforming healthcare and driving towards a sustainable future includes supporting global innovation, investing in the future, building the STEM workforce, fostering global partnerships, and informing international industrial policies. CPI also provides access to world-class facilities and expertise for international R&I activities. Their facilities support a wide range of sectors, including biotechnology, pharmaceuticals, and advanced materials. By offering these resources, CPI

helps international partners accelerate their research and bring innovative products to market more efficiently

4.2.2 The nature of reputation

The UK's reputation as an attractive destination with large-scale research support for international R&I

The UK is seen as a prime destination for international R&I due to its robust and large infrastructure and associated strategic plans, international agreements, and funding opportunities for national and international collaborative use and development of infrastructure. ISIS Neutron and Muon Source which support both national and international researchers, demonstrates the UK's capability to host large-scale research initiatives. As a founding member of the global project CERN, the UK engages with over 13,000 researchers from more than 75 countries, contributing to significant technological breakthroughs and bolstering its global scientific reputation. The UK is thus recognized as a leading hub for large-scale research support due to its advanced research facilities, extensive government investments in large-scale infrastructure, research, and significant involvement in major international projects.

UK's reputation of competitive advantages in key sectors

With large infrastructure, often in selected sectors, the UK holds competitive advantages demonstrating the country's reputation in key emerging sectors (Innovate UK 2023). For instance, supported by strategic infrastructure and associated investments in sectors like AI (e.g. Alan Turing Institute - the national institute for data science and artificial intelligence), fintech (e.g. Fintech Innovation Hub, the Europe's largest technology accelerator for finance, retail, cybersecurity, and future cities technology companies), and biotech (e.g. Stevenage Bioscience Catalyst (SBC), a world-class science park that supports the growth of biotech companies), the UK is home to 122 tech unicorns, ranking third globally and first in Europe, reflecting its globally competitive position in key technology areas (IRR 2023). Therefore, the UK's reputation in emerging sectors achieved through large-scale infrastructure supporting international R&I is likely to attract extensive collaboration and investment, enabling further strengthening of competitive advantages.

UK's reputation as a reliable/trusted partner for new multi-national infrastructure developments

The UK's substantial investment in large infrastructure facilities has significantly bolstered its reputation as a reliable and trusted partner for new multinational infrastructure

developments. For instance, the UK's investment in research infrastructure, such as the recent £72 million funding by UK Research and Innovation (UKRI) for upgrading research facilities, underscores its commitment to maintaining world-class standards in science and technology. These investments ensure that the UK remains at the forefront of innovation, making it an attractive partner for international infrastructure development initiatives. The Diamond Light Source, the UK's national synchrotron science facility, is an example of the UK's large-scale infrastructure that supports international R&I. It attracts researchers from around the world who use its advanced capabilities to conduct cutting-edge experiments in fields ranging from materials science to biology. This facility not only fosters international scientific collaboration, technological advancements, and innovation but also makes the UK a trusted and reliable party for international infrastructure development. The success and reputation of Diamond Light Source have led to partnerships with other international research facilities and infrastructure projects. For instance, Diamond Light Source became a member of the League of European Accelerator-based Photon Sources (LEAPS), a strategic consortium of European synchrotron and free-electron laser facilities. LEAPS brings together 16 organisations that represent 19 facilities. These entities share a unified vision of promoting scientific excellence to address global challenges and collectively enhance competitiveness and integration. This goal will be pursued through a sustainable strategy developed in collaboration with all stakeholders, including national policymakers, user communities, and the European Commission.

4.2.3 Impacts of generated reputation

Table 4.2: Impacts of reputation generated through UK's large-scale infrastructure facilitating international R&I

Types of Impact	Specific Impacts
1. **Financial Impact** - Increased Financial returns	Significant investments and long-term commitments from international investors and stakeholders.
2. **Relational Impact** - Improved useful and strategic networks and relationships	Enhanced international networks
3. **Resource Impacts** - Increased availability of resources	Enhanced opportunities to engage in joint international infrastructure development Enhanced exchange of resources, knowledge, and people
4. **Research and Innovation Impacts** - Increased research and innovation output	Increased opportunities to engage in large-scale international Research and Innovation

Case Study: UK Biobank: UK government investment in large-scale database offering global access

UK Biobank is a large-scale biomedical database and research infrastructure resource opened in 2012.

International R&I activities:

Since its inception, over 27,000 researchers from more than 90 countries have been using it. UK Biobank is a UK government investment aiming to provide state-of-the-art infrastructure with an extensive database, which includes anonymized genetic, lifestyle, and health information from half a million participants accessible to both national and international researchers. UK Biobank's infrastructure includes advanced data storage systems and secure management of consented participant data.

The Welcome-funded Research Analysis Platform (RAP) creates support for developing capabilities which allows researchers to access, store, and analyse UK Biobank data in-situ. The RAP also supports UK Biobank through advanced technology to manage the complex and large-scale data being generated, and facilitates access to researchers worldwide including from low-income countries. The platform has been utilized by approximately 700 access projects with over 2,000 users, exemplifying the extensive reach and impact of UK Biobank's data.

The open-access policy adopted by UK Biobank ensures transparency and maximizes the utility of research outputs, promoting widespread research advancements. Data accessibility has facilitated numerous research projects globally, contributing to significant scientific discoveries and advancements in health research. For instance, during the COVID-19 pandemic alone, 966 projects accessed UK Biobank data, resulting in 265 published papers with over 7,339 citations and 74,487 mentions in social media and news outlets. In addition, the resource has supported 530 patent filings, demonstrating its role in fostering innovation in novel methods, imaging, and therapeutics.

The nature of reputational impacts generated:

Biobank's commitment to independent audits, penetration tests, and compliance with data protection regulations ensures a stable and secure environment for research. Additionally, UK Biobank's adherence to the highest ethical standards and licensing by the Human Tissue Authority (HTA) further enhances credibility and reputation, increasing attractiveness for international stakeholders for collaborative R&I projects. The research infrastructure also showcases the UK's commitment to global advancement in this key sector, further encouraging collaborations and investments in the UK.

Source: UK Biobank Limited (2022)

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4.3. UK's interactions with global R&I forums

The UK's reputation in R&I is significantly enhanced through a variety of strategic activities that engage global research forums and stakeholders. Through the UK's engagement in global forums, the UK is actively funding, raising awareness, and shaping activities across strategic arenas with major geopolitical players. Additionally, the UK engages in global forums through its international presence, ensuring a robust and collaborative global presence and associated international R&I support. Due to these interactions, the UK is recognized as a thought-leader and influencer in the global R&I landscape. Additionally, the UK's leadership in global forums makes the UK a committed and exemplary member of the international community, consistently contributing to and shaping global R&I initiatives. The reputation leads to generating financial, relational, resource, research, innovation, political, social, and environmental impacts (Figure 4.3).

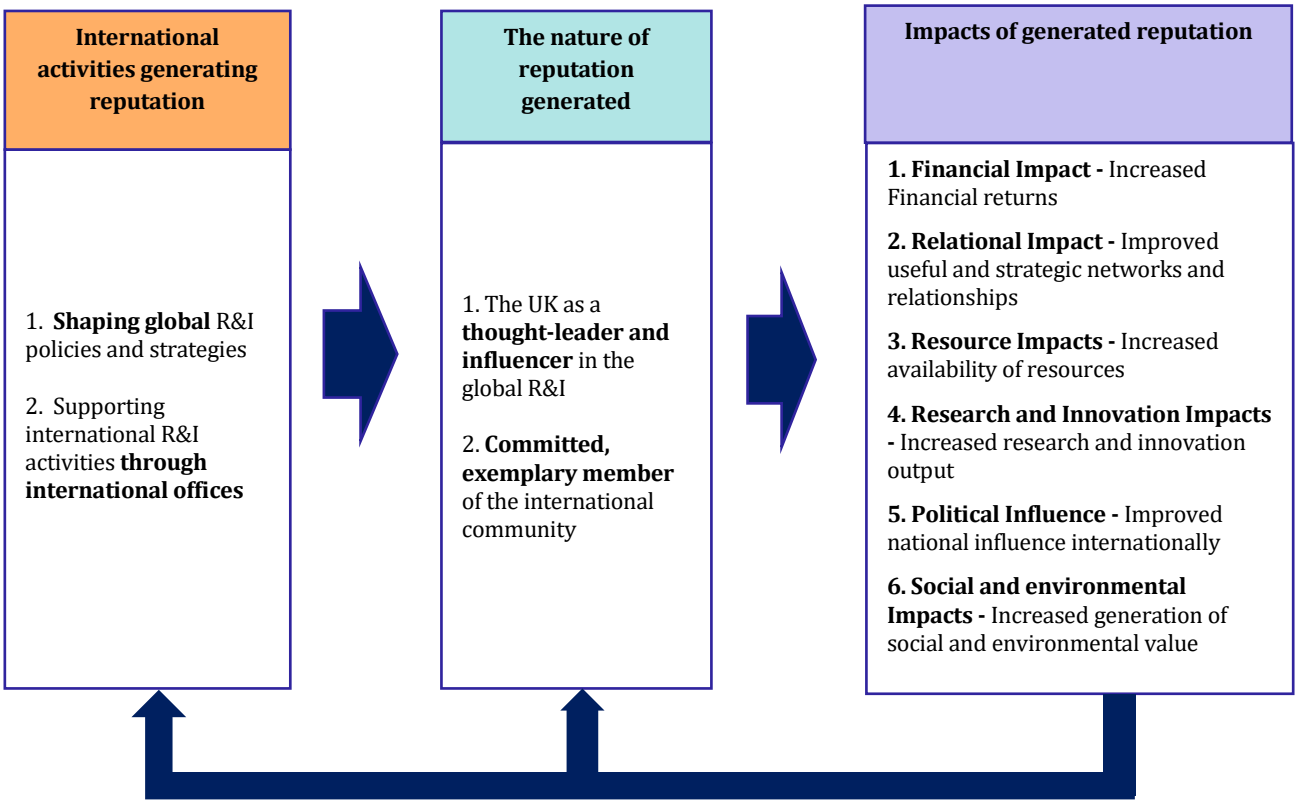

Figure 4.3: UK's interactions with global R&I forums generating reputational impacts

4.3.1 International activities

Shaping global R&I policies and strategies

In global R&I forums, the UK engages in shaping global R&I policies and strategies by fostering dialogue, raising awareness on critical issues, and influencing global R&I agendas (Science & Technology, 2024).

The UK has played a significant role in the Global Research Council (GRC), a virtual organisation comprised of global science and engineering funding agencies aimed at fostering long-term multilateral research and collaboration across continents. From 2017-2022, UKRI held the GRC secretariat, influencing its vision and strategy. It also supported establishing working groups on issues such as Equality, Diversity, and Inclusion (EDI) and Responsible Research Assessment (RRA), helping to shape the global dialogue on R&I policies. By being an active participant in multilateral policy fora, the UK is influencing global thinking and showcasing the UK's thought leadership on global R&I.

The UK's strategic engagement with major geopolitical players includes planning and executing long-term strategies and associated R&I in areas such as nuclear resilience and conventional stockpiles. This approach enhances the UK's leadership within NATO by continuing the modernization of its armed forces, conducting associated R&I, and drawing on lessons from conflicts like the Ukraine war. Investments in programs like AUKUS and Global Combat Air Programme (GCAP) with Italy and Japan, bolster the UK's national defense capabilities and support global arms control and counter-proliferation efforts. The engagements in these global forums offer clear signaling of the UK's leadership in R&I in key sectors.

The UK's Science and Innovation Network (SIN), with its 65 locations across 4 regions Europe, Asia Pacific, India, Middle East and Africa, and the Americas, builds partnerships and collaborations in science, technology, and innovation, thereby influencing global science diplomacy. SIN' strong networks with local science and innovation organisations support UK policy abroad benefiting both the UK and the host country. SIN's notable success stories include European research programme for offshore wind and marine energy with France, which delivered commercial benefits for the UK, leveraged research funding and influence policy to support UK objectives and address global challenges. The activities underscore SIN's leading impact in maintaining the UK's scientific base, strengthening the competitive advantage of its innovative businesses and addressing shared opportunities and threats. The network aims to showcase the UK 's excellence and leadership in science, technology and innovation on a global scale, while actively fostering partnerships that benefit

the UK and provide valuable insights, strengthening UK 's reputation as a leading global R&I collaborator (UK Science and Innovations Network).

Another example is the international partnership on marine protected areas, biodiversity and climate change with Chile. The initiative involved the government agencies such as UK's Joint Nature Conservation Committee (JNCC); Chile's Ministry of the Environment; the National Oceanic and Atmospheric Administration (NOAA) and the Office of National Marine Sanctuaries, both from the US; the Ministry of Energy and Environment, Costa Rica; and the French Biodiversity Agency (OFB).

The UK continues to lead the global research community by establishing new forums and platforms that enhance awareness and support informed decision-making. For instance, the UK launched the Global Coalition on Telecommunications (GCOT) in October 2023, in collaboration with representatives from the US, Australia, Canada, and Japan, to address future telecommunications issues. The UK demonstrates its commitment to fostering global cooperation and reinforces its role as a leader in international R&I by creatively filling gaps in the current multilateral and multi-stakeholder architecture, building global coalitions and like-minded groups, including 'digital deciders,' to shape critical technology and policy development. By adopting a systems approach and working with international partners on issues such as AI, digital standards, and data governance, the UK shows its dedication to global collaborative R&I. Through initiatives such as the G7, the UK-hosted Future Tech Forum, the UK AI Standards Hub, and collaborations with the Organisation for Economic Co-operation and Development (OECD) via the Global Forum on Technology and the Global Partnership for AI, the UK addresses gaps in the current multilateral and multi-stakeholder architecture. This involves building global coalitions and forming like-minded groups beyond traditional partners, including 'digital deciders' on critical technology and data use, development, and policymaking (IRR, 2023). Additionally, on another international scale, the UK launched the 'Global Forum on Technology' at the OECD focusing on quantum technologies, engineering biology and immersive technology, supported by £2 million of UK funding over a three-year period.

Through forums such as the G20 and the Five Eyes intelligence alliance, the UK advocates for responsible technological advancements and cybersecurity measures, thereby influencing global R&I agenda and security policies. Additionally, the UK has strengthened its science and technology partnerships worldwide, for instance through AUKUS (a trilateral security partnership for the Indo-Pacific region between Australia, the UK, and the US) and

through collaboration in global institutions like the G7, G20, NATO, and the International Telecommunication Union (IRR, 2023).

The UK government has also made a commitment to support developing countries via International Climate Finance (ICF) in responding to the global challenges and opportunities of climate change. Between 2016 and 2021, the ICF, endorsed by three government departments including the Foreign, Commonwealth and Development Office (FCDO), Department for Business, Energy and Industrial Strategy (BEIS) and Department for Environment Food and Rural Affairs (Defra), made an investment of £5.8bn, to tackle climate change. As a result, the ICF delivered all UK aims: strengthening global peace, security, and governance, strengthening resilience and response to crises, promoting global prosperity, tackling extreme poverty, and assisting the world's most vulnerable populations. Through participating in multi-lateral fundings, such as the Carbon Initiative for Development (Ci-Dev) - a Word Bank trust fund that supports private finance for clean energy in low-income countries, the UK assists communities to use land in ways that reduce emissions and improve productivity whilst protecting and restoring forests that support important biodiversity and fragile eco-systems. The UK's pivotal role in securing the Paris Agreement in 2015, was demonstrated by its success in reducing emissions quicker than other member countries in G20. All these proactive efforts illustrate the UK's pivotal role in global forums as a leader in climate change, domestically and internationally, including the associated R&I activities.

Supporting international R&I activities through international offices

The UK actively supports bilateral programmes and fosters collaborative R&I initiatives through UKRI (UK Research and Innovation) offices in China, India, North America, and Europe. These offices collectively bolster the UK's stature as a global leader in R&I through strategic international collaborations and serve as vital hubs for deepening partnerships and facilitating innovation across diverse research landscapes, thereby positioning UKRI as a key player in global research and innovation efforts. The collaborations enabled through these offices not only strengthen scientific ties but also contribute to addressing global challenges and advancing technological frontiers, underscoring the UK's commitment to international cooperation in research and development.

For instance, the UKRI office in China actively supports multilateral programmes and fosters significant international collaborations. Since its establishment in 2007, the UKRI China office has performed crucial roles, such as providing strategic insights into China's research landscape, negotiating joint funding programmes, managing key relationships to raise UKRI's profile, and communicating the impact of UKRI's work. UKRI India, established in

2008, has facilitated nearly £400 million in funding commitments across over 260 projects, fostering transformative research partnerships and yielding significant scientific outputs and technical innovations. Meanwhile, UKRI North America, has overseen over £3 billion in collaborative investments since 2015, promoting dialogue and joint initiatives in crucial research areas like climate change adaptation in the Arctic. Additionally, UKRI's office in Brussels (i.e. UK Research Office in Brussels) supports UK participation in Horizon Europe, the EU's €95.5 billion research and innovation programme, where UK academics and businesses have historically secured substantial funding, positioning the UK as a leading beneficiary alongside Germany. UKRI's role as a trusted advisor and promoter of UK research strengths within EU institutions, further enhancing UKRI's impact, and ensuring maximal engagement and influence in European research and innovation policy. These offices collectively underscore the UK's commitment to fostering global research partnerships and advancing scientific excellence across continents.

Additionally, there are other types of networks that the UK is engaged in, which support UK businesses' international engagements. The UK's Intellectual Property Office's IP Attaché Network helps companies in global collaborations navigate intellectual property challenges, ensuring efficient innovation and cooperation. The UK has also established the UK Telecoms Innovation Network, bringing together large companies, SMEs, and academics to stimulate innovation and collaboration, supporting UK companies' participation in global standards organizations (Science & Technology Framework, 2024).

4.3.2 Nature of the generated reputation

Thought leader and influencer in the global R&I agenda

By actively participating in multilateral organizations and taking on leadership roles in forums like the OECD and G7 can influence global research policies, shape norms and standards in critical scientific and technological areas, and maintain its status as a pivotal player in setting the global research agenda.

The UK positions itself as a leader in responsible research and innovation practices sometimes with a sectoral focus such as in AI and cybersecurity. For instance, hosting the inaugural global AI Summit and subsequent events has solidified the UK's role as a pivotal influencer in AI ethics and regulation on the global stage. Following hosting the first Global Investment Summit, the UK announced the creation of three new regulatory sandboxes. The establishment of the AI Safety Institute and the signing of the Bletchley Declaration during the AI Safety Summit exemplify the UK's commitment to advancing safe and responsible AI development worldwide. Furthermore, initiatives like joining the Global Cross Border Privacy

Rules Forum as the first Associate Member and attracting US Venture Capital firm Flagship Pioneering to establish its first base outside the US in London underscore the UK's proactive approach to driving global R&I agendas (Science & Technology Forum 2024). These actions not only demonstrate the UK's leadership in international R&I policies but also reinforce its influence in shaping future technological and ethical standards globally.

The UK has launched a campaign to increase applications to Horizon Europe, targeting R&D-intensive UK firms. This campaign emphasises the availability of over £80 billion for researchers, academics, and businesses of all sizes, aiming to maximize UK participation in Horizon Europe, and leveraging the country's expertise to drive innovation and economic growth on a global scale. At the same time, UKRI has put into effect comprehensive monitoring and evaluation frameworks for current international funds, ensuring accountability and optimizing their utilization effectiveness. These plans serve as a blueprint for developing robust monitoring and evaluation frameworks for future funds, aligning with recommendations to streamline bureaucracy and optimize the impact of R&I investments (Science & Technology Framework 2024). This strategic approach underscores the UK's commitment to maximizing the efficiency of its international engagements and leveraging data-driven insights to enhance its global R&I influence and benefits.

Committed, exemplary member of the international community

The UK’s investments in global forums demonstrate its commitment to global cooperation and security, strengthening its reputation as a reliable and dedicated international partner in R&I.

The UK's involvement in global forums has enhanced its reputation as a supporter and role model of international R&I practices. This influence is exemplified by India's establishment of the National Research Foundation (NRF), modelled on successful international bodies like the UK Research and Innovation (UKRI), showcasing the UK's role as an influencer in the global R&I agenda. UKRI's office in India has been involved in discussions regarding the establishment of the new National Research Foundation (NRF) in India and has provided valuable insights into bilateral relationships in-country, exerting ‘soft’ influence. The NRF was established aiming to consolidate India's fragmented research funding landscape, promote interdisciplinary research, and address national priorities such as clean energy and climate change. UKRI's well-established reputation and expertise in these areas make it a natural partner for the NRF (British Council 2024). This creates opportunities for UK institutions to engage in new research partnerships with Indian universities and colleges, thereby further strengthening bilateral collaborations. The UK’s

engagement in global forums enhances the UK's global influence and helps partner countries achieve their research and innovation goals (British Council 2024).

4.3.3 Impacts of generated reputation

Table 4.3: Impacts of reputation generated through UK's interactions with global R&I forums

Types of Impact	Specific Impacts
1. Financial Impact - Increased Financial returns	Enhanced international investment in the UK
2. Relational Impact - Improved useful and strategic networks and relationships	Enhanced status of the UK in international forums
3. **Resource Impacts** - Increased availability of resources	Enhanced access to international funds and scientific capacities for R&I
4. **Research and Innovation Impacts** - Increased research and innovation output	Increased nation-to-nation /multilateral collaborations in delivering ground-breaking research
5. **Political Influence** - Improved national influence internationally	Increased "Soft" influence of the UK in global decision and policy making
6. Social and environmental Impacts - Increased generation of social and environmental value	Enhanced ability to shape international engagement for generating social and environmental value

Case Study: UKCDR in GLoPID-R: A global coalition of research funders

The UK Collaborative on Development Research (UKCDR) partners with government departments and research funders to strengthen and elevate the UK's international development research sector. For over ten years, UKCDR has united UK research funders to discuss priorities and coordinate efforts, ensuring the maximum impact of international development research. As a neutral and impartial entity, UKCDR is governed by the Strategic Coherence of ODA-funded Research (SCOR) Board.

UKCDR's 2022-2025 strategy focuses on three main pillars: mapping, analysis and foresight; convening for joint action; and sharing information and best practices. These efforts aim to highlight the effectiveness and value for money of UK research for development, assess the overall impact of UK investments, bridge funding and delivery gaps, and enhance collaboration with influential funding bodies and key stakeholders to address global challenges.

International R&I activities:

During the COVID-19 pandemic, the collaboration between GloPID-R (Global Research Collaboration for Infectious Disease Preparedness) and UKCDR (UK Collaborative on Development Research) has been instrumental. GloPID-R, supported by 35 member funding organisations and 8 observers including CEPI, EDCTP, ERINHA, ESSENCE on Health Research, GAVI, GOARN, ISIII and WHO enhances preparedness by strengthening research capacity, especially in low-resource settings, to impact global health. It coordinates the funders activities and facilitates the development of groundbreaking regional and international research to ensure a timely and effective response to infectious diseases with pandemic potential, by tracking emerging research trends, identifying key priorities, and providing tools and practical guidance for funding organizations.

UKCDR and GloPID-R developed a project tracker-live database of funded research projects related to the COVID-19 pandemic, that supports coordination and information sharing among key global funding organisations. The GloPID-R and UKCDR, in collaboration with the COVID-19 Clinical Research Coalition organized the virtual COVID-19 Research in Low & Middle Income Countries event, brought together global funders and researchers actively engaged in COVID-19 research across LMICs. In addition, a Living Mapping Review of future research funding has been developed that includes an analysis of research based on UKCDR-GloPID-R Project Tracker, aligned with the priorities outlined in the UN Research Roadmap for the COVID-19 Recovery.

The nature of reputational impacts generated:

All these activities of the coalition between UKCDR and GloPID-R highlight the UK as a thought leader and influencer in the global R&I agenda, demonstrating its commitment as an international member by facilitating international R&I and providing financial and scientific support. The generated reputation leads to multilateral collaborations in groundbreaking research, enhanced status in international collaborative forums, and improved access to international funding and scientific capacities.

Sources: https://www.glopid-r.org/; https://www.glopid-r.org/articles-newsletter/ukcdr-glopid-r-covid-circle-researcher-coordination-platform/

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4.4. UK's ranking in global research and innovation indices

The UK's R&I reputation is also shaped by its ranking in R&I indices such as the Global Innovation Indices by WIPO, participation in the Global Entrepreneurship Monitor, and World Bank evaluations. The nature of this reputation is characterized by the UK's performance in research and innovation, entrepreneurial spirit, significant investment in R&I, governmental commitment to R&I, and competitive advantages in key sectors. The UK's reputation is built not only on its presence in international rankings but also on its constant endeavour to maintain high scores in those rankings. The positive reputation built through ranking results in financial, resource, research innovation, and political impacts [Figure 4.4].

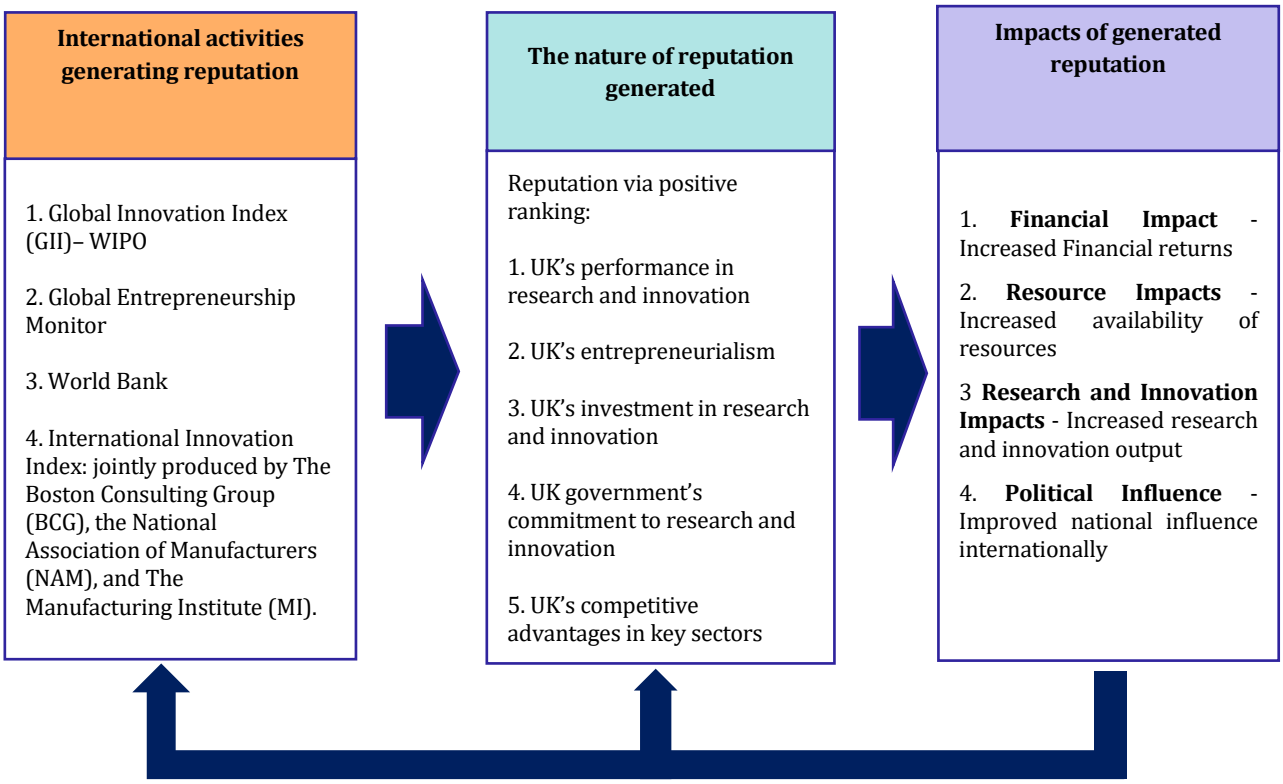

Figure 4.4: UK's ranking in global research and innovation indices generating reputational impacts

4.4.1 International activities

Global Innovation Index – WIPO

The UK is ranked as the fourth most innovative economy globally behind Switzerland, Sweden, and the United States, and the third in Europe according to the 2023 Global Innovation Index (GII), which highlights its strong performance in innovation among high-income countries. In terms of science and technology clusters, Cambridge in the UK is recognized as the most Science and Technology (S&T) intensive cluster globally, underscoring the UK's significant local innovation output.

Global Entrepreneurship Monitor (GEM)

The UK's rankings of R&I depict a mixed but predominantly positive reputation according to Global Entrepreneurship Monitor (GEM) 2023-24. The UK demonstrates strong performance in R&I, entrepreneurialism, and government commitment, despite recent economic challenges. However, entrepreneurial conditions, particularly social support for women and access to finance, lag behind, with the UK ranked 22nd out of 49 economies in the National Entrepreneurial Context Index (NECI). The UK's commitment to supporting small businesses and entrepreneurial growth, through programs like Help to Grow and the Start Up Loan program (Global Entrepreneurship Monitor 2023/2024), reinforces its reputation as a nurturing environment for innovation and entrepreneurship as well as a well-established international R&I collaborator.

World Bank

In its 2023 overview, the World Bank highlighted the UK's active role and significant contributions to research and innovation, entrepreneurialism, investment, governmental commitment, and competitive advantages in key sectors. The United Kingdom is ranked 8 among 190 economies in the ease of doing business, according to the latest World Bank report. The UK holds a position as the major shareholder and participates actively in the World Bank project and contributes with its expertise and solutions to various sectors, which reflects its commitment to global development and innovation. Through membership in institutions like the International Finance Corporation (IFC), the UK contributes to fostering entrepreneurship and private sector growth both domestically and globally.

International Innovation Index

The International Innovation Index is a global measure of a country's innovation level. It is collaboratively produced by The Boston Consulting Group (BCG), the National Association of Manufacturers (NAM), and The Manufacturing Institute (MI), which is NAM's nonpartisan research affiliate. The index assesses both business outcomes of innovation and the

government's role in promoting and supporting innovation through public policy. The study involved: (A) a survey of over 1,000 senior executives from NAM member companies across various industries, (B) in-depth interviews with 30 of these executives, and (C) A comparison of the "innovation friendliness" of 110 countries and all 50 U.S. states. The International Innovation Index provides valuable insights into innovation ecosystems worldwide, emphasizing the importance of both private sector efforts and supportive government policies.

The UK is ranked 9th in relation to innovation performance and innovation output. The UK ranks seventeen out of 166 counties showing readiness to use frontier technologies according to The Frontier Technologies Readiness Index (2023). However, this rank displays a drop of 14 places since 2021 when, it was ranked 3. In the same index, the UK is ranked 12th for skills, and 6th for R&D. The United State, Sweden and Singapore hold the top three positions.

4.4.2 The reputational impacts of ranking

UK's performance in R&I

UK's performance in R&I is demonstrated by its high rankings in various innovation indices including GII-WIPO and GEM. The UK's reputation for high performance in R&I has significantly influenced its global standing and catalyzed several impactful outcomes. High rankings in various international indices highlight the UK's robust R&I ecosystem, required for international investments and collaborations. Overall, the indices showcase the UK's well-established position as an active player in shaping global advancements and collaborations in R&I.

UK's entrepreneurialism

UK being ranked highly in indices such as GII-WIPO and Global Entrepreneurship Monitor for entrepreneurialism demonstrates the UK's vibrant entrepreneurial ecosystem, supported by government programs for small businesses and a positive outlook among business leaders (GEM 2023-24).

UK's investment in R&I

The UK's significant investments in R&D by both public and private sectors - demonstrated by the global country rankings - underline the UK's commitment to sustaining its innovation landscape (World Bank 2023; GII-WIPO 2023). As evidenced by global ranking, the reputation of relatively high expenditure on R&D enhances its appeal as a destination for high-tech industries and skilled professionals and makes it a magnet for international R&I (GII 2023). The UK's financial contributions to global development through the World Bank,

along with its strategic partnerships, highlight a robust commitment to R&I. This commitment positions the UK as a leading hub for technological advancements (World Bank 2023).

UK government's commitment to R&I

UK rankings in World Bank, GEM, and BCG showcase UK government support for international and national R&I, often offered through strategic policies and funding initiatives. The prestigious positioning (e.g. the fourth most innovative economy globally and third in Europe in the 2023 GII) highlights the UK's strong innovation ecosystem and government's commitment, fostering further confidence among private investors (GII 2023; GEM 2023-24).

UK's competitive advantages in key sectors

The UK's strengths in key sectors have been ranked highly by the World Bank, GEM, and BCG. The UK actively participates in global development projects and leverages its expertise and solutions across various sectors as highlighted by the World Bank, demonstrating its commitment to international collaborative R&I and competitive advantages in key sectors, especially in the high-tech and life sciences sectors (GII 2023).

4.4.3 The impacts of the generated reputation

Table 4.4: Impacts of reputation generated through UK's ranking in global research and innovation indices

Types of Impact	Specific Impacts
1. Financial Impact - Increased Financial returns	The positive reputation of the UK's entrepreneurialism and investment in research and innovation attract international investment
2. Resource Impacts - Increased availability of resources	The positive reputation of the UK's performance in research and innovation increases access to resources and skilled talent.
3 Research and Innovation Impacts - Increased research and innovation output	The positive reputation of the UK's performance in research and innovation, investment in research and innovation and UK government's commitment to research and innovation makes the UK an attractive destination for high-tech industries.
4. Political Influence - Improved national influence internationally	The reputation of the comparative positioning of the UK compared to other countries enhances the UK's "soft" influences on key global decisions

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About the Innovation and Research Caucus

The IRC supports the use of robust evidence and insights in UKRI's strategies and investments, as well as undertaking a co-produced programme of research. Our members are leading academics from across the social sciences, other disciplines and sectors, who are engaged in different aspects of innovation and research system. We connect academic experts, UKRI, IUK and the ESRC, by providing research insights to inform policy and practice. Professor Tim Vorley and Professor Stephen Roper are Co-Directors. The IRC is funded by UKRI via the ESRC and IUK, grant number ES/X010759/1. The support of the funders is acknowledged. The views expressed in this piece are those of the authors and do not necessarily represent those of the funders.

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